PROCEEDINGS

From Conflict to Co-operation in International Water Resources Management: Challenges and Opportunities

International Conference
20-22 November 2002
UNESCO-IHE Institute for Water Education
Delft, The Netherlands

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(SC-2004/WS/19)

PREFACE

The response to the call for papers for the International Conference "*From Conflict to Co-operation in International Water Resources Management: Challenges and Opportunities*" was a success. In evaluating the papers submitted, the organizing committee assessed their quality, the coverage of topics and the geographical distribution of the authors. This volume collects the papers accepted, some of which were presented at the conference, as well as some of the keynote speeches.

The papers have been structured around the keynote sessions of the conference. An overview of these sessions is provided at the beginning of this volume as a summary of the conference.

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International Conference "*From Conflict to Co-operation in International Water Resources Management: Challenges and Opportunities*" 20-22 November 2002, held at the UNESCO-IHE Institute for Water Education in Delft, The Netherlands.

Although the conference objectives were manifold, one of its targets was to reflect on the results of the World Summit on Sustainable Development in Johannesburg and its impact on sustainable transboundary water management. Furthermore, the conference was to introduce and discuss the results of the first phase of the From Potential Conflict to Co-operation Potential: Water for Peace Programme (PC->CP: Water for Peace). Both the programme and the conference aimed to deepen the knowledge about the roots of conflicts and to achieve a better understanding of co-operation mechanisms and conflict resolution tools. At the same time, the keynote presentations, panel discussions, individual paper presentations and open debate sessions were planned to produce ideas to initiate the second phase of the programme. The conference provided as well an opportunity for dialogue and exchange of experience and information for experts in PC->CP relevant subjects who otherwise were not directly involved in the project.

With regard to the issues addressed at the conference, several keynote speakers were invited, whose lectures were followed by a panel and debate, focussing on a case study or a well defined region discussing the problem relevant to the theme of the keynote. The more than 160 participants witnessed seven major sessions in which the principal topics were discussed.

Session 1

Keynote: Institutionalizing co-operation mechanisms: some means and tools (William Cosgrove)
Panel discussion: International river basins in Western-Africa (Chair of panel: Jean François Donzier)

The session focussed on the need to develop institutional mechanisms, both formal and informal, in order to resolve conflicts. River Basin Organizations can be relevant international institutions, although it is important to include all stakeholders within the process. It was argued that at the international level there is an absence of governing structures and legal mechanisms with as consequence that international water management institutions are playing an increasingly significant role. Although important, however, these institutions are most often inadequate to the task. Furthermore, it was stressed that there exists a strong potential role for international institutions in providing the services and tools to facilitate and promote the process that leads to a resolution of the conflict.

Session 2

Keynote: Enlarging the Pie?: Identifying, sharing and creating benefits (David Grey)
Panel discussion: International water agreements in the SADC region / Lesotho Highlands Water Scheme/Orange River (Chair of panel: R.M. Teka Teka)

The session focussed on the complexity of international waters and how within this myriad of interrelated elements one can develop co-operation strategies. Since the rationality of sovereignty and national agendas cannot be ignored, one has to identify common grounds and exploit the benefits of co-operation in areas of common interest. The concept of co-operation was explained as a continuum: there are different types of benefits to share at different levels. The ideal level of co-operation will be determined by the unique circumstances of each basin, which could entail co-ordination, collaboration, joint action or even integration. To be successful it was argued that this process might involve, amongst other actions, the creation of specific organizations or institutions that need to develop joint management plans as well as innovative benefits sharing mechanisms. The session suggested to create an International Water Facility giving support to set up mechanisms and organizations of shared water resources management

Session 3

Keynote: Public and private actors and partnerships on different scales (Margaret Catley-Carlson)
Panel discussion: Danube River Basin (Chair of panel: Michaela Popovici)

The session centred around the often 'ideological' debate between proponents and opponents of private sector participation in water supply and sanitation. An overview of the arguments of the proponents of private sector participation was provided: an increase in efficiency, more financial resources and a higher accountability for safe water. However, each argument is refuted by the opponents and marks a fundamental distrust of corporate players. It was stressed that the opponents base their arguments on the prevailing belief that water provision is a basic responsibility of governments and that private sector participation will lead to higher costs for water services. However, the session also presented ideas and recommendations that could build a bridge between the two sides: the involvement of all affected stakeholders, the creation of regulatory mechanisms and good governance systems, an effective water law and the development of clear dispute resolution procedures prior to private sector participation.

Session 4

Keynote: Climatic, social and technological changes and their impacts (Slobodan Simonovic)
Panel discussion: Mekong River Basin (Chair of panel: Sokhem Pech)

The session dealt with climate change issues such as global warming and the consequences for the human species. Other issues for concern that were highlighted dealt with changing precipitation patterns, flooding and landslides, rising sea level, shifting vegetation zones and natural disasters. Furthermore,

attention was focused on water issues such as quantity, quality and its interaction with people, development, food production and health.

Session 5

Keynote: What incentives does water offer for co-operation?
Ethical and cultural incentives of water for co-operation (Fekri Hassan)
Water as a vehicle for interstate co-operation under scarcity conditions: a legal perspective (Kerstin Mechlem).

The session included two keynote lectures. The first presentation (F. Hassan) argued that the process of social change has to be taken into account when one attempts to transform conflict situations into co-operative ones. Furthermore, attention was focussed on the human dimension in the role of confidence building and within the prevention and resolution of conflicts. Co-operation is predicated upon the notion of mutual recognition of rights and obligations which are grounded in the ethics of justice and equity. Therefore, incentives for co-operation have to include an appeal to ethics as well as social, economic and political payoffs to the public across nations to promote and sustain co-operation.
The second keynote speech (K. Mechlem) focused on the question how the core principles of international water law, i.e. the right of equitable and reasonable utilization, the duty not to cause significant cross-border harm, and the obligation to co-operate have the potential of preventing conflicts by encouraging the reconciliation of different and diverging interests. The paper highlighted the importance of specific watercourse agreements to accommodate the circumstances of each specific case and of the role of joint bodies and commissions in applying these principles and thereby in building continuous co-operative relationships leading to increased confidence.

Session 6

Keynote: Implementing international security agreements – Interaction with water resources management (Gianluca Rampolla)
Panel discussion: Lempa River Basin (Chair of Panel: Munther Haddadin)

The session explained that shared water can be a trigger as well as a solution to conflict. Water is a highly political issue and should be dealt with as such. Therefore, it is necessary to continue to focus on confidence building and the role of institutions such as NGO's and International Organizations to facilitate these processes. Additionally, the role of education with regard to raise awareness among the young about water in all its aspects was stressed.

Session 7

Keynote: International support for co-operating around water: education, awareness raising, governance: towards an advisory panel (Aaron Wolf)

The session refuted the theory that water scarcity is leading to war by reviewing the findings of a database that includes the world's 261 international watersheds and a compilation of more than 400 water-related treaties. According to the speaker, the one and only outright water war dates took place some 4,500 years

ago in what is now called Southern Iraq. In fact, once co-operative water regimes are established through treaties, they turn out to be resilient over time. It was argued that the likelihood and intensity of disputes rises as the rate of change within a basin exceeds the institutional capacity to absorb that change. That way, rapid changes either on the institutional side or in the physical system are to be perceived as the roots of most water conflicts. Additionally, the concept of a Hydrodiplomacy Clearinghouse was raised which could function as a co-ordination centre between different institutions as UNESCO-IHE Institute for Water Education (technical), Universities Partnership (education/research) and the Permanent Court of Arbitration (mediation/facilitation).

General conclusions and recommendations

The conference emphasized some central concepts and principles which should be inherently linked with International Water Resources Management such as co-operation, sharing benefits, pre-emption and stakeholder participation. Additionally, the complexity of IWRM was highlighted by pointing out the intertwinement of the legal, political, economical, cultural and environmental dimensions. Attention was drawn at the difficulties to view IWRM beyond the national level, while stressing the importance to find solutions on an international scale. Therefore, since decision-making is an national affair, the key to co-operation is to find how these different agendas can be converged. We note as well some discussions concerning the role of all stakeholders and their relevant involvement in any decision-making process. Related herewith were arguments for partner-relationships (public service, private sector, NGO's, international institutions, experts) embedded in an interdisciplinary and multi-sectoral framework. However, an indispensable element for an effective IWRM is related to capacity building. Several speakers and participants emphasized the importance of information, training, education and awareness raising.

At the same time, strong pleas for finding solutions to the current and future problems were presented. These have been summarized as recommendations for IWRM:

-Be pre- emptive in creating institutional capacity. Flexibility towards future changes is essential as some of the increased water-related conflicts are associated with the lack of governance structures to absorb changes. Consequently the conflict potential increases. Priority must be given to create flexible organisations designed to absorb shocks and turn conflict potential into co-operative arrangements.

-Review other mechanisms of management and their relevance at international scale.

-Bridging water utilisation plans and basin development planning in order to pre-empt conflicts to arise.

-Strengthen coherence of interministerial and inter-state co-ordination of water-related activities.

-Involve stakeholders in the design and implementation of processes, at all levels and scales. The participatory decision making principle should be implemented in the international context.

-Strengthen international law and compliance measures, as a basis for dialogue, co-operation and conflict resolution.
-Share knowledge and diffuse information as part of mutual trust building and to avoid misconceptions and deviating aspirations.

-Create a transparent and empowered international regulatory system.

-Global clearing-house to provide «ingredients» of basin governance and process facilitating tools and advisory services.

-International Water Facility: providing seed resources to engage riparians and stakeholders in pre-emptive actions and in human and institutional capacity-building.

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INTEGRATED WATER RESOURCES MANAGEMENT: NIGER AUTHORITY'S EXPERIENCE

I.A. Olomoda[1]

1. INTRODUCTION

Setting up an Integrated Water Resources Management (IWRM) for an International River Basin with catchment areas covering several Countries such as the Niger Basin, requires a binding agreement for co-operation among the riparian countries.

The Niger river basin covers 9 countries: Benin, Burkina, Cameroon, Ivory Coast, Guinea, Mali, Niger, Nigeria and Chad. Just after independence in the early 60s, these countries came together to develop a binding agreement to form the Niger River Commission (NRC) for co-operation in the field of management and use of the water resources of the Niger. The NRC was initially formed to foster co-operation and promote sustainable development. Consequently, the river Niger became a binding force for co-operation and socio-economic development of these riparian countries.

The convention during which these countries established the NRC, took place in Niamey on October 26th 1963, and is known as the Niamey Act. A year later, on November 25th 1964, after many rounds of negotiations, the act was adopted and the NRC was formed.

Three conventions, in 1968, 1973 and 1979, had to improve the NRC's functionality, which was below expectations. At each convention, statements about the objectives were issued:
* a close co-operation between the member states for sound development of the basin-wide resources
* freedom of navigation on the river Niger among member states
* equal access to the basin's water resources for all users

In 1980, a new convention established the Niger Basin Authority (NBA), thereby replacing the NRC whose performances seemed to be insufficient.
Despite its additional mandates, the NBA still did not meet up with the yearn and aspirations of the member states. Some of these states signified their intention to change their membership to an observer status while others merely attended the meetings with scepticism.
It was not until 1998, when a resourceful leadership was formed and with the co-operation and assistance of the countries and donors, that the NBA found new spirits.

This paper takes a critical look at the evolution of the Niger Basin Authority with the IWRM, the strategic action plan that transformed the organisation, the various problems and some of the lessons that could be learnt from the NBA experience.

[1] Niger Basin Authority, NBA, Niamey, Niger.

2. THE NIGER RIVER BASIN

2.1. Physical Context

The Niger River is, with its 4200 km, the third longest river in Africa and the 14th longest in the world. Its theoretical catchment area is about 2 millions square km making it the world's ninth largest river system with an active catchment area about 1.5 million square km.

The Niger covers 9 Countries of West Africa and part of Central Africa in the following proportions: Benin (2%), Burkina (4%), Cameroon (4%),Chad (1%), Ivory Coast (1%), Guinea (6%), Mali (25%), Niger (21%) and Nigeria (32%).

Its geographical basin covers tropical forests, woody savannahs, permanent wetlands and vast desert zones.

The Niger Basin has unique physiologic and hydrologic characteristics and can be divided into four sub-basins; the Upper, the Inland Delta, the Middle and the Lower Niger Basin.

2.1.1. The Upper Niger Basin

The river catchment areas of the Upper Niger Basin cover Guinea and part of Mali and counts following main tributaries: the Tinkisso, Milo, Niandan, Mafou and Bani rivers. The river Niger rises in the southern face of the Fouta-Djallon highland in Guinea, at a height of approximately 1,000 metres. Initially, the river and its main tributaries run along an abrupt slope and when entering Mali, the river becomes navigable. The Upper Niger covers an area of about 750,000 km^2. The rainfall in this section is abundant and ranges from more than 2000 mm in the south to 800 mm in the north.

2.1.2. The Inner Delta

The Inner Delta has a surface area of approximately 80,000 km^2, entirely located in Mali. The rainfall ranges from 800 mm in the South to less than 100 mm in the North. The river runs north-eastward to form flood plains in the Inner Delta in Mali, which is at the southern edge of the Sahara Desert. This area is a wide flood plain in the arid region with an abundant loss of water through evaporation and infiltration before reaching to Middle Niger. The average river flow in this area is approximately 45 billion m^3/year and covers between 20,000 to 30,000 km^2.

2.1.3. The Middle Niger

The basin in this area covers 530,000 sq. km from Tossaye in Mali to Yelwa in Nigeria. Rainfall in this area increases from 200 mm in the North to more than 700 mm in the South.

The river Niger catchment areas cover Benin, Burkina Faso, Ivory Coast and Niger.

Hydrological monitoring in the Middle Niger basin, dating back to 1923, reveals that flows are widely dependent on input from the Inner Delta. The average annual flow of the Niger in Niamey between 1971 and 2000 was estimated to be only 697 m3/s,

and 993 m3/s between 1957 et 1975, showing a progressive reduction in the annual mean flow of the river Niger. Fig. 2 shows the mean annual flow pattern from 1990 to 2000 of river Niger within the Middle Niger in Niamey.

2.1.4. The Lower Niger

The Lower Niger is a sub-basin of about 650,000 sq. km, including the Benue sub-basin, covering Nigeria, Cameroon and Chad. Rainfall increases considerably from 700 mm in the north to more than 3000 mm in the south.

The Benue river is the largest tributary of the Niger and has catchment areas covering Nigeria, Chad and Cameroon. The two rivers come together at Lokoja in Nigeria. From there, the river Niger flows southwards to the Atlantic Ocean in Nigeria.

2.2. Environmental Context

The Niger River provides a habitat for a wide rang of species including, among others, a wide variety of fish, hippopotami, crocodiles, and sea cows. Vegetal cover provides a barrier against desert encroachment and tree planting is extremely encouraged, particularly in arid zones
Mining, bush burning and poor agricultural land management are the major causes of soil erosion and siltation of the river.
River pollution from industries are on rampant, as well as the pollution from human and animal wastes through rainfall runoff
Flood hazard during rainy season has become major problem for the teaming population living close to the river boundaries.

Within the Sahel, drought conditions leading to human pressure on the available land and water that often gave rise to conflicts, most especially within the Inner Delta, persists.

2.3. Socio-economic Context

The NBA member states are amongst the poorest in the world. The total population of the basin in 2000 was estimated at about 100 million representing about half of the total population of the nine (9) riparian countries at a growth rate of 3%. The population younger than 15 years represents 44% of the basin's population.

The majority of the population are farmers but migration to urban areas is rapidly taking over as a result of the unfavourable climate (poor rainfall, desert encroachment) and famine.
In general, the literacy rate is still very low, dropping under 20% in some regions. Economic growth has improved from around 1% at the beginning of the decade to approximately 5% in 1997. However, as far as Nigeria is concerned, economic growth is heavily dependent on the performance of the agricultural, industrial and oil sectors. In the riparian states, over 40% of the GDP is derived from agriculture and more than 10% from mining. Economies are vulnerable to both drought and fluctuations in world commodity prices. Table 1 is an indicator of socio-economic characteristics of the NBA member states.

2.3.1. Fishing

Fishing activities have for long constituted a major socio-economic activity for the riparian populations of the River Niger basin, most especially in Mali, Niger and Nigeria. Recently, fish production has decreased seriously because of the reduction of water resources resulting from the persistent drought in recent years.

2.3.2. Navigation

River transportation is a major means of transportation and gives access to remote areas, thereby opening them up to socio-economic development. Presently, 6,000 km of the Niger are estimated to be navigable. Before entering Nigeria, the river is navigable as follows:
* Kouroussa (Guinea) to Bamako (Mali): 370 km
* Koulikoro (Mali) to Ansongo (Mali): 1280 km
* Niamey (Niger) to mouth (Nigeria): 1140 km
* Garoua (Cameroon) to mouth (Nigeria): 980 km.

The federal government of Nigeria is currently developing the downstream navigation up to the Atlantic Ocean to boost the socio-economic development of the country.

2.3.3. Agriculture

The agricultural potential of the basin is not known in detail but is estimated at 2.5 million ha of irrigable land, 20% of which is presently hardly exploited.
Irrigation along the flood plains serves traditionally the rice crop. Farmers take the advantage of flood recession and soil water moistures the crops. A UNDP study carried out in 1995, estimated the flood plain irrigation potential at 700,000 ha, while the actual irrigation potential could reach about 2.5 million ha.

2.4. Dam Infrastructures

Dam structures within the Niger Basin are predominantly found within the Upper and the Lower Basins. Others are planned and the feasibility studies of some of them are completed.
A hydro-electric dam was constructed in Dabola on the Tinkisso River in 1974. Downstream in Mali, there are 3 dams: the Sotuba/Bamako Dam on the Niger River constructed in 1929 for irrigation and adapted for hydro-power generation in 1996, the Markala Dam on the Niger River constructed in 1917 for irrigation, and the Selingue Dam on the Sankarani River constructed in 1982 for hydro-power generation.

Feasibility studieshave been carried out for the Fomi and Taousah.

On the Lower Niger downstream, the Kandadji Dam project, at about 180 km from Niamey, has been proposed.

There are four hydropower dams on the Lower Niger. These are the Kainji, Jebba and Shirroro dams in Nigeria and the Lagdo dam in Cameroon. There are other large irrigation and water supply dams in Nigeria, among which are the Goronyo

and Bakori dam on the Sokoto River and the Dadin Kowa dam on the Gongola River.

3. NBA INTEGRATED WATER RESOURCES MANAGEMENT

3.1. The Niger Basin Authority (NBA)

After the adoption of the Niamey Convention and the creation of the NRC on October 25, 1964, the 9 NBA member countries revised the NRC convention several times to improve its institutional performance. When these revisions showed no result, the Niger Basin Authority (NBA) was formed to replace the NRC.

The NBA was created on October 25, 1980, and has its headquarters in Niamey (Niger). Its long-term objectives are to promote co-operation among the member countries and to ensure basin-wide integrated development in all fields through development of its resources, notably in the fields of energy, water resources, agriculture, livestock, forestry exploitation, transport and communication and industry.

To improve the IWRM of the NBA, focal points were established in 1986 to oversee its activities at the regional level. The NBA's institutional structure was amended in 1987:

- A summit of Heads of State and Governments is responsible for policy-making, decision-making and the general orientation of the development of the basin.

- The NBA Council of Ministers is responsible for the decision-making and supervising the activities of the NBA Executive Secretariat.

- A Technical Committee of Experts is responsible for the preparation of the meetings of the Council of Ministers.

- The executive secretariat is the administrative organ of the organisation and responsible for the execution and management of the organisation's programs. It is headed by an Executive Secretary supported by 3 Directors namely the Director of Administration and Finance, the Director of Project Planning and Execution and the Director of Information and Documentation.

On October 27, 1987, the revised convention for the restructuring of NBA was adopted, containing the following objectives;

- to harmonise and co-ordinate national development policies on basin wide resources
- to formulate a policy and implement an integrated plan to develop the basin
- to design, build and maintain common structures and projects

Despite these new objectives, the organisation continued to face several operational and management difficulties. Some of them are as a result of inadequate political will to back the mandates and of various economic, social and political problems back at home. Similarly, since the degree in which the countries share in the basin varies, with Nigeria having 30% and Chad 1 %, the riaprians have different levels of interest and commitment in development and management of the basin.

The NBA Executive Secretariat got a new head in 1998. The new head carried out a 3 Year Action Plan (3 YAP) based on the following sectorial activities that led to the transformation of the NBA:

3.2. Institutional Capacity

The improvement of NBA's institutional capacity was carried out by the following actions:

- Reinforcement of infrastructures in the NBA secretariat
- Recruitment of additional personnel based on the evolution of the NBA activities
- Training of personnel
- Organisation of international conferences, seminars and workshops, e.g. a workshop on navigation development in the Niger Basin took place Abuja, Nigeria.

3.3. Regional Projects

The development of regional projects to enhance the co-ordination, monitoring and control of the basin resources at the regional scale was improved by:

- the intensification of the Hydroniger IFC hydrological data collection systems, control analyses of real time data transmitted daily by satellite.
- the development of a regional program for the eradication and control of water hyacinth in the basin.
- the development of a project document on silting.
- the pursuit of the study on the development of desertification techniques.
- the development of a strategic approach for environmental protection.
- the creation of a socio-economic data bank specific to the planning of integrated development of the River Niger basin
- the co-ordination of navigation activities in the River Niger basin

3.4. Regional Pilot Projects

Support was given to initiatives developed by rural communities and falling under the framework of a regional pilot project management and development. Some of these are:

- Supply of drinking water to rural communities
- Promotion of female market gardening
- Promotion of pisciculture

3.5. Publicity and Information Sectors

The development of its information, publicity and documentation department permitted the sensibilisation about the NBA activities, and permitted to carry out programs and projects.

- (Modernisation of the NBA Documentation Centre and production of the NBA-Info, a quarterly NBA magazine that provides broad based information on the NBA established and in circulation since 1998.

- Production of the Hydrological Monthly Bulletin, distributed world-wide to provide hydrological information.

3.6. Collaborations with International Institutions

The NBA intensified co-operation and collaboration with national and international institutions based in Niamey among which are the ACMAD, AGRHYMET, ICRISAT, IRD etc., and formed joint working programs.

In the areas of capacity building for the member countries the NBA, ACMAD and AGRHYMET provided annual training on the seasonal forecasting tagged PRESAO, the 5th edition having taken place this year.

Similarly, the consortium of NBA and AGRHYMET is presently carrying out the WMO pilot project on HYCOS for West and Central Africa, sponsored by the French Government.

3.7. Contact with Heads of States and Donors

The new NBA leadership's first steps were to restore the activities of the NBA Council of Ministers and Technical Committee of Experts (TCE), which had been inactive since1994. The 17th Session of the Council of Ministers preceded by the meeting of the TCE, took place in 1998, in Abuja, Nigeria, to identify the major problems and proffer potential solutions.

The Executive Secretary had direct contact with the Heads of State, which made these heads regain confidence in the organisation.

The NBA visited donor organisations and appealed to donor agencies to finance not only studies, but also concrete development projects. The most important visits were the 1999 working visits of the President of the Council of Ministers and the Executive Secretary to key donors in Europe and North America.

4. ACHIEVEMENTS

4.1. Project Studies

The NBA and the NRC conducted several key studies aiming to achieve an IWRM and the development of the basin. These studies were conducted with the financial support of donor organisation and the international communitt. These project studies are:

- "Study on the Rive Niger Commission" by Holmes and Narver, Inc. 1964
- "Integrated development of the River Niger basin" by a UNDP/FAO multi-disciplinary Team, 1968
- "Study on the navigability of the River Niger from Tossaye (Mali) to Yelwa (Nigeria) by NDECO, 1970
- Hydrological Monographs of the River Niger, FAC/ORSTOM (Version 1, 1968 and Version 2, 1986)
- Establishment of a Documentation Center, UNDP/UNESCO, 1971
- Study on the anomalies of the River Niger Floods, FAC/ORSTOM (1974-1977)

- Prospective Plan for the Development oft he NBA, 1980
- Hydrological Forecasting System in the River Niger Basin, UNDP/OPEC/UE/WMO, 1980-1991
- Mathematical Model of the River Niger, FAC/ORSTOM.IGN/SOGREAH, 1978-1982
- Support Study for the Evaluation and Restructuring of the NBA, UNDP/FAO, 1986-1987
- Study on the Evaluation and Prospects of the NBA, NBA/MULPOC, 1994-1995
- Study on the Hydraulic Schemes on the Upper and Middle Niger, FAO/UNDP, 1983-1985
- Study on the Organisation of a Colloquium on the Safeguard of the River Niger, MULPOC, 1995
- Study on Models of Management, Fixation of Prices and Sharing of Costs relating to Water Resources, MULPOC/ECA, 1995
- Study on Legal Intervention Framework of the NBA, MULPOC/ECA, 1995
- Study aiming at the Coherent Development of the River Niger Basin (1985 to date)
- Consultants Missions for the diagnosis of the River Niger environmental issues, UNDP/GEF, 1996-1997

4.2. Development of New Sharing Formula

The 6th Summit of Heads of State and Governments of the NBA member countries finally adopted in December 2000 a new formula for dues, heretofore shared more or less equally in past. The new formula gives the three greatest beneficiaries of Niger basin resources (Mali, Niger, Nigeria) a substantial increase in their shares, while the other member states receive corresponding budgetary relief. The new sharing formula ranges from 30% for Nigeria to 1% for Chad, which reduces the financial burden of the poorer nations.

4.3. Regional Stability and Co-operation

The NBA facilitated talks on the IWRM of the Benue basin between Nigeria and Cameroon. The two countries are finalising the signing of a Protocol Agreement integrating management and development of the basin to improve co-operation, socio-economic development and regional stability.

The NBA has recently successfully hosted a meeting about the Taousah Dam for Mali and the Kandadji Dam for Niger, in order to amicably settle out differences on the project implementations.

4.4. Hosting of Summits and Meetings

Since the 5th summit of the Heads of State that took place in 1987, there is now consistency in the hosting of the biannual Summit of Heads of State and Governments of NBA member Countries. The 6th Summit took place in Bamako, Mali, in the year 2000 and the 7th Summit has already taken place in February 2002 in Abuja, Nigeria.

There has been no interruption in the meetings of the Council of Ministers since the NBA was rejuvenated in 1998. For instance, the 1998 NBA Council of Ministers Meeting was hosted by Nigeria, by Cameroon in 1999, by the Benin Republic in

2000, Guinea in 2001 and Niger in 2002. The enthusiasm of member countries to host the annual meeting of NBA Council of Ministers is commendable.

The NBA Technical Committee of Experts (TCE) has been consistent in holding their annual meetings to review new NBA projects, programs and budget for the following year.

The NBA has also revamped the activities of the Hydroniger technical committee that oversees the activities of the Hydroniger IFC, the technical organ of the NBA.

4.5. Return of Donor Support

The response of Donors towards the development of basin is quite encouraging. Among the most recent projects achieved thanks to donor assistance are:

a) The ongoing TRI-NIGER project on "Reinforcement of NBA capacity on Conflict Resolution among its Member State" sponsored by the American Government and UNDP.

b) The ongoing GEF project on "Reversal of Environmental Degradation Tendency in the Niger Basin".

c) The FAO project on Aquatic Weed Control.

d) The NBA/UNICEP Biogas project.

e) The current World Bank support for the development of a "Strategic Action Plan" (SDAP) through a shared vision, acceptable to all the member countries, which will be the base of all future developmental programs and projects within the Basin that will enhances rapid development and IWRM of the Basin.

5. PROBLEMS AND CONSTRAINTS

The major institutional problem the NRC and later the NBA had to face, could be summarised as follows:

i) A lack of clear defined objectives and suitable regional strategies based on clear shared vision or master plan acceptable among riparian Countries for the development of the basin.
ii) A lack of legal and institutional mechanism for benefit sharing for the prevention and management of water related conflicts.
iii) An inadequate framework for defining institutional objectives and policies.
iv) Inadequate institutional and operational capacities for planning design and execution of projects.
v) A lack of community involvement in the projects, from grass root project planning to their execution.
vi) A weak institutional capacity and vision for planning and co-ordinating the implemented action.
vii) The non co-operation between riparians or member countries.
viii) An insufficient mechanism for consultation among stockholders.
ix) A lack of adequate knowledge of national policy, activities and orientation of water resources project at national level

x) A lack of co-operation and adequate consultation between institutions, inter-governmental organisations and donor agencies.

5.1. Environmental Problems

The environmental problems in entire basin continue unabated. Some of the most serious ones that still persist to date are:

- Desertification encroachment along the Saharan climatic zone
- Erosion, siltation and sediment transportation along the river
- Incessant flood and flood disaster downstream particularly within the flood plains
- Pollution of various origins (domestic, industrial, craft industry, agricultural, mining)
- floating plants (water lettuce, water hyacinth, etc...)

6. LESSON LEARNT

The River Niger has always been the major source of potable water for the people and their socio-economic development as well as for co-operation among the 9 NBA member countries. Since its creation, almost 40 year ago, the NBA has battled to achieve its objective of ensuring integrated development of the basin, but has been confronted with a series of fundamental and peculiar problems inimical to shared basins.

The lack of adequate solutions, the under exploitation of the basin's abundant potential resources, coupled with the increasing environmental degradation are among the causes of the present alarming growth of poverty in region.

Rather than focussing too much on equitably sharing the basin's resources, the countries should develop a shared vision for integrated development and management of projects. This would ensure benefit sharing and enhance the rapid socio-economic development of the basin.

6.1. Shared Vision and Sustainable Development Action Plan (SDAP)

The lack of a shared vision and a Sustainable Development Action Plan (SDAP), had led to unco-ordinated projects development with an attendant negative environmental and socio-economic impact to other riparian countries downstream. Some of these projects had to be stopped due to international outcry.

Project site location also poses a lot of problems, most especially when the best site is outside a country's jurisdiction.

This problem combined with a lack of shared visions hinders development. The NBA resolved to use the principle of collective ownership of the river basin to achieve integrated development. This will be carried out by the development of a shared vision to produce the SDAP for the basin.

6.2. Shared Benefits

The SDAP for the basin should be based on a shared vision that will induce joint participatory and co-operative projects among member countries.

The principle of shared benefit, rather than sharing the available resources, will provide rapid socio-economic development and foster better co-operation among the countries. It will eliminate EIA problems to a large extent, protect the eco-system and adequately equip the NBA in its IWRM efforts.

7. THE WAY FORWARD

The mandate to develop a shared vision and then a SDAP was given to the NBA by the 6th Summit, in Bamako, Mali. The NBA's request for the World Bank's assistance to the development of a shared vision was approved by the 7th Summit.

The President of the Republic of Niger, the Chairman of the Summit of the Heads of State, wrote a letter in this regard to the President of the World Bank to ask for the World Bank's assistance and support. The World Bank responded favourably and a workshop sponsored by the WB in Abidjan, Ivory Coast, for the member countries and the NBA was concluded in September 2002.

The Niger Basin SDA, will be based on a shared vision of its member countries. The activities based on a shared vision, are the following:

7.1. Regional Sectorial Studies

This will involve the exploration of strategic opportunities and possible constraints at the basin level within selected key sectors. These studies will identify the synergies and draw from existing national and regional initiatives as well as established linkages with regional initiatives of ECOWAS-UEMOA, regional agricultural policies, the transport and trade facilitation program, the West African Power Pool (WAPP) etc.

7.2. A Socio-Economic And Benefit Sharing Integrating Study

This will involve the integration of the findings of the regional sectorial studies to provide an overview and a reference framework for decision-making. It would identify and analyse opportunities for co-operative development, present principles and guidelines for assessing trade- offs among development options, and suggest modalities and frameworks for benefit sharing.

7.3. Consultations

A broad based program of consultation will be required for feedback on all aspects of the sectorial and integrating study. It will also help to define key priorities and build consensus among the riparian countries for integrated basin-wide development.

7.4. Capacity Building

This involves the improvement of the NBA's institutional capacity through training programs appropriate to the NBA and its member countries' needs and expectations.

7.5. Donor Outreach And Co-Ordination

There will be donor outreach and co-ordination, with the assistance of the WB, throughout the process outlined above, to initiate a renewed and strengthened partnership between the NBA and the donor community. Active outreach to and involvement of key donors will provide donor commitment to the process. High quality sectorial studies will be shared with donors and their inputs and comments will be sought to the studies and the consultations. It is envisaged that a Consultative Group will be held at the end of the planning process to seek donor pledges.

8. CONCLUSION

River basins are the major sources of potable water world-wide and the poor IWRM has contributed to the present high level of water demand, famine and poverty in developing countries. It is in this context that IWRM has become the focus of world attention and the United Nations designated the year 2003 as the year of "INTERNATIONAL FRESH WATER YEAR", with the 3rd World Water Forum in Kyoto, Japan.

The current World Bank's assistance to develop a shared vision that would provide a SDAP for efficient IWRM of the Niger Basin will enhance integrated development of the basin resources and provision of adequate potable water supply for all. This will lead to rapid socio-economic development, peace, stability and poverty alleviation in the region. This is why the 3rd World Water Forum in Kyoto, Japan, should also support this timely assistance of the World Bank to the Niger Basin.

The River Niger, the third longest river in Africa and the world's ninth largest river system with over 100 million people within its catchment area, is also a potential spot for water conflict that urgently needs the support of the international community, wich can assist the NBA in the development of the shared vision.

The preservation of the river Niger is also a barrier against desertification and Sahara's march southward, and will give back life to over 100 million people in the basin.

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REGIONAL INSTITUTION: AN EFFICIENT TOOL FOR CONFLICT RESOLUTION

Reza Ardakanian[2]

ABSTRACT

Middle East, North Africa, Arab countries and several Central Asian countries in the world water scarcity areas are considered as the most vulnerable regions to the intensified old and new conflicts of water resources.

Through the analysis of the vital water resources of the countries of the region, being considered as the poorest in the world from the water resources point of view, and their water demands, this paper reveals that if all the countries use the opportunities and advantages for a properly effective co-operation, they will be able to initiate the assured sustainable supply of water to the benefit of all the region's inhabitants.

Next, the successful experiences for institution in the region and the process of establishing the Regional Center on Urban Water Management (RCUWM) in Tehran/IRAN under the auspices of UNESCO, as a Regional Institution for solving the problems of Urban Water Management (UWM) and capacity building will be described.

At the end, certain proposals about the framework of these institutions and their structures are highlighted.

In fact, the paper is based principally on the fact that "one can not be hopeful for the Globalization of solutions to the Water Resources Joint Management without the process of getting Regional".

1. INTRODUCTION

The Middle East, North Africa, the Arab countries and several Central Asian countries in the world water scarcity areas are considered as the most vulnerable regions to the intensified old and new conflicts of water resources.

Unfortunately, due to historical conditions and variances of the political frameworks, as well as the economic, social and cultural backgrounds, and in spite of bilateral efforts between countries, attempts among the third party countries and the international agencies, there are still a lot of dominant bottlenecks and problems to be solved in order to establish assured and stable conditions.

On the other hand, due to the lack of willingness among the regional institutions of these countries in the establishment of these institutes and due to the lack of mutual understanding, the conflict solving is restricted to temporary activities without being organized and sustainable.

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Analyzing the valuable water resources and water demands of the countries in the region, this paper reveals that if all the countries of the region, being considered as the poorest in the world from the water resources point of view, use the opportunities and advantages for a properly effective co-operation, they will be able to initiate the assured sustainable supply of water to the benefit of all the region's inhabitants.

The process of establishing the Regional Center on Urban Water Management (RCUWM) in Tehran/IRAN under the auspices of UNESCO, as a Regional Institution for solving the problems of Urban Water Management (UWM) and capacity building can be recognized as a successful experience for institution in the region.

It is strongly believed that "one can not be hopeful for the Globalization of solutions to the Water Resources Joint Management without the process of getting Regional". This requires the recognition of the historical package round and accurate specifications of each region, to initiate the work based on untwisting to establish the institutions, to approach gradually the major steps for controlling the conflicts and to prop proper solutions.

2. WATER CRISIS IN THE MENA REGION

In general, the MENA (Middle East and North Africa) region accounts for about 5% of the world's population, but only 1% of the freshwater. Per-capita water availability in the MENA region has fallen by 62% since 1960 and is expected to fall by another 50% in the next 30 years. 87% of all freshwater resources in the region are used in mainly low value agriculture. Water losses in municipal distribution systems often exceed 50% of the water supplied for urban use (World Bank, 1995). Throughout the MENA region, the most serious issue is water quantity, followed by water quality.

The countries in the region are highly dependent to their groundwater resources. About 60% of the world desalination plants are located in this area.

The number of water- scarce countries in the Middle East and North Africa has risen from 3 in 1955 (Bahrain, Jordan and Kuwait) to 11 by 1990 (With the inclusion of Algeria, Israel and the Occupied Territories, Qatar, Saudi Arabia, Somalia, Tunisia, the United Arab Emirates and Yemen). Another 7 are anticipated to join the list by 2025 (Egypt, Ethiopia, Iran, Libya, Morocco, Oman and Syria). The state of water scarcity in different countries in the twentieth century is depicted in table 1.

In both the Middle East and North Africa, increasing poverty in certain countries, population pressure, unsustainable water withdrawals, continuing territorial dispute and growing nationalism, environmental degradation and water scarcity are factors that may increase regional tensions.

The link between environmental degradation, water scarcity and violent conflict is a serious threat.
Throughout this region, the origin of water stress is not limited to scarcity but stems from three interacting crises:
Demand for fresh water in the region exceeds the naturally occurring, renewable supply.

Much of the region's limited water is being polluted by growing volumes of human, industrial and agricultural wastes.
The same water is desired simultaneously by different sectors of the same country or wherever it flows across (or under) an international border.
Facing historical, psychological and political barriers that have impeded co-operation and deadlocked diplomacy, nations in the region are sliding toward conflict over water. Water's growing role in the emerging hydro-politics of the region has stressed the need for a new approach to safeguard this diminishing resource. The integration of water into developing strategic co-operation frameworks becomes visible among regional states and could facilitate the protection and preservation of water resources. This interaction could eventually pave the way for the long-term security of Middle East water. In light of the formidable barriers that have prevented agreement to date, such an approach may represent the only method to turn back the tide of the new water politics of the Middle East.

***Table 1*: Water scarcity in the twentieth century country groups Palais Des Nations, (1997)**

Category 1 *(absolute water scarcity)*	Category 2 *(economic water scarcity)*	Category 3	Category 4
Afghanistan	Angola	Albania	Argentina
Egypt	Benin	Algeria	Austria
Iran	Botswana	Australia	Bangladesh
Iraq	Burkina Faso	Belize	Belgium
Israel	Burundi	Bolivia	Bulgaria
Jordan	Cameroon	Brazil	Canada
Kuwait	Chad	Cambodia	(China)*
Libya	Congo	Central African	Costa Rica
Oman	Ivory Coast	Republic	Cuba
Pakistan	Ethiopia	Chile	Denmark
Saudi Arabia	Gabon	Colombia	Dominican Republic
Singapore	Ghana	El Salvador	Ecuador
South Africa	Guinea-Bissau	Gambia	Finland
Syria	Haiti	Guatemala	France
Tunisia	Lesotho	Guinea	Germany
United Arab	Liberia	Honduras	Greece
Emirates	Mozambique	Indonesia	Guyana
Yemen	Niger	Kenya	Hungary
(China)*	Nigeria	Lebanon	(India)*
(India)*	Paraguay	Madagascar	Italy
	Somalia	Malaysia	Jamaica
	Sudan	Mali	Japan
	Uganda	Mauritania	Mexico
	Zaire	Morocco	Netherlands
		Myanmar	North Korea
		Namibia	Norway
		Nepal	Panama
		New Zealand	Philippines
		Nicaragua	Poland

	Peru	Portugal
	Senegal	Romania
	Tanzania	South Korea
	Turkey	Spain
	Venezuela	Sri Lanka
	Zambia	Surinam
	Zimbabwe	Sweden
		Switzerland
		Thailand
		UK
		Uruguay
		USA
		Vietnam

Definitions:

Category 1: These countries face "absolute water scarcity." They will not be able to meet water needs in the year 2025.

Category 2: These countries face "economic water scarcity." They must make more than double their efforts to extract water to meet 2025 water needs, but they will not have the financial resources available to develop these water supplies.

Category 3: These countries have to increase water development between 25 and 100 percent to meet 2025 needs, but need more financial resources to do so.

Category 4: These countries will have to increase water development modestly overall on average, by only five percent to keep up with 2025 demands.

*These countries have severe regional water scarcity. A portion of their populations (381 million people in China in 1990 and 280 million people in India in 1990) is in Category 1. The rest of their populations are in Category 4.

3. EVALUATION OF NATIONAL WATER INSTITUTIONS

In every country of the region, water-management institutions are oriented to the goals of supply management (construction of dams, storage reservoirs and other engineering works) with little attention to demand management. Furthermore, the national institutions typically devote most of their attention to large-scale, centralized forms of supply management. Small-scale, decentralized options tend to be neglected or left to the communities. The national institutions tend to be insensitive to indigenous practices, gender concerns, ethnic groups and the environmental impacts of the institution’s actions. Such organizations merely reflect the concerns of their governments.

Water-management agencies in this region differ only in degree from their counter parts in most other countries, North or South.

Their true distinctiveness lies in two other characteristics: the centralization of water management at the national level and their close relationship with national agricultural agencies. Every one of the Middle Eastern countries has a ministry or senior agency in control of water affairs.

The close political association of water and agriculture means that inter-sector conflicts tend either to be ignored or to be resolved in favor of farmers. It also means that internal water institutions resist to suggestions to increase water prices for farmers or to move toward any form of water market of other means of establishing rational allocation. In many countries (notably, Iraq, Jordan, Libya, Syria and Yemen), demand is supply limited because of the infrastructure being unreliable or undersized or because of the poor quality of the water, particularly in the summer.

4. BILATERAL / MULTILATERAL CO-OPERATION

There are several treaties on water among the countries in the region. Table 2 shows a list of these treaties.
As we have seen, there is no institutional treaty on water. There are some potential areas for multilateral co-operation among the countries in the region such as:
Removing political limitations in import/export of Water.
Co-operation in drought management
Organized co-operation in basin level
Institutional co-operation in water resources pollution, wastewater and other research issues
Planning and policy making
Knowledge & technology transfer
Water legislation

***Table 2*: List of water treaties among the countries in MENA region (Wolf A.)**

Subject	Parties	Principal Issue Area	Treaty Basin	Total Basin	Date	Signature
Utilization of the frontier parts of the rivers Aras & Atrak for irrigation & power	Iran USSR	Water Supply	Aras Atrak	Aras, Atrak	11 Aug. 1957	Bilateral
Concerning the regime of the Soviet-Iranian frontier and the procedure for the settlement	Iran USSR	Other	Tedzen, Atrak, Aras, Harirud	Aras, Atrak	14 May 1957	Bilateral

Concerning the use of frontier watercourses	Iran Iraq	Water Supply	Bnava, Suta, Qurahtu, Gangir, Alvend, Kanjan	Euphrates	6 March 1975	Bilateral
Terms of reference of the Helmand River Delta Commission	Iran Afghanistan	Water Supply	Helmand	Helmand	7 Sept. 1950	Bilateral
Concerning the supply of Kuwait with fresh water	Iraq Kuwait	Water Supply	Unspecified	Euphrates	11 Feb. 1964	Bilateral
Regarding the construction of the Owen Falls Dam, Uganda	Egypt Great Britain	Hydropower	Nile	Nile	31 May 1949	Bilateral
Agreement between the United Arab Rep. and Sudan	Egypt Sudan	Water Supply	Nile	Nile	8 Nov. 1959	Bilateral
Use of the River Nile for Irrigation	Egypt Great Britain	Water Supply	Nile	Nile	7 May 1929	Bilateral
Regarding the construction of the Owen Falls Dam in Uganda	Egypt Great Britain (Uganda)	Hydropower	Nile	Nile	16 July 1952	Bilateral
Regarding the construction of the Owen Falls Dam in Uganda	Egypt Great Britain (Uganda)	Hydropower	Nile	Nile	5 Dec. 1949	Bilateral
Co-operation in Meteorological Affairs	Egypt Great Britain (Uganda)	Hydropower	Nile	Nile	19 Jan. 1950	Bilateral

5. REGIONAL INSTITUTIONS ON WATER

There are some problems in the formation of the regional institutes which are:
Discontinuity in water management structures;
Lack of Basin Management Institutes on national and regional levels;
Shortage of qualified human resources in water management.

Some of the existing regional institutes are described as following:

AAN (Asia Arsenic Network)

The Asia Arsenic Network (AAN) was founded in 1994 to learn more about the mechanisms and extent of contamination in order to assist in providing co-operative solutions to problems, using common experiences and shared information.

Initial activities focused on establishing contacts by visiting affected areas and inviting researchers to visit the AAN. In October 1995, the AAN issued a pamphlet aimed at increasing the awareness of the problem.

Currently, the AAN is establishing a data base on Asia's arsenic problems so that relevant information will be readily available to interested parties.

NetPEM (Network for Preventive Environmental Management)

Environmental Consciousness has taken the front seat in the last quarter of the 20th century. Organizations worldwide are turning proactive in the quest for sustainable world. Network for Preventive Environmental Management (NetPEM) is one of the organizations working towards the accomplishment of this Sustainable World. The operative secretariat of NetPEM is located at Nagpur, India.

ACSAD (The ARAB CENTER for the STUDIES of ARID zones and DRY lands)

ACSAD is a regional center for research and studies pertaining to the development of the arid and semi-arid areas of the Arab World. It was established in Damascus (capital of the Syrian Arab Republic) in 1971 within the framework of the League of Arab States. ACSAD is governed by the Council of the Arab Ministers of Agriculture.

The Arab states' decision to establish ACSAD was based on the importance of the Arab arid and semi-arid lands vis-à-vis the future of the agricultural development and the realization of the objectives of the food security in these lands which cover about 90% of the area of the Arab World.

ICARDA (International Center for Agricultural Research in the Dry Areas)

Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is one of the 16 centers strategically located all over the world and supported by the Consultative Group on International Agricultural Research (CGIAR). With its main research station and offices based in Aleppo, Syria, ICARDA works through a network of partnerships with national, regional and international institutions, universities, non-governmental organizations and ministries in the developing world, and with advanced research institutes in industrialized countries.

IRTCES (International Research and Training Centre on Erosion and Sedimentation)

Established in 1984 in Beijing, China, International Research and Training Centre on Erosion and Sedimentation promotes of international exchange of knowledge and co-operation in the study of erosion and sedimentation problems; focusing on sediment-related problems pertaining primarily to rivers, including not only their courses from source to estuary, but also their entire watersheds.

HTC — Kuala Lumpur (Regional Humid Tropics Hydrology and Water Resources Centre for Southeast Asia and the Pacific)

Regional Humid Tropics Hydrology and Water Resources Center for Southeast Asia and the Pacific promotes collaboration among countries in the regions of South-East Asia and the Pacific through technology and information exchange, education and science. It tends to increase scientific and technological knowledge about the hydrological cycle in order to better manage and develop our water resources in a holistic manner. The Center was established in 1999 by the government of Malaysia.

RCUWM-Tehran (Regional Center on Urban Water Management)

The Iranian National Commission for UNESCO submitted in September 1999 to the 30th session of the General Conference of UNESCO a proposal on the establishment of a Regional Centre on Urban Water Management in Tehran within the framework of the Fifth Phase of the International Hydrological Program of UNESCO (IHP-V), in the form of a draft resolution.

While the draft resolution itself was judged inadmissible according to the criteria set out in the Rules of Procedure of the General Conference, UNESCO informed the Member State that "the Director-General welcomes this initiative and is willing to follow it up on the basis of a detailed proposal".

In June 2000, the Senior Vice-Minister of Energy of the Islamic Republic of Iran briefed the 14th session of the Intergovernmental Council of the International Hydrological Program on the proposed regional urban water management center. After due consideration, the Council adopted Resolution XIV-6, in which it welcomed the proposal and requested the IHP Secretariat to assist the Government of I.R. of Iran in the presentation of the submission to the governing bodies of UNESCO.

In fulfillment of the request contained in the resolution, a UNESCO mission was undertaken to Iran in early December 2000, concluding in the signature of a MoU between the two parties. Some of the main results were:
(a) The commitment on the part of the Iranian Government was reflected in actions carried out. It had: (i) created an ad hoc Task Force of top government officials and IHP National Committee representatives; (ii) gathered a large segment of the governmental, scientific, academic and professional water community of Iran behind it; (iii) already invested enough funds in preliminary activities and in acquiring and equipping the venue of the Center; and (iv) initiated a number of contacts conducive to gathering regional and international support for the Center.
(b) A detailed action plan for the establishment of the Center under the auspices of UNESCO, culminating with a submission to the 31St session of the General Conference of UNESCO, with the expected formal opening of the Center in January 2002.
The Government of the Islamic Republic of Iran formally submitted to UNESCO in March 2001 a detailed proposal for the establishment of the Regional Center on Urban Water Management in Tehran under the auspices of UNESCO.

In accordance with the agreed plan of action, a Regional Consultation convened by UNESCO and hosted by Iran took place on May 2001 in Tehran. It involved representatives of 13 countries and 14 international governmental organizations and scientific and professional NGO's. The meeting was highly successful in generating initiatives of co-operation with the Center by the countries and organizations, as expressed in its Closing Statement. For this center, the region consists of Iran and its neighboring countries, CIS countries, and Arab states in the south of Persian Golf.

The Executive Board of UNESCO at its 161st session examined the detailed proposal of the Islamic Republic of Iran and the considerations by the Secretariat of the Organization on the feasibility of the Center. In October 2001, at the 31st session of UNESCO's General Conference, the final proposal of establishment of RCUWM was approved.

Finally, in February 2002, the agreement between the Government of the Islamic Republic of Iran and UNESCO for the establishment and operation of the Center was signed.

The Center tried to attract international support, and tried to make use of national potentials since the beginning of its establishment. These activities have resulted in the signing of several bilateral agreements between the Center and other institutes such as: IJNESCO-IHE, Russian and Japanese National Committees of Hydrology, IWA, IAHS and a few national institutes.

The mission of the Center is considered as below:
The Center will be an advisory and co-ordinating body that will steer the execution of the program of activities by means of universities, researchers, and governmental agencies.

The Center follows the following objectives:
- To generate and provide scientific and technical information;
- To promote research on urban water management issues;

- To undertake effective capacity building activities;
- To advance co-operation with international institutions.

The Center will do the following functions to achieve its objectives:
- To promote scientific research;
- To create and reinforce networks for the exchange of scientific, technical and policy information;
- To develop and co-ordinate co-operative research activities on UWM with participatory of regional potentials;
- To organize knowledge and information transfer activities;
- To develop a strong program of information and communication technology;
- To provide technical consulting and advisory services in the region and beyond;
- To produce technical publications and other media activities.

The Center is defined as "a co-ordinating and consulting entity employing the capabilities of the universities, research centers and the other governmental and non-governmental organizations in order to execute its activities and programs".

Its structure involves:
Board of Trustees: high-level government body that includes the Minister of Energy (head), the Minister of Science, Research and Technology and other authorities, essentially in charge of ensuring appropriate conditions for the Center and the Iranian funding share and the oversight of the Center on behalf of the Government of the Islamic Republic of Iran.

Governing Board: body with membership of representatives of the host country, UNESCO and other participating countries of the region, and international organizations. So far, the officials from Bangladesh, Lebanon, Oman, Pakistan, and Syria have shown interest to become a member of the Governing Board of RCUWM-Tehran.

Secretariat: body in charge of executing the activities of the Center under the authority of a Director appointed by the chairman of the Board in agreement with the Director-General of UNESCO.

The organizational chart of the Center is depicted in Fig. 1.

As the initial projects, the activation of center is being realized by the following three projects in the region:
Compiling information on Urban Water Management in the Region
Training courses for decision-makers on Water Demand Management
Problem Assessment and Strategic Planning on Urban Water Management in the Region

6. CONCLUSION

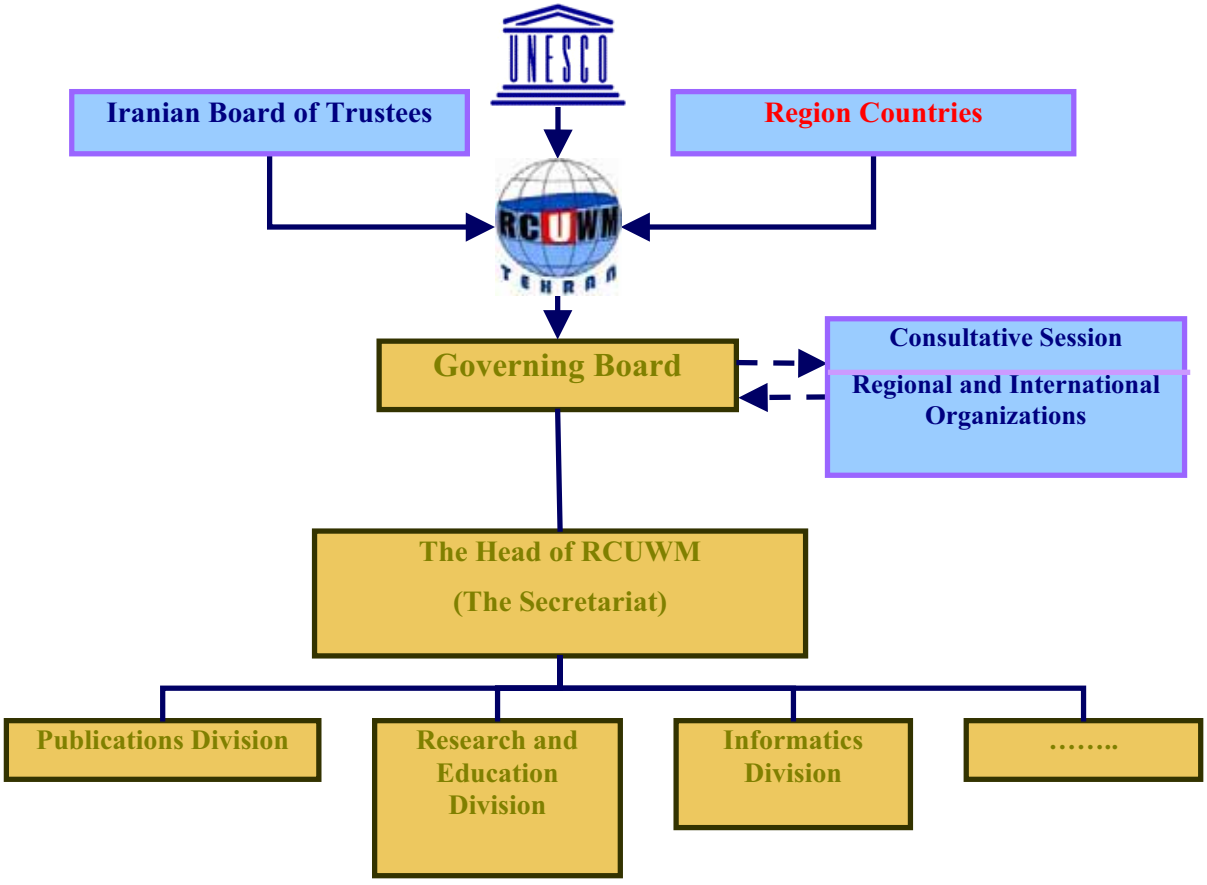
The Middle East and North Africa region is considered as the poorest region from the renewable water resources point of view. Considering the highest population growth rate, the countries in this region use water in a very low level of efficiency. In addition, the environment and the quality of water resources are hardly

regarded. Boundary rivers in this region are likely to cause conflicts between countries. These water conflicts may intensify regional political stresses.

Many international institutions and programs were active in the region but they appear not to be really successful due to the lack of effective regional institutions.

The globalization of solutions to the water resources joint management will not be achievable unless the process of regionalisation is completed. Coming to regional institutions the following prioritized suggestions are propounded relatively:
Organizing a regional forum for water dialogue;
Promoting regional co-operation based on the results of the dialogue;
Focusing on boundary water management co-operation;
Expansion of regional water market.

***Figure 1*: the organizational chart of RCUWM**



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ISSUES IN DEVELOPING CO-OPERATION FOR THE SUSTAINABLE MANAGEMENT OF TRANSBOUNDARY AQUIFERS

S. Puri[3]

ABSTRACT

The scientific principles involved in the sound management of transboundary aquifers are well known and understood by groundwater specialists. These include an appreciation of the full system, i.e. from sources of recharge, to the regions of discharge, as well as the quantity and quality issues along the flow path. Usually the system is well described by the use of conceptual models through which groundwater specialists from across national boundaries can communicate well. Unfortunately sustainable management of transboundary aquifers goes well beyond developing consistent conceptual models. It needs in addition, harmonisation of legislation (L), equivalence in institutional structures (IS) and consistency in socio-economic (SE) drivers as well as a coherent application of the environmental protection (EP) criteria, abbreviated to LISSEEP. Developing co-operation for sound management therefore requires an equal attention to these other drivers, which must follow upon the hydrogeological conceptual consistency. One of the key issues in developing co-operation is strengthening institutions such as Basin Commissions or Joint Bodies, for these aspects to be addressed. There exists extensive literature and substantial experience in developing co-operation for the sound management of transboundary river basins. While many of the principles from this experience can be applied to aquifers, there are issues peculiar to aquifer behaviour that should be defined in the LISSEEP for co-operation to be made effective. This paper addresses some of these issues, drawing on the experience from Mozambique's shared water resources and the programme for saving the Aral Sea Basin.

1. INTRODUCTION

The worldwide distribution of transboundary aquifers has recently been demonstrated in the world Hydrogeological Map (IAH & UNESCO 2002). Almost 90% of all accessible freshwater is held in aquifers. While specific statistics have not yet been compiled from such a map, it is reasonable to assume that they will be analogous to transboundary river basins (Wolf 2002). About 45.3% of the global land area lies in transboundary river basins and 40% of the world population lives in such basins. Transboundary basins provide 60% of the global river runoff. As no such quantitative data is available for aquifers, a worldwide project devoted to an inventory and analysis of transboundary aquifers has been initiated (Puri 2001). A Framework Document sets out the elements that are needed when addressing transboundary aquifers (UNESCO 2001).

There is limited experience about the national & international regulations for the sound management of transboundary aquifers. One pioneering survey has been carried out in Europe through a questionnaire conducted under the UN ECE's transboundary water programme (UN ECE 1999). Despite the existence of many joint bodies for transboundary water resources, aquifer resources have been given

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very limited attention. While the main thrust of the ECE project is to develop guidelines for consistent monitoring of the water resources, the findings of this study are useful when assessing what issues need particular attention. One of the lessons learnt from studying 90 transboundary aquifers, is that lack of consistent terminology by the Joint Bodies in the designation of aquifers may lead to inconsistent assessment of their resources and consequently of their management. Sometimes this can have significant quality related impacts that manifest themselves over time. The survey demonstrated that even in Europe, with its long tradition of water resources management, transboundary aquifer management is yet in its infancy.

This paper aims to demonstrate that Basin Commissions and Joint Bodies need considerable strengthening. Sustainable transboundary aquifer management requires more than just a sound scientific appreciation of the system through a conceptual model. Superimposed on this model should be other, critical factors, such as legislation (L), institutional structures (IS), socio-economic priorities (SE) and environmental protection (EP) in the sharing countries. The co-ordination of all of these factors, abbreviated to LISSEEP, is difficult to achieve without strengthening of key institutions and building capacity. Where transboundary resources play a significant role in national economic development, mainstreaming these issues within government and among stakeholders is as important as redefining the joint commissions. This paper will outline the institutional setups of Mozambique, in Africa (Vaz 1999) and of the Aral Sea region, Central Asia, (Dukhovny 1999) and the efforts needed to strengthen them for the sound management of their transboundary aquifers.

2. SCOPE OF SIGNIFICANT ISSUES

Before reviewing the national structures for the management of transboundary aquifers, the following general comments on River Basin Commissions and Joint Bodies charged with transboundary resources sets the background in the international context.

2.1. Basin Commissions & Joint Bodies

A review of the scope of responsibilities of Commissions & Joint Bodies suggests that there is limited institutional experience that can be drawn upon as far as the management of transboundary aquifers is concerned. Some guidance may be inferred from a series of conventions relating to the use of shared natural resources. Among these is the highly innovative and prescient 1968 African Convention on the Conservation of Nature and Natural Resources. In Article V (2) the convention provides that:

> *"Where surface or underground water resources are shared by two or more of the Contracting States, the latter shall act in consultation, and if the need arises, set up inter-State Commissions to study and resolve problems arising from the joint use of these resources, and for the joint development and conservation thereof."*

This is also stated in the ILA's Seoul Rules on International Groundwaters (1986), under article III, clause 3, which states that "Basin states shall co-operate, at the

request of any one of them, for the purpose of collecting and analysing additional needed information and data pertinent to the international groundwaters or their aquifers". However, for such co-operation to be fruitful and yield results, there is a need for adequate capacity and institutional strength. Traditionally, groundwater management remains dispersed and fragmented in most countries of the world.

2.2. Constraints In Existing Commissions

In considering institutional arrangements for transboundary aquifers, it may be relevant to review the existing arrangements for shared surface waters, noting some of the difficulties that have constrained their activities, shown in Table 1.

***Table 1*: Existing River Basin Commissions**

Basin Commission	Comment
Danube & Rhine Commissions	Set up for the purpose of regulating navigation. Recent extension of responsibility to pollution issues.
Indus & Nile Commission	Established to settle water apportionment. The latter only includes two members.
International Joint Commission USA – Canada; International Boundary and Water Commission USA – Mexico	Both have operated well with discussion and settlements of most disputes.
Mekong Commission	It has recently started to become fully active

2.3. Scope Of Activities For Aquifer Commissions

Several general observations, which might be of value in establishing aquifer commissions, can be made:

- Commissions issue recommendations and may be advisory.
- Commissions may be of indefinite or long durations, and thus have time to adapt to changes.
- They have the authority to undertake studies, conduct investigations; consequently they have an important influence during early stages of planning, when co-ordination is crucial.
- A technical bias in a commission precludes the domination of political influence – it may be retained at the Commissioner level, therefore participation of all members is needed.
- They should possess judicial powers to settle disputes, decide on allocation of water, costs and benefits.

Assuming that riparians in a transboundary aquifer decide to establish institutions for the joint management of resources,
Table ***2*** shows an outline of the scope of responsibilities that should be considered.

***Table 2*: Scope of responsibility for Aquifer Commissions**

Scope	Responsibilities

Technical	• Establishing a sound conceptual model of the whole aquifer & interaction with surface water • Formulation of a sustainable basin development plan & co-ordination, including prioritisation, water quality & pollution prevention plans • Control of beneficial uses – allocations for municipal demands, agricultural demands, industrial demands • Establishing other aquifer uses e.g. thermal energy, balneological needs, natural discharges to wetlands, etc
Economic & financial	• Internal financing, including cost sharing & sharing criteria • Financing specific projects, management of international funds, compensation criteria, sharing benefits, payment of interest & repayment of debts • Assessment of collection of revenues, setting of tariffs • External financing
Legal & administrative	• Administration of the right to use water at the national level and co-ordination with national agencies and institutions, establishing water users associations • Prevention and settlement of disputes between water users • Drafting and implementing required legislation – international agreements, ministerial resolutions, harmonization of legislation • Other legal advice
Public participation	• Ensuring full involvement of the stakeholders • Empowering water user associations and defining property rights • Implementing the full scope of sustainability in resource use

These tasks to be entrusted to a Commission should not preclude alternative options that could be adopted. Since the existing agencies may well have river basin management responsibilities, then consideration should be given to strengthening the existing basin management agency. In their complete absence, a new authority or a specialized management institution e.g. irrigation agency, could be developed and entrusted to act as the 'apex' body for water resources, including groundwater. Other aspects such as duration, constitution of the commission, procedures for decision making and the LISSEEP factions should to be taken into account.

3. MANAGEMENT OF TRANSBOUNDARY AQUIFERS

The development of a hydrogeological conceptual model underlies the approach to sound management of transboundary aquifers.

Take the case of a river that acts as an international boundary. The water resources are allocated according to the extent of the surface catchment within the territories of sharing countries. As demonstrated in Figure 1, regional groundwater flows contribute to resources across national boundaries, by-passing the river system. If the legislative (L) and institutional structure (IS) of the riparian countries separate the management of ground and surface water, serious environmental degradation may results. For example, in the case of most Aral Sea riparians, surface water

resources are managed by institutions with an irrigation focus, while ground water resources are managed by the agencies for Geology.

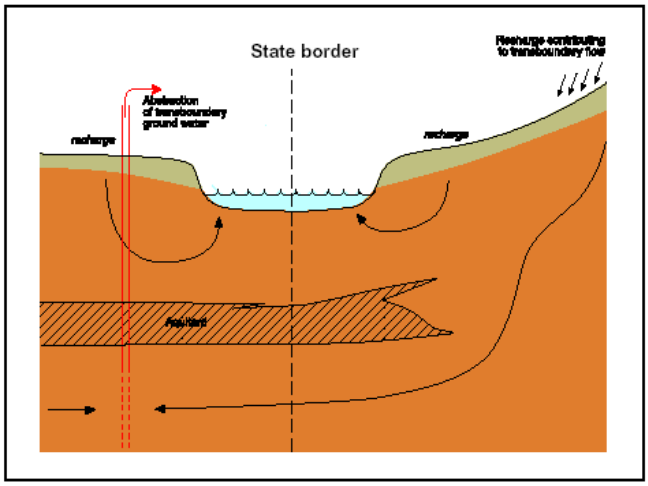

***Figure 1*: Regional groundwater in the Transboundary context**

This separation of responsibility is one of the reasons for severe land degradation and water logging (Dukhovny 1999) as well as for continuing conflicts between institutions. On the other hand, in Mozambique a unique institutional setup permits addressing these issues, through the establishment of an office specifically charged with international waters (Vaz 1999). The latter, though still a weak institution due to lack in capacity, at least permits 'mainstreaming' of water issues for environmentally sustainable development.

The key consideration in mainstreaming water resources in economies that are highly dependant on them, as is the case in the Aral Sea region as well as in Mozambique, has to lie in involving national line ministries in the process. There is a particular need for this for transboundary aquifers are not well known nor well understood in many parts of the world. Institutions charged with transboundary waters often lack the capacity to incorporate aquifer resources into their integrated water planning.

4. INSTITUTIONAL STRENGTHENING

4.1. Water Resources Management In Mozambique

The following example is drawn from Mozambique. The national water resources were described in a "Country Situation Report – Water Resources (1988)" (DNA 1999), where it is noted that the socio economic development of Mozambique depends to a large extent on the correct and sustainable use of its water resources. As the last downstream riparian of several major rivers basins that discharge through Mozambique (Zambesi, Save, Limpopo, Incomati, Umbeluzi & Maputo, Figure 2), the nation is uniquely dependant on sound transboundary resource management. The severe floods of 1998 had a measurable impact on the GNP and it has been argued that sound transboundary resource management in neighbouring countries could have ameliorated the impact. Groundwater resources

are the main source for rural areas and there are adequate resources in most of the country. Major cities are also provided by groundwater, such as Pemba, Tete, Quelimane, Xai Xai and Chokwe. The regional source of recharge to these aquifers is either from groundwater inflowing across boundaries or leakage from transboundary rivers.

A unique department, known as the Gabinet dos Rios Internacionales (GRI) has been installed in the National Directorate of Water (DNA), which is charged specifically with transboundary resources. The weaknesses of the institutional setup of the DNA and the GRI are described in Vaz 1999. In the last year (2002), institutional strengthening through 'process analysis' has started in order to support and strengthen the DNA, and in particular the GRI (World Bank 1999).
The process analysis included a review of the functions and structure of the GRI. (GRI 2003) The small unit is currently staffed by experts in three fields, international relations, law, and water-environmental management. Their responsibilities are entirely focussed on the urgent day-today issues driven by the scope of the SADC water sector activities, negotiations related to the establishment of joint river commissions and co-ordination within some line ministries. The key area of weakness is the lack of expert resources to analyse the strategic impact of the water related agreements on the economy of Mozambique. There is an urgent need to develop decisions support systems, evaluation tools, and access to data and information for input to the analysis (figure 3). The result of the process analysis has suggested several key institutional developmental steps, building of capacity and phased increase of staff resources. As an immediate step, the triple focus of GRI is recommended to increase to four areas of expertise, represented by the Venn diagram of Figure 4.

***Figure 2*: The transboundary basins of Mozambique**

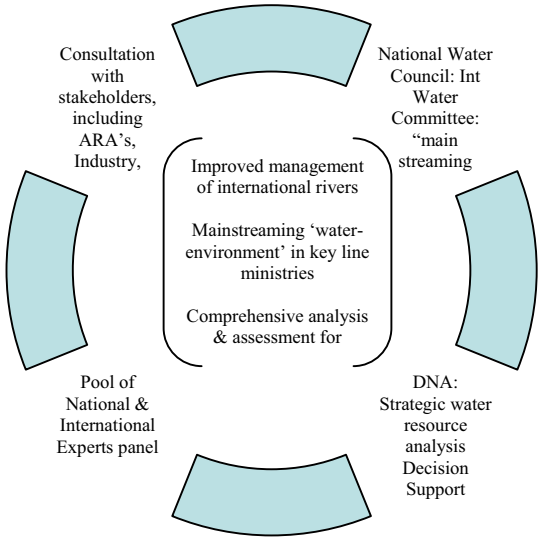

***Figure 3*: Institutional strengthening of GRI, Mozambique**

The institutional analysis of GRI indicated that mainstreaming water issues could be conducted at the National Water Council level through the establishment of a specific committee devoted to transboundary waters. The water resources analysis would be conducted by the Directorate of Water Resources, but through a dedicated liaison officer, with resource planning competences. Access to national and international scientific expertise could be provided through a dedicated Expert Panel. The Venn diagram illustrates the close internal collaboration in the strengthened GRI, (Fig. 4). The fourth area of expertise is strategic planning based upon economic and decision support systems; expertise that is accessible in-house within the GRI. Taking account of the financial resources available, staffing levels were set to increase over the next five years from the current five to nine.

4.2. Surface And Groundwater Interactions In The Aral Sea Basin

The Aral Sea basin is located in Central Asia and is shared by five, now independent States (Figure 5). Previously these five states belonged to a single administration and a huge irrigation supply infrastructure was constructed in response to the need for rapid economic development. As an add-on, hydro-energy generation was also included in the infrastructure. The current river basin management suffers from conflicting demands and the new priorities of the independent states. The problem has been extensively described in literature (e.g. Dukhovny 1999) in relation to the desiccation of the Aral Sea. In this paper attention is focussed on the institutional limitations; and an analysis of the focal problem relative to the basins of the two rivers that drain into the Sea, the SyrDarya & the AmuDarya. In all the literature concerning the basins there is remarkably little mention of groundwater. The key reason for this is that surface and groundwater management in most of the sharing States is separated as mentioned above. To this day the separation continues and the effective disintegrated management issues are only just starting to receive some attention.

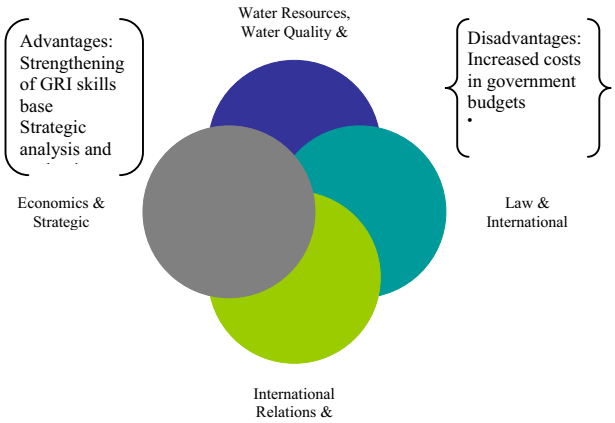

***Figure 4*: Extending the focus to address strategic transboundary water issues in GRI**

***Figure 5*: The Aral Sea basin**

Groundwater resources in the lower part of the drainage basins of the two river systems are described by Veselov (pers. Communication, 2003). Saturated aquifers of thickness upto 600m are present in the region, but the flow directions do not necessarily coincide with river channels because of very low gradients (Fig. 7). There appear to be adequate fresh groundwater resources for conjunctive use with surface waters. Shallow aquifer quality has been impacted by poor to very poor irrigation practices, near lack of drainage and, in the past, excess application of agrochemicals.

A 'problem tree' analysis was conducted for the region. The focal problem identified is *"degradation of land and pervasive salinity of irrigation return waters"*; the cause and effect linkages were established (not described here). Based on this, a long term 'objective tree' was developed, shown in Fig. 6, which is formulated as *"strengthening the capacity of the Basin Water Organisations (BWO's), for water resource planning"*. The BWO's are the operational units under an Inter State Commission for Water Co-ordination (ICWC, Fig. 8). Unfortunately the ICWC does not have competence over hydro-energy generation, and as previously stated, groundwater management. Under the Soviet Union, the BWO's had the competence to regulate the hydraulics of the irrigation system within a central 'command and control' system; the current reality of the socio-economics (SE) dictates that sovereign countries need bottom-up operational regulations. The main practical means of achieving this will be through providing tools and human resource capacity within the BWO's i.e. through developing their competences in performing water resource planning functions.

Since the legal frameworks (L), as expressed in their national 'water codes' are different and the institutional structures (IS) are not uniform, then attention should be focussed at sub catchments where there is at most bilateral jurisdiction, for the development of resource planning strategies. The territorial units of the BWO's would be the most suited to this, from direct operation control on local hydraulics. A

donor programme to support this approach is in the process of formulation. Under the project, decision support models and other tools for basin wide application, will scaled down to bilateral, or at most trilateral sub catchments – where the bottom-up approach of balancing demands to available resources can be optimised through integrated resource planning.

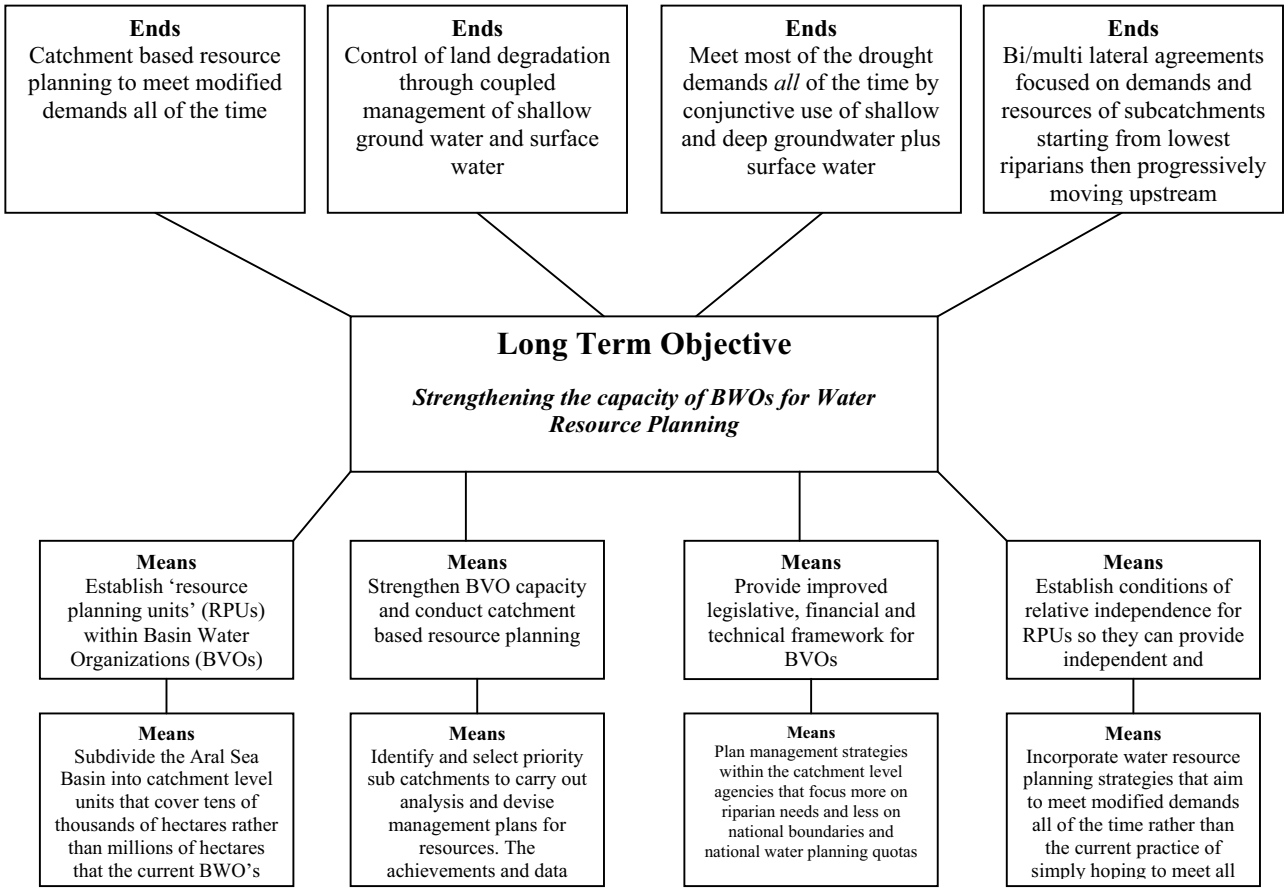

***Figure 6*: Long term objective tree: means to achieve ends**

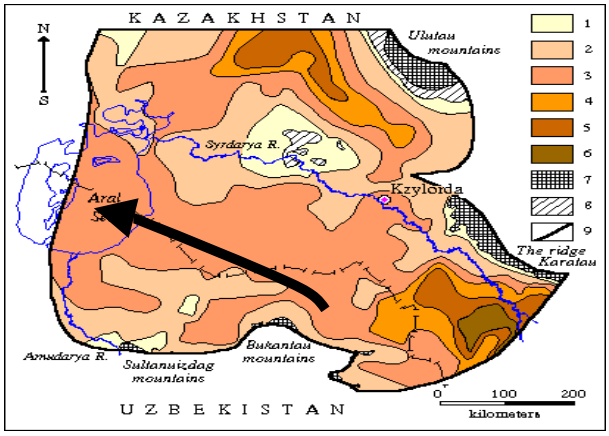

***Figure 7*: Aquifer conditions in the AmuDarya and SyrDarya basins**

Aquifer thickness, m:
1 – <100, 2 – 100-200, 3 – 200-300, 4 – 300-400, 5 – 400-500, 6 – >500; 7 – outcrop of Palaeozoic rocks; 8 – areas without water-bearing horizons; 9 – investigation area boundary
Regional groundwater flow direction

***Figure 8*: Organisation structure of Basin Water Organisation, Aral Sea Region**

5. CONCLUDING REMARKS

In reviewing the issues for developing co-operation in transboundary aquifer, it is worth recalling previous commentary on institutional strengthening and capacity building. In the mid 1990's the role of capacity building for integrated water

resource management was much discussed (Biswas et al 1996), as were international waters (ed Biswas 1997). Many of the basic issues raised there, have been overtaken by Hague Ministerial Declaration (March 2000) and the adoption by UNESCO IHP-VI (2000) and other UN and international agencies. Nevertheless, governments have still been slow to react and operationalise the expert group recommendations that have been made. The issues described above, from Mozambique and Central Asia, suggest mixed reaction to the essential needs in transboundary management – i.e. the need to address water resources in the context of LISEEP. Both the examples in this paper demonstrate the need to integrate the role of transboundary aquifers into water resource planning.

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CHALLENGES AND FUTURE OPPORTUNITIES IN THE NILE BASIN

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ABSTRACT

The Nile River Basin is one of the nine rivers shared by more than six countries out of the 261 shared river basins in the world. Water plays an important role in the socio-economic development of the Nile Basin countries. It has direct effects on all the economic sectors e.g. domestic water, agriculture, hydropower, industry …etc.

In this paper, challenges and constrains facing the Nile Basin water management are highlighted and discussed. The attempts to establish treaties and agreements to govern the Nile waters, since the 19th Century, are reported. The people of the Nile Basin have understood from the early days the importance of coming together and co-operate for better utilization of the water resources within the Nile Basin. Several projects have been initiated aiming at better awareness of the potential of the Nile Basin and the best ways to get maximum benefits out of its water and natural resources.

The paper emphasizes the importance of the Nile Basin Initiative (NBI) among the other projects, which was signed by all the riparian Nile countries except Eritrea. It addresses shared vision strategy and regional concept for the first time. The capacity building of institutions and human resources development, besides the exchange of information and experiences are essential for effective and efficient water resources management within the Nile Basin. Finally the paper points out the main conclusions and recommendations.

1. INTRODUCTION

Water is a finite, pervasive, mobile, precious and multi-functional resource. It is also indispensable for good governance. No responsible government is likely to consider its development policy or strategy to be complete unless it specially considers the water sector in terms of its use and availability, for domestic and industrial purposes, agriculture production and hydropower generation.

Of the total amount of water on the earth's surface, only 3% is fresh, whereas 97% is seawater. The fresh water in the globe, if it spreads evenly, would make up a larger of 70 meters high. It should also be known that out of the 3% fresh water, only 0.3% is found in rivers and lakes while the rest is locked in icecaps and glaciers. It is not so much the amount of fresh water available on the surface of the earth that makes it scarce, but rather its uneven distribution. Had water been spread evenly, it would have been ample for all conceivable human needs. However, this plenty of water in the globe is in many cases either in the wrong place or available at the wrong time.

The Nile River has been providing life to the vast Nile Basin for hundreds of thousands of years. It is a great river, which deserves the Nile Basin's people deepest respect. The Nile is the longest river in the world and its course towards the Mediterranean Sea crosses several climatic regions (6671 km from the remotest point headstream). The Nile Basin, covering a total area of about 3 millions km^2, is shared among ten countries: Burundi, Congo, Egypt, Ethiopia, Eritrea, Kenya,

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Rwanda, Sudan, Tanzania, and Uganda. Due to the great variation of socio-economic and environmental conditions, the pressure on natural sources, in particular surface water, varies among countries. The immense drought and desertification the Nile Basin Countries had to face in the last three decades accelerate natural resources deterioration. Fig (1) shows the Nile Basin as adopted by the Nile Basin Initiative (NBI) Project.

2. NILE BASIN AS TRANSBOUNDARY RESOURCE

Water is the great gift provided to humankind and to all living things. However, water resource has not the abundance of unlimited resource as we all realize now, particularly after those years of drought and decades of desertification and shortage in water witnessed in the last decades. The dialogue on water is very sensitive when water is extremely scarce.

Cross boundary rivers are considered as a regional link amongst the river line countries. For millennia, the Nile river represents a unique waterway nourishing varied livelihoods, an array of ecosystems, and a rich diversity of cultures. It serves as a home to world-class environmental assets, such as Lake Victoria (the second largest fresh water body by area in the world) and the vast wetlands of the Sudd.

It also serves as a home to an estimated 160 million people within the boundaries of the Basin, while about twice that number – roughly 300 million – live within the ten countries that share and depend on Nile waters.

In the African continent about 60% of its area is covered by transboundary river basins. A third of the African population lives in an under water scarcity situation, and half of the African countries will suffer from water stress by the year 2025. Shared water utilization plays and will be playing a significant role in inter-state relations. Moreover, population growth and the onslaught of recurrent drought and famine in some parts of the African continent would intensify the demand for fresh water.

3. NILE WATER AS A POTENTIAL FOR CONFLICT & CO-OPERATION

Through history, water has been a major force in the rise and fall of great civilizations and a source of conflict and tensions between nations. Civilizations and life is tied with water. By the same token, civilizations have collapsed when water supplies have failed or were improperly managed. The most important question now: Is water in the 21st century a potential for conflict? The answer unfortunately is yes, if it is not properly managed and efficiently utilized in an integrated manner, e.g. the war between India and Pakistan in the fifties and the recent conflict between Lebanon and Israel.

In the Nile Basin most of the national economies depend heavily on agriculture and the people rely on subsistence production for food and income security. In the past, the Nile Basin water resources have been adequate to meet existing and emerging demands. Due to population growth and environmental degradation of the resources, annual water availability per inhabitant of the Nile Basin has declined. With increasing pressure on the scarce common water resources, the capacity at regional and national levels need to be improved to ensure sufficient and efficient water resources management and planning for sustainable and conservation of the resources. A sustainable Nile co-operation build on management, utilization and

conservation of the water resources is constrained by limited capacity, including institutions, social structure and human resources.
Using the World Bank population estimates the total renewable resources (fresh water resources) which include flows of rivers and groundwater from rainfall within the country and river flows from other countries, are shown in Table (1).

***Figure 1*: The Nile River Basin**

***Table 1*: Fresh water withdrawals of the ten Nile Basin countries as compared to other parameters.**

Country	GNP Per Capita (US$)	Population Without Safe water (%)	Population Growth Rate (%)	Annual Freshwater Withdrawals per capita in cubic Meters	Life Expectancy at birth (Year)	Infant Mortality Rate (Per 1.000 Live births)	Daily calories Intake per Capita
Burundi	140	48	2.3	20	42.7	106	1685
D.R.C	110	32	2.9	18101	51.2	128	1755
Egypt	1290	13	1.5	920	66.7	51	3287
Eritrea	200	32	2.6	N/A	51.1	70	1622
Ethiopia	100	75	2.5	50	43.4	110	1858
Kenya	350	56	1.5	87	51.3	75	1976
Rwanda	210	21	2.8	134	40.6	105	2056
Sudan	290	27	2.0	669	55.4	73	2395
Tanzania	220	34	2.3	40	47.9	91	1995
Uganda	310	54	3.1	20	40.7	84	2085

Data Source World Development Indicators Database.

4. PAST TREATIES AND AGREEMENTS WITHIN THE NILE BASIN

Water has been a major concern in the Nile basin since the 19th century when Great Britain (for Egypt and Sudan) and Italy signed the first Treaty in East Africa on April 15th 1891. In general, most of these consist only of the tracing of colonial boundaries and economic territories. In chronological order the following are the most important treaties and agreements within the Nile basin:

The Anglo Italian protocol signed on April 15th 1891.
The 1901 agreement between Britain and Italy over the use of the River Gash
The Treaty between Britain and Ethiopia of May 15th 1902.
The Agreement between Britain and the government of the independent state of the Congo signed on May 9th 1906.
The Tripartite (Britain – France –Italy) Treaty of December 13th1906.
The 1925 exchange of notes between Britain and Italy concerning Lake Tana.
The Agreement between Egypt and Anglo Egyptian Sudan dated May 7th 1929.
The 1959 Nile Waters Agreement (between Egypt and Sudan).

5. EVOLVING CO-OPERATION

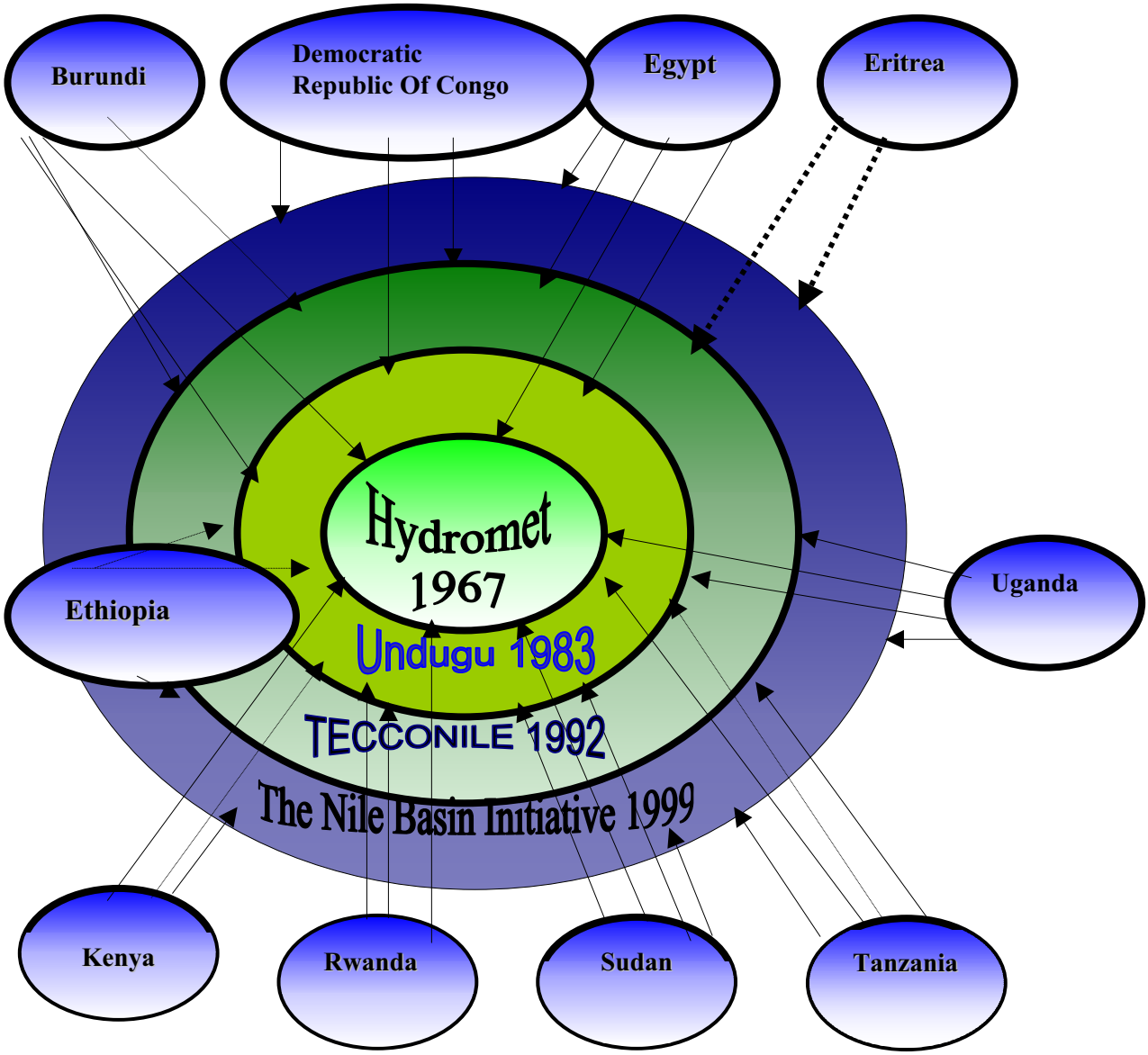
The framework of co-operation, Fig (2), in the Nile Basin goes back to 1967 when the Hydromet Survey Project was launched to carry out a hydro-meteorological study of the catchments of Lakes Victoria, Kioga and Albert. The project which has since become the pointer to the present day co-operation framework in the Nile Basin, was prompted by the need to establish the cause of the sudden unpredictable increase in rainfall in the equatorial lakes region, which caused

flooding of the shores of the Lakes and Wetlands of southern Sudan. However, most of the planned projects that were proposed by Hydromet remained far from being realized. This is mainly due to a lack of trust and confidence amongst some of the riparian countries, next to other factors that deterred the implementation of the projects.

Undugu, which was formulated in Khartoum in 1983, succeeded the Hydromet. It drew its members from six Nile riparian states, Fig. (2), in addition to one-riparian neighbouring state, namely, Central African Republic. Although the Undugu idea was aimed to forge co-operation in areas of infrastructure, environment, culture and trade, it failed to meet its objectives due to many factors. Nevertheless, Undugu prepared the road for the TECCONILE (Technical Co-operation Commission for Promotion and Development of the Nile), which was established in 1992 in Kampala, Uganda, when the Council of Minister of Water Affairs of the Nile Basin riparian states (Nile COM) signed its agreement, Fig. (2). The main objective of TECCONILE was to promote through a series of ten Nile 2002 conferences, supported by CIDA, an informal mechanism for riparian dialogue and exchange of views between countries as well as with the international community.
In 1997, the World Bank agreed to a request of the Nile-COM to lead and co-ordinate donor support for their activities. Thus, the World Bank, the UNDP, and CIDA began operating in concert as "co-operating partners" to facilitate dialogue and co-operation among the riparian states, creating a climate of confidence within which an inclusive mechanism for working together could be established. Therefore, in 1999 the Nile Basin Initiate (NBI) was established in Dar es Salaam to pave the way for a new era of co-operation within the Nile Basin States. The main objective is "*to achieve sustainable socio-economic development through the equitable utilization of the common Nile Basin water resources and their benefits.*"

The main policy guide lines and primary objectives of the NBI, which provide a basin-wide framework for moving forward with co-operative action, are:
To develop the water resources of the Nile Basin in a sustainable and equitable way to ensure prosperity, security and peace for all its peoples.
To ensure efficient water management and optimal use of the resources.
To ensure co-operation and joint action between the riparian countries, seeking win-win gains.
To target poverty eradication and promote economic integration.
To ensure that the program results in a move from planning to action.

***Figure 2*: Nile Basin Countries in Gradual Process Towards Co-operation**



Full member

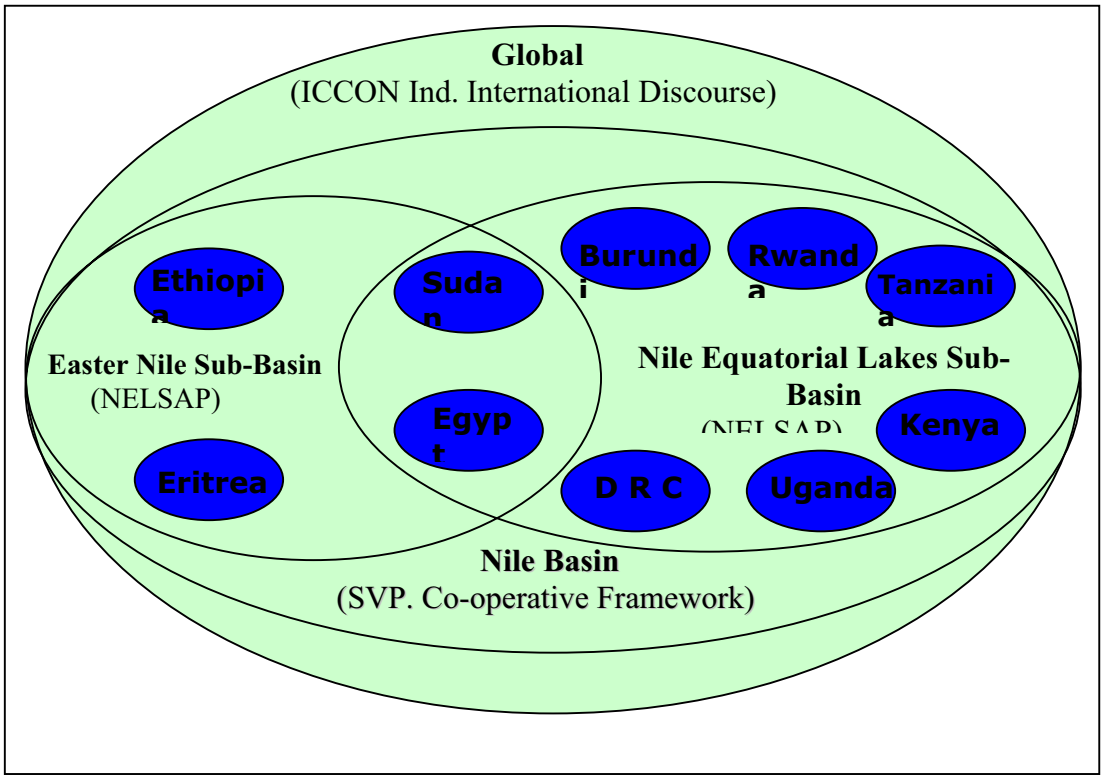
Observer

6. NILE BASIN INITIATIVE (NBI)

The NBI is based on a vision and basically entails a "Strategic Action Program" that consists of two complementary programs (a) Shared Vision Program (SVP) and (b) Subsidiary Action Program (SAP). SVP and SAP are set out in such a way that the former is dealing with whole basin issues while the latter is dealing with the sub-

basin issues. In SVP, seven projects were selected, (Environment, Power Trade, Efficient Water Use for Agricultural Production, Water Resources Planning Management, Confidence Building and Stakeholder Involvement Applied Training and Socio-economic Development Benefits Sharing) aiming to create an 'enabling environment' for co-operative action through building trust and skill. SAP includes many projects aiming to plan and implement investments and activities 'on the ground' at the lowest appropriate level, taking into account the benefits from, and impacts of these activities on all riparian countries. The SAP projects will be implemented through two main sub-basin setups, Fig. (3):
The Eastern Nile Subsidiary Action Program (ENSAP) - Sudan, Egypt and Ethiopia. Eritrea now is an observer and it may join in the future.
The Nile Equatorial Lakes Region Subsidiary Action Program (NESAP) - Burundi, DRC, Kenya, Rwanda, Tanzania and Uganda as well as the downstream riparian Egypt and Sudan.

***Figure 3*: Levels of Co-operation within the Nile Basin Initiative**



Nile2002 Conference Series

The Nile2002 conference series emerged from the Nile2000 conference held in Egypt. Subsequent conferences were held in Khartoum, Arusha, Kampala, Kigali, Cairo, Addis Abeba, and Nairobi in 2002. The Nile2002 conference series represent an informal platform for professionals to present their technical work and other views on regional dimensions of the Nile water. The ideas, views and directions expressed and spelled out in the Nile2002 conference series help to promote a mode of sharing, understanding and valuing other opinions. This platform should continue and eventually be transformed into a permanent body for developing studies, research and publications. Moreover, it will build confidence and trust among the professionals in the region and it will further develop transparency.

7. CHALLENGES AND CONSTRAINTS

The physical problems associated with the Nile Basin are interlinked and all have a negative impact on socio-economic conditions. The following are the main problems and challenges the riparian countries are faced with.

- *Population growth and poverty*: rapid growth at 2.5-3.0 percent per annum i.e. increase population pressure on the natural resources.
- *Displaced people and refugees* and their negative practices on the natural system to meet their urgent needs.
- *Climate change*: is increasingly recognized to have serious impact on water which directly affects the socio-economic conditions.
- *Institutional structures* and capacity for effective water resources management are *weak*.
- Often well trained professionals are commonly over-burdened and poorly under-resourced.
- *Erosion and sedimentation*
- *Natural disasters:*
- Flood devastation range from loss of lives to widespread crop destruction and other economic activities.
- Drought and desertification
- *Watershed degradation*: combination of poor cultivation practices, deforestation and overgrazing.
- Lack of financial resources and technology to improve management

8. INTERDISCIPLINARY DIMENSION

Today, engineers of the public sector water institutions are undertaking much of the water resources management and development in the region. Along with its extraordinary importance, three additional features that make the study and development of water resources necessarily interdisciplinary are:

- Scarcity
- Variability in time and space
- Sharing
- Quality

Because of these four features, water is the subject of concern of other disciplines e.g. climatology specialists, hydrologists, biologists, geologists, historians, sociologists, economists, political scientists, geographers and other scientists. It should also be admitted that the legal aspects are very essential in water resources management.

9. LONG PROCESS NEEDS PATIENCE

Despite all the challenges, the Nile basin governments have begun to take important steps towards developing frameworks to manage their water resources together. It is important to engage and expand the basin-wide dialogue on diverse issues, to seek common ground. Data, information, and the exchange and sharing of information are critical issues in the development of a trans-boundary water dialogue. Thus, it is in the interest of riparian countries to seek building capacity of institutions and human resources. Moreover, it is important to replace the ill

feelings (if any) with trust, partnership, recognition and sharing common goals. Building confidence and capacity is a slow process, and the issues will be there for decades; however efforts to manage the system to meet the urgent and essential needs cannot wait.

10. REGIONALISM CONCEPT

Regional concepts in thinking and planning emerge from the ratification of many treaties and agreements between nations with regional water resources systems. The Nile riparian countries have emphasized the need for a regional approach, and this in such a way as to identify activities that will generate benefits for all the Nile countries. This is in line with the "win-win" basis of the Nile Basin Initiative. Thus, the dispute should focus on opportunities and co-operation and issues that bring people together. As we know, the water issue is highly related to the development in general. Therefore, the utilization of potential natural resources within the Nile basin should be planned on a regional level for the benefits of the whole basin-wide community.

10.1. Institutions and Capacity

Effective water resources management is complex and requires many skills:
A network of competent institutions and significant analytical capacity.
A long term or holistic vision in planning for water management.
A consistent economic rationale for project selection or water allocation.
The Prioritization, planning and technology selection.
A sufficient support, sense of ownership and willingness of the users to pay.
Good management of water utilities.

10.2. Good Operation And Maintenance Of The Infrastructure.

It is important to have the " right" professionals as a prerequisite i.e. good, competent, Cadre.

11. CONCLUSIONS AND RECOMMENDATION

Good communication, information exchange and extensive interactions between different stakeholders at all levels are essential requirements for better water resources management.
Despite the challenges and the limited resources and experience, the governments of the region took important steps towards developing frameworks for joint co-operation to manage this water resources system.
A similar platform like the Nile2002 conference series should be created to increase confidence building and build the bridge of trust.
To create links among related institutions in the region, exchange programs and joint research with mutual benefits should be created.
Building confidence and capacity is a slow process, and the issues will be there for decades; however, efforts to meet the urgent and essential needs should realized.
It is important to replace the ill feelings (if any) with trust and partnership – recognition and sharing common goals.

Efforts should focus on opportunities and co-operation and issues that bring people together, and controversy issues should await more discussions and deliberations.
Alternative energy sources should be developed to conserve the natural resources: such as solar, wind, and gas.
Co-operation in the management of the basin national resources should be enhanced by using the relative advantages of each riparian country.
The riparian countries should work together closely to integrate their potential resources for the basin-wide benefits.
A Permanent Joint Commission should be established to guide and co-ordinate co-operation to further integration.
A Trust Fund for the development of the basin projects should be created to achieve common goals.
A new technology in water related systems should be adopted.
The environmental elements and the water quality should be protected through co-ordination.
Capacity Building should be developed: strategic elements for sustainable management of the water sector.

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WATER RESOURCES AND WATER PROBLEMS IN UKRAINE

Viacheslav Manukalo[6]

1. INTRODUCTION

The Dublin Conference and Chapter 18 of *Agenda 21* both identified water as a finite and vulnerable resource vital to all aspects of life, including sustainable development. Water is of vital importance to all socioeconomic sectors. Human development is simply impossible without a safe, stable water supply. But water can also become a destructive element, causing harm to people as well as material damage. In the context of water resources, sustainable development means, above all, that the resource base is not impaired by human activities, and that the long-term perspective is considered as well as that of the present (Loncks, 2000).

Providing sustainable water resources management is not an easy task, especially in countries with economies in transition which face economic, social, and ecological problems. The purpose of this paper is to examine the experience of the Ukraine, a typical post-socialist country of Eastern Europe. It is based on data from:

- National Report on Environment Conditions in Ukraine in 2000
- annual statistical reports on water by the State Hydrometeorological Service and State Committee for Water Management.

2. WATER RESOURCES OF UKRAINE

Ukraine has about 22,000 rivers, with a total length of 170,000 km. Most of them drain into the Black Sea and Azov Sea basins. Water resources are not equally distributed throughout Ukraine: sufficient resources are found in the north and the north-west of the country, but the south is poorly endowed. Average annual precipitation varies from south-east to the west, with 300 mm in the semi-arid south-east Black Sea and Azov coastal zones, rising to 1,500 mm in the Ukrainian Carpathian mountain region.

The runoff of the Dnypro, Dniester, Siversky Donets, Western Bug, Southern Bug, and Danube Rivers and their tributaries, as well as of the smaller rivers of the Black and Azov Seas basins, is a main source of freshwater in Ukraine. The average annual runoffs of these main river basins are shown in Table 1.

[6] State Hydrometeorological Service, Ministry of Environment and Natural Resources of Ukraine

Table 1: **The average annual runoff of the main river basins of Ukraine**

River basins	*AVERAGE ANNUAL RUNOFF, KM^3*		
	Total	*Formed within the territory of Ukraine*	*Inflow from other countries*
Western Bug	1.4	1.4	–
Danube	133.8	10.8	123.0
Dnister	10.7	9.7	1.0
Southern Bug	3.2	3.2	
Dnypro	53.5	19.1	34.4
Siversky Donets	4.81	2.96	1.85
Black and Azov Sea river basins	1.82	1.82	–
Total	**209.23**	**48.98**	**160.25**

Altogether, 160.25 km^3 (about 76 percent) of waters come from the Russian Federation, the Republic of Belarus, and the Danube river basin countries, and only 48.98 km^3 (about 24 percent) are formed within the territory of Ukraine. Therefore, Ukraine can be described as a country with an insufficient water supply (1.6 km^3 of water per inhabitant per year). According to this index, Ukraine is one of the lowest-ranking countries in Europe.

According to calculations by the experts of the Ukrainian National Academy of Sciences the total cost of the natural resources of Ukraine was $5,002.2 billion in terms of the world prices of 1997. Freshwater resources covered only about 1 percent of this total cost.

Ukraine's main river is the Dnypro, the third largest river in Europe. The Dnypro basin drains almost half the country's surface area (293,000 km^2); its average annual flow amounts to 53.5 km^3. There are six large reservoirs on the river, creating water reserves with a total volume of 43.8 km^3. Most of the population of Ukraine, and its most important industrial areas, depend on its water.

The distribution of water resources across the territory of Ukraine is uneven and does not match the needs of industry and agriculture, the most important water consumers. The eastern and southern regions of the country, with the highest concentrations of industry and agriculture, are subject to freshwater shortage.

3. WATER SUPPLY AND USE

Ukraine’s water supply is heavily influenced by seasonal variations in precipitation and river flow. The most water-intensive industries, as well as the most heavily cultivated agricultural areas, are situated in the dry south-eastern region.

Over a long period the economy of Ukraine has been developed without proper consideration for either the economic or the ecological consequences. The sectoral and territorial structures of industry have both grown in an unbalanced manner, the basic water-consuming industrial sectors (fuel and energy, ferrous and non-ferrous metallurgy, and heavy engineering industry) predominating. The main attention has been paid to increasing industrial production, and not to the effective use of the natural resources.

In 2000, 18.28 km^3 of freshwater was withdrawn from surface water bodies and groundwater (15.3 km^3 and 2.98 km^3 respectively) to satisfy the requirements of the economy and population. About 56 percent of total water withdrawal is from

the Dnypro River and the rivers of its basin. This is 1.5 km^3 less than in 1999 and almost 12 km^3 less than in 1990. In 2000, 12.18 km^3 of freshwater was used – 1.29 km^3 less than in 1999 and almost 16 km^3 less than in 1990.

The decrease in water withdrawal is due to the economic recession in the country. The introduction of a system of payments for special use of freshwater resources was another factor influencing the volumes of waters abstracted.

Surface waters are the main source of drinking water supply. Approximately 60 percent of the population is supplied from the Dnypro, 15 percent from other surface waters, and 25 percent from groundwater along with water for industry and agriculture. The irretrievable waters consuming was 5.92 km^3 (32 percent of the total water withdrawn). The main consumers are industry (45.7 percent), agriculture (33.8 percent), and the municipal economy (21.5 percent).

4. WATER QUALITY

In 2000, 10.5% km^3 of sewage waters came in the surface waters of Ukraine. A total of 3,025,400 tonnes of pollutants (oil products, sulfates, chlorides, organic matter, pesticides, heavy metals, and so on) have also been discharged into the water bodies along with sewage waters. The most serious factors in pollution are municipal utilities, ferrous and non-ferrous metallurgy, heavy engineering, and agriculture.

The ecological condition and water quality of the Dnypro reservoirs and small rivers are the object of special anxiety. The reservoirs' construction allowed water provision to the population, industry, and agriculture, permitted an increase in consumption, and made its availability constant throughout the year. Seventy percent of the Ukrainian population is provided with water from the Dnypro reservoirs. At the same time, the reservoirs' construction changed the natural hydrological, hydrochemical, and hydrobiological regime of the river, led to the transformation of a "river" ecosystem into a "lake-river" one and, as a result, a slowing in water exchange and water self-purification processes.

Small rivers affect the water reserves, hydrochemical properties, and water quality of large rivers, affecting the natural landscape over huge areas. These attributes of small rivers are predominantly dictated by physical–geographical conditions and human impacts prevalent within a river catchment.

Analysis of long series of observation results gathered by the hydrological network of the State Hydrometeorological Service showed that the most common pollutants of river waters are nitrogen compounds, nitrites, biogenic and organic matter, heavy metals, oil products, and phenols. The Dnypro River is particularly polluted with heavy metals and phenols. The Dnypro reservoirs are mostly polluted with oil products, nitrite, phenols, copper, zinc, manganese, and chromium. According to Ukraine's water quality classification, the small rivers of the steppe and forest–steppe geographical zones, as well as many small rivers of the forest belt, are "contaminated" or "dirty" in terms of chemical and bacteriological pollution. The large volumes of water consumed, water quality deterioration, and a lack of prudent economic activity in the river catchments has resulted in degradation of the whole ecosystem of the river basin, distorting natural processes of water self-purification and making it significantly harder to provide pure drinking water.

Although anthropogenic pressures on water resources have decreased in recent years, this is largely the result of the long-term economic crisis, although

measures to improve the state environmental management system in recent years have helped.

5. WATER DISASTERS

River floods and the inundations connected with them are characteristic of most rivers in Ukraine, and represent one of the most frequently occurring natural hazards. The spring floods are the single most characteristic phase of the hydrological regime of the rivers of the plains in Ukraine. Snow- and rainfall floods occur in the mountain rivers of the Carpathians during the winter and spring. The rain floods are typical of these rivers.

Over the last ten to fifteen years an increase in the frequency of very high floods has been observed in Ukraine. Over the last six years, between five and ten floods have been observed annually in Carpathian rivers, more than half of them meeting the criteria for designation as natural hazards. They cause damage to the economy of Ukraine estimated in tens of millions of dollars, and sometimes also exact a cost in human life. Climate change and inappropriate development and economic activity in the river basins (deforestation, building in flood plains, and so on) are major contributing factors to the impacts of inundations.

The global changes in climatic characteristics observed during the last century have affected the territory of Ukraine and the adjacent regions of the Republic of Belarus and the Russian Federation. Investigations have demonstrated that regional climate change in the last two to three decades has contributed to decreasing water volumes in the rivers of southern and eastern Ukraine. At the same time they have caused frequent catastrophic floods in the mountain river basins in the Ukrainian Carpathians (Manukalo, 1998).

6. PRESENT STATE OF WATER MANAGEMENT

6.1. Legal Regulation

Nowadays, water management is regulated by the Law on Environmental Protection (1991) and the Water Code (1995) of Ukraine. The Law on Environmental Protection lays down the basic principles of nature protection and, in particular, the principle that users must pay for the use of water resources as well as for discharging pollutants into water. The Water Code provides the basic framework for Ukraine's water legislation. It specifies the ownership of surface waters and groundwaters and regulates the management, conservation, and use of water resources. The water resources belong to the people of Ukraine and are allocated for use as appropriate. Furthermore, the Water Code regulates the competencies of central and local bodies with executive power over the management, control of use, and renewal of water resources.

At the same time, an ever-expanding framework of regulations and other policy statements effectively perform legislative functions to a great extent. This framework includes, among other things, the standards on water quality for water supply and industrial use, limit values for concentrations of pollutants in natural water bodies, the regulation of standards for maximum permissible discharges of pollutants, and a list of relevant pollutants. It also includes the regulation of the state water monitoring system. Along with the most important acts already mentioned, there are numerous interdepartmental policy documents setting out

regulations, rules, instructions, techniques, and requirements that must be followed.

6.2. Institutional Regulation

The Ukrainian Parliament (Verhovna Rada) defines national water policy and provides the legal framework for the management of water-related issues. The Parliament decides on payments for water use and designates the state and local authorities with executive power in the areas of water resources use, protection, and restoration.

Executive power for state water resources management lies with the Cabinet of Ministers of Ukraine. Special authorities of the state executive with powers in the area of water resources management are: the Ministry of Environment and Natural Resources, which includes the State Hydrometeorological Service and State Geological Survey; the State Committee for Water Management; the Ministry of Health Protection; the State Committee for Building, Architecture, and Housing Policy; and the Ministry of Emergencies and Affairs of Population Protection Arising From the Consequences of the Chernobyl Catastrophe. The Ministry of Environment and Natural Resources coordinates the environmentally important issues related to different sectors and institutions.

The State Hydrometeorological Service operates the most extensive surface water quantity and water quality monitoring network, including observation networks on the Black Sea and Azov Sea. The State Hydrometeorological Service is also responsible for meteorological observation (including monitoring of air pollution) and forecasting weather and hydrological conditions. The State Geological Survey monitors the geological sphere, including groundwater. It operates an extensive groundwater monitoring network and gives advice on groundwater abstraction. The split in responsibilities between these authorities, together with poor communication, sometimes leads to omissions in the activities to be undertaken, duplication of activities, or even contradictory actions.

On both national and local levels the respective government authorities maintain special funds for financing measures for protecting the natural environment and for works needed to restore and maintain natural resources in proper condition. The various payments for usage of natural resources are made to these special funds. There is no fixed rule governing the assignment of these funds, however, and the respective bodies make their own independent decisions (Table 2).

Table 2: **The distribution of payments for usage of natural resources**

Payments for:	*To budget*	
	State	*Local*
Water extraction (national significance)	80%	20%
Water extraction (local significance)	–	100%
Polluting substances discharge	10%	90%
Water use in hydropower generation	100%	–
Water transportation	100%	–

6.3. Regulatory Instruments

The current water management regime in Ukraine utilizes a combination of command-and-control (standards, norms, environmental impacts assessment, permits for water use and discharge, state inspection) and economic instruments (charges for water use and pollution discharge, fines).

At present, the former Soviet Union water standards governing water use for drinking, fish farming, and the communal, recreational, and other economic needs of the population are still in force in Ukraine.

There is one environmental standard: the *maximum allowable concentration* (MAC). Levels are set for a fixed time period, on the basis of ensuring zero damage to human health. There are MACs for more than a thousand different substances but their number, and in some cases their strictness, are impractical. The resulting complexity of the system undermines enforcement, and also overwhelms understaffed and under-equipped regulatory authorities.

Both surface and groundwater use (for both abstraction and discharge) require a permit. The licensing procedure depends on whether the water resources in question are of national or local significance. Permits affecting water resources of national significance are granted by the Ministry of Environment and Natural Resources, while abstraction from and discharges into local water bodies are permitted by local authorities. The licensing procedure provides for cooperation with the State Committee for Water Management and the Ministry of Health Protection.

6.4. Economic Regulation

Administrative and legislative measures alone cannot solve all problems raised by water use and water protection. Establishing an economic basis for water use and protection involves measures including establishing rights of ownership (privatization), establishing a system of payments for their use, and creating a system for economically stimulating appropriate use and protection of water bodies, involving financing restoration and protection measures. These principles are not yet effective, however: not all the economic enterprises involved are solvent, and the levels of payments themselves do not stimulate the introduction of natural protection measures.

6.5. Public Participation

According to the Water Code of Ukraine, citizens and associations of citizens, as well as other public institutions, have the following rights with regard to water resources management and protection:

- To participate in considerations by state bodies of issues connected with the use, protection, and restoration of water resources.
- To participate in the monitoring of water users' compliance with water protection rules enforced by specially authorized state bodies, and to put forward proposals concerning these issues.
- To carry out public environmental impact assessments, to publish their results, and to submit them to the bodies authorized to make decisions concerning the location, design, and construction of plants, facilities, and other objects (either new or reconstructed) involving the use of water, according to procedures established by legislation.
- To maintain effective public control over the use, protection, and restoration of water resources.

- To access information on the state of water bodies, sources of pollution, and the use of waters, along with plans and measures concerning water resources use, protection, and restoration, in accordance with established procedures.

However, due to an absence of executive procedures and implementation guidelines – and to the lack of an appropriate enforcement structure – there is limited scope for participation by the general public in decision making about water resources management, while dissemination of environmental information is weak.

7. MAIN WATER MANAGEMENT PROBLEMS

Ukraine and other countries in Eastern Europe are facing serious economic and social problems. They are in such a difficult phase of economic transition that investments in environmental protection and pollution control are not among the priority tasks defined for the near future. Ukraine's water management problems reflect the nation's more general economic and social problems:

- The erroneous technocratic concept of "natural" economic development results in ecological and economic crises and social tension.
- There is a lack of funds in budgets intended to provide sustainable water resources management and water protection.
- Water management is based on extensive water use.
- The planning and management of the social, ecological, and economic aspects of water management take place separately, which restrains the development and application of economic regulatory tools.
- In some cases, there is duplication of activities by a number of institutions involved in water management.
- Sector-oriented water quantity and quality observation networks and information systems are not suitable for delivering the complex information required by integrated water resources management.
- The various monitoring networks generate large volumes of data but these are stored in different databases using different software. Consequently, it is very difficult to compare the monitoring data collected by different networks.
- There are a large number of water-quality standards, norms, water use instructions, and regulations.
- In spite of the gravity of the problems posed by the impact of regional climate change on the hydrological regime and the water resources of transboundary rivers, little scientific work is devoted to this problem.
- Effecting agreements in water management is often problematic due to lack of financial commitment, institutional and human capacity, and experience.
- Levels of public participation in water-related activities are low.

8. NATIONAL POLICY OF SUSTAINABLE WATER RESOURCES MANAGEMENT

In accordance with the main ideas and principles announced at the UN Conference on Environment and Development (Rio de Janeiro, 1992), Ukraine has declared its intention to achieve sustainable development to provide for a balanced solution to socioeconomic issues, and to safeguard the natural environment and natural resources to meet the vital needs of the present and of future generations.

Development of the Draft Conception of Sustainable Development of Ukraine was completed in 1998; it was approved by the central governmental bodies and presented to the Cabinet of Ministers of Ukraine in 1999. It offers a political basis for harmonious integration of state strategies aimed at the solution of economic, environmental, and social problems connected with the current process of socioeconomic reform. The formulated policy is based on the use of both ecological and economic instruments (particularly the system of payments for use of natural resources and for pollution of environment) to regulate the use of natural resources. This policy is implemented by developing and realizing national, state, regional, local, and specific programs and projects reflecting key priority directions.

It has been recognized that concrete measures for implementation of these programs must be concentrated at the regional and local levels, and integrated into the strategy embodied by regional (local) plans for socioeconomic reform.

While human pressure on water resources has decreased in recent years, this is largely a result of the long-term economic crisis, although measures to improve the state environmental management system in recent years have played a progressive role.

The role of policy in the field of sustainable water management in the near future will be twofold. First, improved institutional and technological measures are needed to overcome negative tendencies of production development towards the decrease of water resources consumption. Second, it is necessary to create a system of management, control, and technological maintenance that will ensure that pressure on water resources does not rise proportionately when economic activity increases in the future.

National priorities in the fields of environmental policy and the use of natural resources were also emphasized in the State Program of Structural Reorganization of the Ukrainian Economy for the period 1999–2003, and by the Program of Socioeconomic Development of Ukraine for the period to 2010.

The implementation of national policy in the field of water management, including that affecting transboundary river basins, should be carried out on the national, local, and international levels through:

- development and implementation of national, local, and international programs and action plans
- integration of the Ukrainian water management and water protection policy into that for the European Union
- incorporation of water management and water protection policy into regional and local plans for socioeconomic development.

Ukraine has made real steps towards joining the European Union. One important part of this work is adjustment of the Ukrainian water-related activities to conform with those of the EU. Integration into the EU will require commitment to EU directives, international conventions, and declarations. This is taken into account in the development and realization of such important international programs as the Black Sea Environmental Program, and the Danube River Basin and Dnypro River Basin Programs.

In the period 1994–2001 several state programs for developing water resources management and protection, including the technical improvement of hydrological observation and forecasting systems, have been adopted by Ukraine at ministerial level.

During recent years the study of climate change and its impact on the hydrological cycle has been developed in Ukraine. These researches have been carried out in several scientific organizations and institutions, including the Ukrainian Research Hydrometeorological Institute, Odessa State Environment University, and Kyiv National University. They have involved Ukrainian scientists working in co-operation with scientists from the Russian Federation, especially from the State Hydrological Institute. Climatic scenarios basing on palaeoclimatic reconstruction developed at State Hydrological Institute have been used in making assessments of likely changes in climate and water resources in Ukraine.

9. CONCLUSIONS AND RECOMMENDATIONS

In spite of its economic problems, Ukraine is developing its water management and water protection policies, including that on transboundary waters. Much attention is being given to the reformation and extension of the legislative and regulatory framework, including covering changes in water use and coordinating the state water monitoring system.

Ukraine is harmonizing its legislation with international and European Union norms. This harmonization should be a priority for all authorities responsible for water management and protection policy.

Plans for the harmonization of national legislation should include the commitment of funding to ensure implementation and compliance. It is necessary to set out achievable objectives, rather than devising elaborate but unrealistic programs.

Coordination and cooperation between all institutions involved in the development of international assistance for the management of internationally funded projects should be improved.

A number of water monitoring networks have been set up under various authorities. These address the particular purposes of these various authorities but mostly operate independently. Sometimes it is very difficult to use monitoring data that are collected and stored by different authorities for decision making.

Strengthening institutional responsibilities for water management, including those for water monitoring and standard-setting, is necessary. Programs of water monitoring by different observation networks should be coordinated in order to avoid duplication.

Taking into account the changed conditions arising from new market relationships as well as the privatization of natural resources, the establishment of economic water use and water protection mechanisms is of special importance. During Ukraine's transition to a market economy, the role of the state in legal regulation of water rights is becoming especially important.

Economic difficulties mean that Ukraine cannot resolve its problems with water management and protection by itself. This makes it very important to continue with, and intensify, participation in international programs and projects that offer technical and financial assistance in developing national water resources management. Evaluation of the effect of water projects on environment and socioeconomic conditions should include changes caused by other phenomena, such as possible climate change, during the period analyzed.

Public participation in decision making, and in implementing water resources management and water protection programs, is indispensable to achieving sustainability. The general public of Ukraine usually receives information only in emergency or accident situations. Little effort is made to raise public awareness of

the need to preserve natural resources, on the one hand, and to prevent possible damage to the environment, on the other. It is necessary to recognize and encourage the potential role of the general public in the protection of water resources and promoting ecological safety. To do so, it is necessary to specify basic information requirements – what type of information the public would need, and can easily appreciate – and to decide what information projects and/or institutions concerned with river basin management are in a position to provide.

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THE INTERNATIONAL JOINT COMMISSION AS A MODEL OF CO-OPERATIVE MANAGEMENT OF SHARED WATER RESOURCES: LESSONS FOR THE DEAD SEA REGION

Elly Hermon[7]

ABSTRACT

The rapidly falling Dead Sea water level and the ensuing environmental and economic problems affecting its basin, highlight the urgency of promoting integrated sustainable development of water and related resources in the region. The paper is based on the assumption that establishing a tri-national (Jordanian-Israeli-Palestinian) management structure for water and related resources in the Dead Sea Basin may significantly enhance integrated regional sustainable development by facilitating the necessary co-ordination and mutually beneficial co-operation among the three nations sharing the natural resources of this region.

Considering the Canada-U.S. International Joint Commission (IJC) as an outstanding example of international joint management of shared water resources, the paper is to analyse the relevance of this experience as a model for the Dead Sea region. The rationale, management patterns, methods and achievements of the IJC are to be examined with a view to drawing lessons which may facilitate the promotion of internationally co-ordinated sustainable development of the Dead Sea Basin water and related resources. While highlighting potential advantages, notably from the perspective of problem-solving and conflict resolution, of adopting for this purpose certain basic patterns, methods and guidelines orienting the IJC, the specific geopolitical features of the Dead Sea region and its environmental, economic and cultural constraints are also considered. The paper aims thus at providing some indication about the extent of the applicability of lessons drawn from the IJC experience in the Dead Sea region.

1. INTRODUCTION

The fate of the dying Dead Sea and its considerable potential for serving as a leverage for inducing, on the basis of water resources development, co-operative regional development of an arid area with some unique natural and cultural features, has been recently brought to the attention of the international community by the Jordanian-Israeli announcement of the intention of the two governments to launch the Red Sea-Dead Sea Canal project, made at the Johannesburg World Summit on Sustainable Development [8]. The announcement of this project, intended to help stabilising the rapidly shrinking Dead Sea water level while making a major contribution to water desalination, provided a significant opportunity to highlight at the international level the disastrous environmental impacts of this situation, which has also far-reaching negative repercussions on the economic development of the region, and the urgency of saving the Dead Sea from the danger of eventually disappearing in a few dozens of years at the current rate of decline of its water level (Dalal, 2002). The declarations

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[7] The author is thankful for comments on this paper provided by Dr. Murray Clamen, Dr David Brooks and Prof. Jameson Doig. He remains entirely responsible for any possible error and the views expressed in this paper. Institut québécois des hautes études internationales, Université Laval, Québec,Canada G1K 7P4

[8] http://www.un.org/events/wssd/pressconf/020901conf12.htm

made in this forum by high level Jordanian and Israeli officials in merit of co-operative efforts intended to save the Dead Sea and also provide much needed additional fresh water supplies to this water-starved region, show that the transition from conflict to co-operation in development and management of water resources is not impossible in this conflict-ridden region, though political understanding is obviously a necessary condition[9]. In the light of these developments, trying to apply to the Dead Sea region lessons learned from experience accumulated in other parts of the world in the area of co-operative management of shared transboundary water resources, appears as a reasonable and potentially helpful endeavour. This is supported by historical evidence showing that transition from conflict to co-operation has often been a non-linear process and that ups and downs do not preclude ultimate progress and success. That is the rationale from a political perspective behind the examination of the IJC model in such a context.

The Canada-U.S. International Joint Commission (hereinafter IJC) is a unique binational organisation with an impressive record of achievements in the area of joint management of shared transboundary water resources and often described as a most relevant model for other parts of the world. This paper aims to offer a brief analysis of the IJC management model, the factors having contributed to its success in problem solving and conflict resolution, and a selective review of some of its achievements with a view to drawing lessons applicable in the Dead Sea region [10]. This success is highlighted by the complexity of the IJC role in managing boundary and transboundary waters along and across one of the longest borders between two nations, a significant part of which being constituted of shared water resources often subject to competing regional and sectorial demands and conflicting national interests. It is precisely this complexity of the IJC task which renders its management model all the more relevant for the Dead Sea region where problems related to shared water resources are complex as well. However, the contrast existing from many perspectives - geographical, environmental, economic, political and so forth - between the North American setting and that of the arid Dead Sea basin shared by three nations afflicted by acute water shortages, may at first glance raise some scepticism as to the relevance of the IJC experience for this region. Nevertheless, at closer examination it becomes apparent that there are some potentially useful lessons to be drawn from the North American experience in co-operative management of shared water resources and that the IJC model deserves to be carefully examined for this purpose. This does not necessarily imply that the IJC model might be transferred to the Dead Sea region indiscriminately, it only suggests that some lessons drawn from the IJC experience and some features of its management model might be

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[9] Such political understandings have been reached, at least in principle. The Jordan-Israel peace treaty of 1994 and the Israel-PLO Interim Agreement of 1995 provide for establishing joint water committees. Furthermore, Annex IV of the Israel-PLO draft agreement of 1993 provides also for a joint Israeli-Palestinian-Jordanian Plan for co-ordinated exploitation of the Dead Sea area. The agreements envisage examination of the option of building a Red Sea-Dead Sea canal, in the first case, or a Mediterranean (Gaza)-Dead Sea Canal, in the latter case, entailing development of large scale hydropower and desalination projects (Lonergan and Brooks,1994:218-23; Kliot,2000:208-11), which highlights the strong interest of the parties in developing co-operative management of water and related resources in the Dead Sea region.

[10] For a more systematic review of the IJC experience see: Carroll,1983; Willoughby,1979; IJC,1997.

transferable for the purpose of promoting co-operative management of shared water resources in this region.

2. THE BOUNDARY WATERS TREATY OF 1909: ITS ROLE IN THE IJC EVOLUTION

The IJC successful record is thus largely due to two categories of factors: those related to its organisation and management patterns, on the one hand, and those related to what might be considered as "the rules of the game", on the other hand; both categories stemming from principles and guidelines established in the BWT. These two categories of factors appear as two necessary and complementary elements for successful joint management of shared transboundary water resources. The IJC is often described as the most successful international organisation in the area of joint definition of the "rules of the game" or the principles and guidelines intended to orient the decision-making process of the joint management structure. However, problem solving where conflicting interests are at stake is likely to become an immensely complicated task. The BWT has the merit of identifying the main categories of water uses in the context of the Canada-U.S. boundary waters - such as consumptive uses, navigation, hydropower production - and establishing an order of precedence to be respected when these interests present competing demands. Another most important principle established by the BWT is that of equity and equality which ensures that the interests of the contracting parties are to be respected equitably, although the principle of rights stemming from water uses existing prior to the treaty is maintained. Yet another important merit of the BWT is establishing conflict resolution procedures to be followed, a key element of which being impartial fact-finding through a joint effort of credible experts of both countries based on careful examination of scientific evidence and stakeholders positions.

There is a most important lesson to be learned from the IJC experience in this respect which is applicable to the Dead Sea region and the efforts aimed at creating a joint management structure for the shared water resources in this region. A necessary condition for the successful operation of such a structure is prior agreement on the guiding principles which are to orient its decision-making process. In the case of the IJC, this condition is satisfied in the first place by the definition provided by the BWT as to the categories of cases - such as the use, diversion, obstruction and pollution of boundary and transboundary waters to the detriment of interests on the other side of the border - where the Commission is authorised to exercise its jurisdiction. Criteria or principles - including, most importantly, the order of precedence of competing water uses - which are to govern the settlement of differences arising between the parties, are yet another key element in such an agreement. It has greatly facilitated the IJC work under art. VIII of the BWT and seems to be all the more relevant for the Dead Sea region where competition between various interests such as tourism, agriculture (notably as regards water supplies to the Dead Sea diverted for irrigation out of the region) and mineral extraction is particularly intense. On the other hand, such an agreement should allow, as it is the case with the BWT, also for a certain degree of flexibility for adjustments required in special situations or unforeseen developments in the natural and human related environment[11]. It was precisely this degree of flexibility

[11] The relevance of a water management approach involving a high degree of adaptability for the Jordan River Basin is emphasized by Kay and Mitchell, 2000:186-8.

provided by the formulation of the BWT which enabled the IJC to adjust to changing circumstances and revise its own positions in the light of new data or scientific evidence, as it was the case, for example, with its re-evaluation of the causes of fluctuating Great Lakes water levels and the measures intended to alleviate their adverse effects, which led to the adoption of a more comprehensive approach to these issues and to new conclusions (see section 3 below). The ecosystem approach, adopted by the Commission in the 1970s as its conceptual basis for dealing with water quality issues, is another case in point. This conceptual evolution reflects the Commission adaptability to growing public concerns. While the BWT does have a provision prohibiting pollution of boundary waters (art. IV), water quality issues are not a primary concern of the treaty largely dominated by water quantity issues. However, the treaty implicitly authorises the Commission to divide, on its own discretion, its energies between the various issues that it was empowered to deal with. Responsive to the public concerns of the day, water quality issues had not been a primary concern of the Commission during the first 5-6 decades of its history largely dominated by water quantity issues (water apportionment, regulation of water levels and flows, etc.). In the 1960s and notably in 1970s, as a result of the growing public preoccupation with environmental issues which led to the signature of the Great Lakes Water Quality Agreements (hereinafter GLWQA), the focus of the Commission's concerns was gradually shifting towards water quality issues which facilitated adopting an ecosystem approach in the GLWQA of 1978. In the light of the responsibilities conferred to the IJC under these binational agreements the signature of which had been significantly facilitated by its advocacy efforts, the Commission appeared to become, in a most pragmatic manner, a promoter of sustainable development. This evolution reflects the high degree of the flexibility allowed by the BWT which enabled the IJC to keep pace with the evolution in social values and the related political circumstances, and highlights its relevance, from the perspective of its legal framework, as a model applicable in similar problem areas in other parts of the world.

3. THE IJC MANAGEMENT PATTERNS

The discussion in this section is to focus on those features of the IJC management model deemed to be of particular interest from the perspective of lessons which might be drawn for the purpose of establishing a joint management structure to deal with shared water and related resources in the Dead Sea region.

An important feature of the IJC management patterns which deserves close examination is the use the Commission made of highly qualified specialists required for conducting its investigations and its field work. Actually, while during the first decades of its existence the Commission's work tended to concentrate on discharging its quasi-judicial responsibilities under art. III, IV, VIII of the BWT related to examination and approval of applications for permission to use, divert and obstruct boundary and transboundary waters, subsequently it was its investigative function which tended to predominate its activities. This investigative function of the Commission is exercised under art. IX of the BWT, authorising it to examine and make recommendations on any matters of difference arising between the two countries along their common frontier referred to it by the governments (and according to new rules adopted in 1964 even by only one of them). The BWT defines thus clear limits for the investigative power of the Commission: its investigations are to be initiated only at requests coming from the governments and the resulting recommendations are not binding. The investigative function was thus given a clearly

defined mission: fact-finding, the assumption behind it being that joint fact-finding facilitates agreement about the factual side of the problems considered, which is necessary for any agreement about solutions..

The procedures developed by the Commission for the purpose of selecting the personnel needed for staffing its working groups or boards functioning in the various areas of the Commission's responsibility - investigation, regulation, monitoring - are a factor of utmost importance for the success of its work. Instead of recruiting a permanent staff, the Commission opted for selecting the required experts - engineers, hydrologists, economists, environmental scientists, etc. - among the relevant specialised government agencies and the universities. These experts are lent to the IJC by the agencies employing them without any charge for the Commission and on an ad hoc basis for the specific needs of a particular task. This procedure entails a number of important advantages for the IJC: reducing considerably its operation costs, avoiding the rigidities inherent in a large organisation and most importantly, enabling it to select the experts it needs for discharging its investigative, technical and advisory functions among the best informed specialists of the two countries. The dedication generally shown by these experts and their authority related to their positions in their respective specialised agencies, contribute significantly to strengthening the IJC authority. Another significant principle orienting this procedure is associated with the selection of these experts on a parity basis among citizens of the two countries, which ensures the binational character of the boards on which they serve. Enabling experts from specialised agencies of the two countries dealing on a regular basis with the issues under examination to develop direct contacts with their counterparts serving on the same board, provides valuable opportunities for developing international co-operation through other channels than the traditional diplomatic ones. Moreover, though these experts are not serving on the IJC boards as representatives of their respective agencies, their involvement in the IJC boards' work contributes to improving understanding between their respective agencies, which are most frequently government agencies, and hence facilitates agreements between the two governments on the issues considered as well as acceptance of the IJC conclusions. The merits of this IJC procedure, that contributed significantly to developing a collegial approach to dealing with the issues considered and to avoiding divisions on national lines, are widely recognised, which does not shield it from some criticism stemming from scepticism about the impartiality of experts assigned to the IJC when it comes to evaluating activities of their own agencies.

A most significant lesson from the IJC experience in this respect, which might be applicable for the purposes of developing joint management of shared water resources in the Dead Sea area, is related to the value of technical co-operation and the modalities of developing it. It highlights notably the value of developing direct contacts between experts from the relevant governmental agencies discharging responsibilities regarding the issues considered, and provides some indication as to the modalities to be employed by a joint management structure for this purpose. In the political context of the Dead Sea region, such IJC proven procedures as inserting officials from various government agencies in an organisational environment stimulating joint endeavours, such as those aimed at impartial fact-finding and formulation of objective recommendations, are of a particularly high educational value for developing a culture of international co-operation so much needed in a region where conflict and adversity have prevailed for so long.

A brief review of some other elements of strength of the IJC management patterns may highlight its value as a model for other parts of the world such as the Dead Sea region. One of these elements is the degree of independence which the Commission was allowed to enjoy. Although the IJC depends financially for its functioning on the governments and the commissioners are appointed by their respective governments, they are serving on the Commission in a personal capacity and not as representatives of governments. On the other hand, the latter generally refrained from interfering in the Commission's decision-making process, nor did they reverse its decisions. The Commission could thus develop a tradition of collegial approach to problem solving and conflict resolution, the commissioners orienting their positions in the light of their search for the common good, avoiding divisions on national lines which would paralyse the Commission's work, which did not occur but in very few cases. This has been achieved through a consensus building procedure requiring reaching decisions by a majority vote including at least one commissioner from each country, while in practice the decisions are reached through consensus, a procedure applied also as regards the Commission's boards. Another element which contributed to the IJC success was the principle of equality between the two parties enunciated in the BWT and which oriented the Commission's procedures. Accordingly, in spite of the obvious asymmetrical relationship between the two countries, they were to enjoy equal representation on the Commission and its organs, the stronger partner refraining from imposing its own views by the mere weight of its advantage. Yet another factor contributing to the IJC success is its pragmatic approach to problem solving. Accordingly, the Commission tends to base its decisions on the merits of each case dealt with, privileging examination of the facts and specific context of the issue considered rather than strict legal considerations and precedence.

Any examination of the IJC model for the purpose of drawing lessons applicable in other parts of the world, inevitably raises the question of a possible extension of the Commission's powers. The question has been often debated among observers of the IJC. This debate may provide some useful insights for the purpose of promoting effective joint management of shared water resources in other parts of the world. There are differences of opinion as to the desirability of increasing the Commission's powers, notably by empowering it to initiate investigations in order to be able to alert the governments about potentially dangerous developments in the Commission's sphere of activity, or co-ordinate the activities of the various agencies and levels of government involved in the complex area of managing water resources, or ensure some effective follow-up of its recommendations. While those favouring such an extension of the Commission's powers deplore what they consider poor fulfilment of its potential, others are inclined to think that it is precisely the relatively low profile kept by the IJC which enables it to discharge its responsibilities effectively in the political context of jurisdictions jealously defending their prerogatives. Indeed, it should be noted that the governments have clearly indicated their reluctance to let the Commission deal with issues which they deemed to be able to deal with more effectively through bilateral channels. While keeping a low profile deprived the IJC from gaining an increased influence in its sphere of activity, it shielded it from criticism and opposition associated with a politically high profile role which would have proven detrimental to fundamental prerequisites for its successful functioning such as impartiality and credibility. A more politicised role not only could encounter stiff opposition from jurisdictions jealous of their respective prerogatives but would also make considerably more difficult avoiding divisions on national lines within the Commission.

There are potentially useful lessons to be drawn from this orientation of the IJC model, lessons applicable for the purposes of creating in the Dead Sea region an equivalent joint management structure - but not necessarily endowed with similar powers -, lessons all the more relevant in the light of the political sensitivities existing in this region regarding national sovereignty. Any future joint management structure in the Dead Sea region would have to strike a delicate balance between the need, on the one hand, to gain such a degree of influence on matters related to its sphere of activities as required to render its role effective, and on the other hand, the need to keep a politically low profile avoiding its exposure to politically motivated opposition likely to prove an enormous impediment for its successful functioning. The modesty shown by the IJC throughout most of its long history seems to be the best recipe also in the Dead Sea case. However, this does not mean that the modesty shown by the Commission is synonymous with conservatism. The readiness of the Commission to embrace new and innovative conceptual approaches to the issues in its sphere of activity, approaches characterised notably by a holistic vision of the problems associated with these issues, should not be underestimated. No doubt, advocating such approaches and such a vision, as the ecosystem approach, may require a certain degree of political courage where implementation of such approaches encounters resistance of certain interests. The example set up by the IJC in this respect deserves close attention. Sometimes, in certain situations, an organisation like the IJC might be called upon to fulfil a leadership role in advocating innovative approaches even where they are not yet fully accepted or understood. In such cases, the organisation might engage, as the IJC has done, in efforts intended to educate stakeholders and the public at large about the merits of the proposed approach regardless criticism which might follow from some conservative quarters, including government or politically influential circles. In the long run, the advocacy efforts deployed by the organisation are likely to pay, as shown by IJC experience. A valuable lesson drawn from the IJC management patterns indicates that a certain degree of independence is not only desirable for such a body but also necessary for its adjustment to progress in scientific understanding of the issues and to evolution in social values, without which its effectiveness is greatly hampered in the long run. This lesson is surely applicable for the purposes of creating a joint management structure in the Dead Sea region, all the more that the complexity of the problems does require adoption of innovative approaches which may encounter stiff resistance in some quarters.

The limits of the general relevance of the IJC model for the purposes of promoting joint management of shared resources in the Dead Sea region are highlighted by the conclusions reached at a self-evaluation IJC seminar regarding the applicability of the IJC model in other problem areas in the bilateral Canadian-U.S. relations. While expressing scepticism about such an extension, these conclusions underline the main factors considered to have contributed to the success of the IJC: "a close mutuality of the U.S.-Canadian interests; a near equality of rights; the absence of any strong political forces; parity in (the Commission) membership; the professional skill and integrity of its boards". The conclusions emphasise that there are "few other situations (in the Canadian-U.S. relations) where the same formula is present" (IJC*,*1974*).* Obviously, some important ingredients of the IJC success formula are missing as well in the Dead Sea region, and notably the close relationship existing between the two North American countries. This does not preclude applying at least some of the guiding principles orienting the IJC model in building a joint management structure for water and related resources in the Dead Sea region. Here again, the conclusions

reached at the above-mentioned IJC self-evaluation forum are enlightening by indicating that joint fact-finding may serve as a basis for additional binational institutions in other problem areas where they should however play an advisory rather than decision-making role (ibid.). This recommendation may apply as well to the Dead Sea situation where, given the obvious political constraints related to the absence of a tradition of regional international co-operation, it would be questionable to try building a joint management structure with powers similar to those conferred to the IJC, the failure of which would only strain relations between neighbours much in need of mutual trust building (Wolf, 1993). Instead, joint fact-finding would enable such an envisioned body to exercise a useful advisory function, which by itself would be an educational process enhancing development of a much needed culture of international co-operation. Nevertheless, the consultative forums organised by the IJC contribute to conflict resolution by providing valuable opportunities for stakeholders and government agencies to discuss together their respective concerns regarding the issues considered, which facilitates mutual understanding necessary for consensus building. Such an approach favouring conferring the joint management body of shared water resources relatively modest powers, at least at a first stage, appears to be better adapted to the foreseeable pattern of international relations in the Middle East[12].

3.1. The IJC and Public Participation

The public participation aspect of the IJC activities, notably those related to its investigative function, has undergone a considerable evolution due to growing awareness of its importance. The prevailing views as to the extent and modalities of public participation in the Commission's work have thus considerably evolved over time. It should be emphasised that the merits of public participation have always been recognised by the Commission, public hearings having been always a fundamental element of its procedures, but its conception of the desirable degree and modalities of this participation has gradually changed. With the conclusion of the Great Lakes Water Quality Agreement of 1972, the need for transparency and visibility in discharging its investigative function was given by the Commission a higher priority. Accordingly, in the early 1970s the Commission introduced a series of provisions intended to raise significantly the level of interactions between its boards and the public, including such measures as permitting its boards to have direct access to the media, hold public meetings (but not public hearings - a privilege still reserved to the Commission itself), take public opinion surveys, disseminate information to the public, etc. In 1977, the process of public participation in the IJC decision-making was brought forward still a further step when an IJC study group allowed representatives of the public to participate in formulating its recommendations submitted to the Commission (Willoughby, 1979: 40). The Commission's procedures for holding public hearings are intended to facilitate participation of interested persons and groups and expression of their respective views on the issues under investigation. Such hearings are held in the locality affected by the issues investigated and are mandatory before the Commission reports to governments, providing thus to all interested persons and stakeholders the opportunity to comment on the recommendations that the IJC is to submit to the Governments..

[12] For advocacy of such a staged approach see: Amery, H.A., "Co-operative Water Management in the Middle East" in Stout and als., 1993:63-4.

Observers tend to agree that despite some obvious deficiencies of the public consultation process developed by the IJC, it constitutes a valuable mechanism increasing the visibility of the Commission, improving the transparency of its decision-making process and most importantly, improving communication between the Commission and all interested players as well as among the latter. This is considered indispensable for ensuring better understanding of the issues and facilitating consensus building, and last but not least: strengthening the Commission's credibility and enhancing public support for its proposed decisions.

Public participation appears thus to be one of the most important aspects of the IJC management patterns and there are some useful lessons to be learned from the Commission's experience in this area which may be relevant for any international joint management structures operating in the area of water and related resources. One of the most significant of those lessons is related to the recognition of the value of public participation as a consultative and educational process intended primarily to improve double-way communication between the management structure and all interested players, providing credible updated information, improving understanding of the issues and facilitating consensus building often hampered by misunderstanding of the problems considered due to lack of relevant information. The remarkable efforts deployed by the Commission and its study boards to explain in great detail and in widely publicised reports the whole range of the various considerations – scientific, technical, economic, social, environmental, etc. - taken into account in their decisions or recommendations, contribute significantly to rendering its decision-making process more transparent and facilitating consensus building by improving the mutual understanding of the positions of all interested players

Public involvement in a problem area affecting in a most significant manner vital interests of the citizens called on to participate in the related decision-making process, might serve in the Dead Sea region a double purpose: enabling stakeholders and residents of the region to have a say about issues of vital importance for its development, on the one hand, and developing patterns of citizen involvement in transboundary co-operation, on the other hand. Such an involvement is expected to facilitate considerably, as is the case with boundary regions under jurisdiction of the IJC, the formation of transboundary citizens groups and various kinds of alliances intended to defend common interests transcending boundaries and nationalities which, as shown by the IJC experience, may play a useful role in international conflict resolution

4. THE IJC EXPERIENCE WITH LEVELS AND FLOWS ISSUES: LESSONS FOR THE DEAD SEA

The IJC experience in the area of regulating Great Lakes water levels and alleviating the adverse effects of their fluctuations provides some lessons highly relevant for the Dead Sea major problems resulting from the decline in its water level. It should be reminded that although its water levels in the last decades indicate a noticeable tendency to shrink, they do fluctuate, notably as a result of fluctuations in precipitation affecting its water supplies (Biger, 1995: 111). Obviously, the pattern of Dead Sea water level fluctuations is considerably different from that of the Great Lakes, yet some of the conclusions reached by the IJC studies as to the measures considered most appropriate for alleviating the adverse effects of Great Lakes

fluctuating levels, seem to be relevant for the Dead Sea situation. These studies recommend to shift the focus of the measures intended to alleviate the adverse effects of fluctuating water levels from physical regulation of lake levels through regulatory works to measures related to land use and more precisely shoreline development planning. It is thus recommended to identify the shoreline areas which are vulnerable to fluctuations in lake water levels and to orient their development patterns accordingly.

These IJC recommendations have far-reaching implications regarding the role of the Commission as they imply recognition that water resources management cannot be conducted effectively without adopting a comprehensive approach considering the root causes of the problems observed and the interconnectiveness between different types of problems, which involves orienting regional development patterns. This amounts to giving the IJC a say, in its advisory capacity, in orienting these patterns with a view to promoting sustainable regional development. This conclusion has some significant implications relevant for the Dead Sea region. Any joint management structure intended to deal with the shared water resources in the region is not likely to discharge this responsibility effectively without assuming some more comprehensive responsibilities including some influence, at least in an advisory capacity, on regional development planning. The basic orientations of the IJC management model appear thus to be all the more relevant for the Dead Sea region.

As to re-orientation of shoreline development planning as a measure intended to alleviate the adverse effects of changes in lake water levels by limiting development in vulnerable areas, the overall result of such a policy may obviously bring to a noticeable reduction in the development level in such areas, but economically it still may be preferable to exposing development to the adverse effects of changes in water levels. Does the same rationale may apply to the Dead Sea situation? This remains an open question which deserves serious scrutiny. The IJC experience related to problems raised by this question is surely valuable as it highlights the need for shoreline development planning as a necessary element in any strategy of response to adverse effects of changes in lake water levels. Yet, in the Dead Sea case this element does not necessarily appear as decisive as it is considered by the IJC to be in the Great Lakes region.

Other important factors have to be taken into account as well. Regional development in the Dead Sea area is confronted to a real dilemma regarding maintaining a more stable lake water level. On the one hand, it is heavily dependent on development of the tourist, recreation and health industries, the facilities of which are concentrated on the Dead Sea shores. These industries are consequently most negatively affected by shrinking lake levels so that limiting their development is likely to have bleak consequences for the regional development, involving considerable loss of revenues and rare sources of employment. On the other hand, maintaining Dead Sea waters at a relatively stable level involves increasing substantially its water supplies which, unless inter-basin water transfers are envisaged, is not to be achieved without a substantial reduction in the quantity of water diverted by Israel and Jordan from the Jordan-Yarmouk River system, notably for irrigation purposes [13]. This could be

[13]Biger, 1995:111. According to data reported in 1993 as a result of diversions and impoundments average flow of the lower Jordan River has decreased from almost 1400 million

possibly achieved, at least to some extent, through sound water demand management involving such measures as utilisation of more efficient irrigation methods, water-pricing policies encouraging efficiency and water conservation, and waste water reclamation (Abu-Taleb, 1992; Amery, 1993:62). However, adoption of such measures seems to be hampered to some extent by the dominant ideology, political culture and social structure in the region which tend to favour abundant low-cost water supply for agriculture (Williams, 2000; Turan, I. and Kut, G., 1997).

Alternative solutions involve costly projects, like the Mediterranean-Dead Sea or the Red Sea-Dead Sea canals which have a significant potential not only for stabilising the Dead Sea shrinking level but also for the purposes of water desalination and hydropower production (Murakami, 1995; Wolf, 1995). Another factor inducing the decline in Dead Sea level is the mineral extraction industry. Its extensive use of evaporation ponds increases significantly the considerable loss of Dead Sea waters due to evaporation (Biger, 1995:114). The resulting management dilemma is similar in this regard to that confronting the IJC in the Great Lakes region where it has to deal with conflicting interests resulting from competing uses of Great Lakes waters. The IJC management decisions are however considerably facilitated by the order of precedence established in the BWT regarding competing uses of shared transboundary water resources. In the Dead Sea case the task of establishing such an order of precedence is all the more complicated that the economic value of water used by competing sectors appears to be even more difficult to determine than in some other cases. Tourism, agriculture (as regards diversion of water supplies to the Dead Sea for irrigation purposes) and mineral extraction are all economically and socially important sectors with competing demands as to water supplies affecting Dead Sea water level which have significant repercussions beyond the Dead Sea region. Determination of the economic value of competing uses of water by sector appears thus to be potentially useful for facilitating defining an optimal Dead Sea water level on the basis of water demand management involving a costs/benefits analysis of competing water uses. The IJC experience in dealing with competing interests related to water levels issues is enlightening by showing that such an approach should take into account also non-monetary factors (and hence hardly quantifiable in economic terms) such as social and environmental considerations related to adverse affects of reduction in water supplies to the Dead Sea and the resulting decline in its water level. Maintaining a relatively stable, optimal Dead Sea water level involving striking an adequate balance between competing water uses, seems thus to require managing the whole Jordan-Yarmouk River system ensuring the Dead Sea water supplies and on which largely depend significant segments of the economy and society in the area[14]. Consequently, any joint management structure intended to deal with water resources in the Dead Sea region has to have a say on managing all water resources affecting Dead Sea level or affected by it - as it is the case with the IJC in the context of the Great Lakes-St. Lawrence River system where by its jurisdiction pertaining to regulating water levels and flows, the Commission can orient water resources management from a national perspective (for example, by opposing inter-basin water transfers which might adversely affect Great Lakes interests) as well as sustainable development from a regional perspective. The Commission's leading role in the area

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m^3/yr to less than 300 million m^3/yr (Committee on Sustainable Water Supplies for the Middle East, 1999:41).

[14] For socio-economic data and patterns of water uses in the area see: Committee on Sustainable Water Supplies for the Middle East, 1999:ch. 2; Keenan, 1992:40.

of water level regulation was an important factor in inducing it to embrace the concept of basin-wide management when the impossibility to affect water level of one of the five lakes in the Great Lakes system without affecting (with possible negative impacts) the level of some other one, became obvious. Similarly, the linkage between water quantity and water quality issues became obvious as well. Accordingly, the IJC has developed an integrated watershed management approach by beginning to combine its specialised advisory and control boards dealing respectively with water quality and water quantity issues within the same transboundary watershed. For this purpose, integrated international watershed boards have been already established in a number of rivers basins with a view to providing a comprehensive basin-wide management approach taking into account the various issues related to shared boundary waters and their interrelationships.

It is not the only example of the IJC contribution to promoting a basin-wide management approach. Another case in point is the role played by the Commission in fostering the conclusion of the Columbia River treaty, obtained in 1961 following protracted and complex negotiations (Sadler, 1986:361; Swainson, 1986). The treaty is described as a "leading case" of an international agreement intended to govern joint basin-wide development, though its results are considered as "mixed" (Rogers, 1992:66). Such an experience is particularly relevant for the Dead Sea region by indicating the importance of an international agreement on a basin-wide basis for successful management of shared water resources which should entail agreement about regional development priorities and co-operation in developing water and related resources on a basin-wide basis[15]. The integrated basin-wide and watershed management approach adopted by the IJC is all the more relevant for the Dead Sea basin where the scarcity of water resources is a major constraint making integrated regional development planning all the more necessary. Such a solution involving joint management of water resources co-ordinated by a common commission for the entire Jordan-Yarmouk basin has been advocated by some analysts in the region (Kliot, 1995:198sq.; Shuval, 1993:8; Zgheib and Fullerton, 1993), which highlights still further the relevance of the IJC model for the region. As far as the Dead Sea region is concerned, such a basin-wide approach seems to be promising for dealing with root causes of its particular problems, to the extent of course that its feasibility is to be facilitated by favourable political developments in the region.

A regional joint management structure for shared water resources would become all the more necessary with the possible realisation of such projects as the Red Sea-Dead Sea canal. This expectation does not however preclude projects with a more modest scope, such as developing a regional co-operation framework entailing the creation of a joint management body adapted to specific needs of the Dead Sea region[16]. Such a body would be able to facilitate co-ordination of joint endeavours in such areas of regional common interest as tourism, mineral extraction, protection of the environment and notably ensuring a more stable Dead Sea water level. It would be able to fulfil investigative and advisory functions, similar to those discharged by the IJC, respecting transboundary resources in the Dead Sea region. Creating such a

[15] Such co-operative regional development scheme in the broader context of the Jordan Rift Valley has been studied by experts of the World Bank at the request of the Jordanian and Israeli governments. The study pointed out the significant role that a Red Sea-Dead Sea canal could play in such a scheme (World Bank, 1994).

[16] Such a possibility is envisaged in the Israel-PLO Interim Agreement (see note 1).

transboundary co-operation framework with limited regional objectives could be more feasible than reaching a more ambitious agreement in a broader geopolitical context, as it does not necessarily entail agreement about such thorny issues as apportionment of water resources. Absence of such a regional, transboundary co-ordination would compromise the considerable development potential of the Dead Sea region and the effective protection of its unique natural environment. On the other hand, as indicated by the IJC experience, successful transboundary co-operation in managing shared water and related resources in this region may provide a useful leverage for improving relations between the neighbouring nations.

5. CONCLUSIONS

As pointed out in this paper, if the IJC experience is to be considered as a success story, it is largely due to the existence of an appropriate political-legal framework provided by the BWT of 1909. Such agreements, at least in a tentative form, already exist between the Jordan, Israel and the Palestinian Authority sharing the Dead Sea region and, looking forward for an improvement in the political climate in the region, they may provide a starting point for developing a joint management structure for shared water resources in the Dead Sea region. This process may be facilitated by drawing some lessons from the IJC experience and management model, provided that adjustments are made to adapt them to the realities of the region. A staged approach to such an institution-building process appears to be most promising. Procedures, the value of which has been proven by the IJC experience - such as information sharing and joint fact-finding facilitating consensus building and problem solving, consultation with all concerned stakeholders and public education through a double-way information process improving understanding of the issues and facilitating broad acceptance of sound management decisions – appear as the most relevant lessons applicable at a first stage of such a process. Proper implementation of such measures is expected to enhance developing a culture of international co-operation which would facilitate further institutional development in the area of joint management of shared water resources on a basin-wide basis.

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WATER AND PEACE:
AN INTERNATIONALLY-COLLABORATIVE CURRICULUM PROJECT
ADDRESSING ISSUES RELATED TO WATER AND CULTURE

Project Overview

Kenneth Cushner[17]

Paper related to poster

1. CONTEXT

UNESCO and Green Cross International have proposed a joint program "From Potential Conflict to Co-operation Potential: Water for Peace." This program is designed to examine the potential that shared water resources can serve as a catalyst for development and peace through co-operation. The material prepared in preparation for a November 2002 meeting in the Netherlands provides a brief summary. It states:

> "In the past hundred years, the world's population has tripled while demand for water has increased seven-fold. The signs of a looming water crisis are evident. Since water is essential to every aspect of life, this crisis affects everything – health, human rights, environment, economy, welfare, politics, culture – and is well beyond the scope of any individual country or sector to deal with unilaterally. …In this context of crisis, the 21st century is often labelled as a period that is likely to experience wars over water. …… However, historical evidence shows that water has rarely been the primary reason for armed conflict between sovereign states. On the contrary, it is precisely due to its essential nature that freshwater can be a powerful incentive and catalyst for co-operation."

2. PROPOSED PROJECT GOAL

The proposed project aims to produce an internationally co-operative curriculum that uses water as a unifying force among people and institutions in diverse nations. The ultimate goal of this effort is to develop middle school curriculum materials by educators from a number of countries with which Kent State University College and Graduate School of Education has collaborative links, some of which are currently in conflict. Contributing nations to this project include the United States, Turkey, Greece, Israel, Palestine, Bahamas and Kenya. Curriculum materials will be developed in such a manner that they can be used in schools in each of the participating nations.

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3. PROJECT VISION

Using the intersection of water and culture as the common theme, this curriculum project is designed to introduce students to such interrelated issues as:

- the science of water;
- history of selected civilisations based around water;
- the interactions of people and cultures, including religions of the respective region;
- migrations and movement of people and ideas across water;
- current environmental problems and prospects related to water;
- the potential for water to serve as a divider or unifying agent.

An underlying objective of this project within the broader international context is to bring currently divided cultures into extended contact in pursuit of a common goal – in this case developing educational materials that satisfy each nation's needs that can be integrated into their particular educational setting.

4. PROCESS

An initial planning meeting funded by the Centre for International and Intercultural Education of Kent State University's College and Graduate School of Education and hosted by Bahcesehir University, Istanbul, will take place in March 2003 at the South Eastern Anatolia Regional Development Project (GAP) sponsored Conference on International Communication for Co-operation and Development in Turkey. Following this initial planning meeting, and subject to available funding, educators from each of the respective countries will meet two to three times each year to conceptualise and design curricular materials that develop the various themes and issues of the curriculum. In between face-to-face meetings, materials will be piloted and refined by the team in their respective country.

5. PROJECT COMMITTEE

To date includes the following institutions comprise the proposed project:

Israel:	Oranim College Haifa University
Palestine:	Bir Zeit University.
Greece:	Ministry of Education
Kenya:	Taita Discovery Centre Development Services, Kenya
Turkey:	Bahcesehir University GAP
Bahamas	College of the Bahamas Bahamian Environmental Research Center
U.S.A:	Kent State University

6. INSTITUTIONAL DESCRIPTION

The Gerald H. Read Centre for International and Intercultural Education was named in honour of Kent State University's distinguished Emeritus Professor Gerald Read, one of the founders of the Comparative and International Education Society. The centre, established in 1987 as a support service for students and faculty in Kent State University's College and Graduate School of Education, provides assistance to facilitate the international, global and intercultural priorities of the College by identifying and promoting faculty exchange, research and scholarship, as well as student study and research in both overseas locations and in culturally diverse settings within the United States. In addition to a long history of developing international and intercultural travel programs, sponsoring of major lecture series, co-ordinating student teaching opportunities in more than 16 countries, and supporting international students and scholars in the College and Graduate School of Education, CIIE has active international collaborations and projects in the Bahamas, Kenya, South Africa and Turkey. Kent State University's Water Resource Institute serves in a consultant capacity to this project

Kent State University College and Graduate School of Education and the Gerald H. Read Centre for International and Intercultural Education has had a long-standing relationship with major institutions in most of the proposed contributing nations, including: Turkey - the South Eastern Anatolia Regional Development Project (GAP) and Bahcesehir University, Istanbul; Kenya - the Taita Discovery Centre, regional schools and Kenyatta University in Kenya; Israel - Oranim College, Western Galilee College, Haifa University, and regional educational authorities; Greece - Aristotle University in Thessalonica. Educational materials that are collaboratively developed and trialed in the contributing nations are designed to teach others about critical issues from the perspective of the target nation. People, thus, represent their own perspective in the production of these materials.

7. PROJECT DIRECTOR

Kenneth Cushner is Associate Dean for Student Life and Intercultural Affairs and Professor of Education at Kent State University, Kent, Ohio. Dr. Cushner is author or editor of several books and articles in the field of international and intercultural education and training, including: *Human Diversity in Education: An Integrative Approach,* 4th edition (2003, McGraw-Hill); *Human Diversity in Action: Developing Multicultural Competencies for the Classroom*, 2nd edition (2003, McGraw-Hill); *International Perspectives on Intercultural Education* (1998, Lawrence Erlbaum Associates); *Improving Intercultural Interactions: Modules for Cross-Cultural Training Programs, volume 2* (Sage Publications, 1997), and *Intercultural Interactions: A Practical Guide*, 2nd edition (1996, Sage Publications). A former East-West Centre Scholar, he is a frequent contributor to the professional development of educators through writing, workshop presentations, and travel program development. While at the East-West Centre he assisted with an international curriculum project (The Ocean Project) that used the Pacific Ocean as a common vehicle. He has also worked on Arab-Jewish dialogue programs in the Middle East and was principle author of the "Intercultural Training and Resource

Guide" designed to prepare Turkish development workers to interact more effectively with Arab and Kurdish communities within Turkey. He has developed and led intercultural programs on all seven continents.

8. WATER CURRICULUM THEMES (PROPOSED)

Themes:

1. **The Science of Water**, could include such aspects as:
   -Water facts – a planetary perspective; accessibility; freshwater sources; water cycle; lowering of water table; replenishing aquifers; water mining
   -Chemistry (composition, structure, phases, properties, etc.)
   -Water as the basis of life (biological necessity, community settlement, etc.)
   -Water disasters (weather-related events)
   -Desalination

2. **History and Civilisations**, could include:
   -The Fertile Crescent; Tigris and Euphrates River Valleys
   -Holy Land from the perspective of three of the world's great religions (Moses means 'drawn from the water'; Biblical/Koranic references)
   -Water-based settlements
   -Greece, including the founding of democracy
   -Desert Regions (including the Taru Desert – Kenya, with a focus on indigenous people; Negev in Israel)
   -Mythology; how early people moved water

3. **People and Culture: Ways of Life Around Water-Based Communities**, could include:
   -Examples of early cultures (and religions) in each nation that are either water-based or how their daily life was impacted by water (or lack of), such as Fertile Crescent, Sea of Galilee, early Greeks, lake Victoria in Kenya
   -Damming or otherwise altering waterways, including GAP,
   -Irrigation – traditional and advanced practice with specific examples from each nation; the 'greening' of Israel
   -Modernisation and the impact on traditional people and their interaction around water – including the Bedouins in Israel, Kurds and Arabs in eastern Turkey,
   -Water-Dependent Economies, including fishing and fish-farming, international water rights, industry and development of factories, tourism and recreation

4. **Movement of People and Ideas Across Water**, could include:
   -Transportation; riverways development of shipping routes
   -Migrations of People, including slave ships across the Atlantic and the subsequent African Diaspora
   -Movement of Ideas, including Islamification of the Middle East, spread of Christianity through the Crusades, Jewish Diaspora, Democracy (and possible threats vis-à-vis 9/11) (but how to connect these to water?)

5. **The Environmental Crisis**, could include:

-Pollution and subsequent ecological efforts (oil spills, impact on local flora and fauna on the fishing industry, and on drinking water, etc.); living downstream from factories and communities; sewage/waste water treatment (or lack thereof)
-Rivers drying up; draining aquifers faster than they can be replenished
-Threats to world wildlife with a focus on Kenya (drought, poaching)
-Environmental efforts such as 'Save the Dolphin' type projects, water conservation, water washing/cleansing
-Desertification, deforestation

6. **Bridging Conflicts Over Water: Cross-Cultural Perspectives and Practice**, could include:
-Conflict and mediation (using water-based cultures as examples) (Cyprus/Turkey/Greece; Israel/Palestine and/or Arabs/Jews and Jordan River; Turks/Arabs/Kurds w/GAP as a unifier; conflict over tourism and development, etc.
-Cross-cultural understanding and communication
-Greece - Olympics (perhaps using water sports as a unifying effort)
-Kenya – conflict between people and wildlife over food, water and space, with emphasis on comprehensive conservation programs.
-Israel – Indigenous use and mediation, such as Bedouin practices in the Negev; Islamic practice of sulha or forgiveness; etc. the Peace Pipeline; the Jordan River as a divider;
-Privatisation/sale of water for profit

CONFLICT AND/OR CO-OPERATION IN TRANSBOUNDARY KARST GROUNDWATER RESOURCES MANAGEMENT

Ognjen Bonacci[18]

paper related to Poster

ABSTRACT

The objective of this paper is to point out specific characteristics of karst aquifers, which represent the main reason for possible conflict when they are internationally shared. Open and well organised international co-operation is a basic prerequisite for a more efficient karst aquifer management. It should be based on the principles of sustainable development. Few examples of internationally shared karst aquifers in Dinaric karst between Croatia and Bosnia-Herzegovina are given. In order to avoid conflicts and water crises, especially in Dinaric karst region, it is of paramount importance to establish new legal and administrative frameworks for international co-operation. As a first step, it is necessary to reconstruct and modernise the existing monitoring of meteorological, hydrological, hydrogeological and ecological parameters essential for karst aquifer management. Official contacts of hydrotechnical experts should be strengthened.

1. INTRODUCTION

Biswas (1991) considers that one of the critical issues of the 21st century will undoubtedly be the management of international water bodies. Management of karst groundwater resources everywhere represents a very complex task. When karst aquifers are internationally shared, new problems in water management arise. Only part of the problems deal with technical, geophysical and ecological characteristics. The main difficulties are to be found in the political and socio-economic sphere. In the immediate future, management and development of transboundary karst aquifers could be a reason for bilateral and multilateral conflicts. At the same time, international co-operation based on the principle of sustainable development and management of these valuable resources offers hope and prosperity for all involved sides.

In cases of internationally shared karst aquifers management, water crises are increasingly serious all over the world. The application of the concept of sustainable development, connected with an integral, multi- and interdisciplinary, or holistic approach of water resources management, provides promising answers (Bonacci, 2000).

Sustainable development is a powerful and dynamic concept that has to be refined and whose principles have still to be turned into achievable policies (Sophocleous, 2000). It is an umbrella concept, which until now has not been put into practice efficiently. It has many dimensions with many definitions depending on the

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professional background of the investigator. To obtain a harmonious, reliable and sustainable development, it is necessary to take the complex, interactive, technical, geophysical, social, economical, environmental and cultural aspects of transboundary karst aquifers management into account in decision-making.

The concept of sustainability concerning internationally shared groundwater management should be understood and applied within a rapidly, hardly predictably changing society and environment. Custodio (2002) quotes that the sustainable development of natural resources is the development that meets the needs of the present without compromising the ability of future generations to meet their needs. Future needs and technologies are uncertain, as are karst groundwater resources themselves. Thereore, the first goal of the sustainable development of transboundary karst aquifers management is to meet the needs of one country by not preventing the needs of the other countries.

Humane knowledge about karst aquifers is insufficient and uncertain, especially with regard to the technical, socio-economic and ecological knowledge. Water is a crucial natural factor on which sustainable development of both human beings and their environment depends. Water links biosphere and social systems, and in this way directly and strongly influences the future of our planet. It seems that the human kind is not fully aware of the consequences of their activities dealing with water. The main reason could be a time scale effect caused by the fact that each individual or group contemplates in short time increments which are suitable to their interests.

The objective of this paper is to explain specific problems in karst areas using some examples of the transboundary karst groundwater resources management of the Dinaric karst region and to address the importance of international co-operation and transdisciplinary approaches. The karst aquifers represent natural reservoirs of high quality groundwater. They are very specific, with different characteristics compared with other types of aquifers.

Effects of human activites on a different scale are relevant to all karst aquifers. Local, regional and global differences in climate and water flow are causing varying effects on human activites on the surface, on the underground karst forms and on water quantity and quality. One should bear in mind, that everyone lives upstream or downstream of the effects of some human activity. Policies alone will not solve many internationally shared karst aquifers management issues, but a combination of policy, education, scientific knowledge, planning and enforcement of applicable laws can provide machanisms for sustainable development.

2. KARST AQUIFER

Karst represents a specific area consisting of a surface and a surface-underground hydrographic network resulting from the water circulation and its aggressive chemical and physical action in cracks, joints and fractures along the layers of soluble rocks, such as limestone, chalk and dolomite as well as gypsum and salt. Karst is characterized by soluble rocks located near or at the surface. The karstification process results from the physical and chemical water action on the solution and transportation of elements from the rock. Over time, the permeability

of the rock mass is greatly enhanced, and rainwater, instead of being mostly diverted over the surface and into open streamflows may be infiltrated. Very fast infiltration of water, due to its fractured surface, results in scarcity of overland flow. Thus, karst terrains are characterized by a high proportion of underground drainage. A soluble rock formation may contain voids with a spectrum of sizes from submicroscopic cracks to caverns of tens of meters across.

Karstified rocks can be found in all parts of the world. In certain regions they are quite frequent and cover wide and deep areas (e.g. China, Turkey, Greece, Slovenia, Croatia, France, Spain, Bosnia-Herzegovina, Kentucky State of USA etc.), whereas in other regions they are rare and appear only in certain areas most often as shallow surface karst (some countries of northern Europe and South America). Karst is estimated to cover 20 to 25% of the surface of all continents (Bonacci, 1987).

Karst water resources have many particular features that often clearly distinguish them from water resources of other geologic formation. The essential principles of the hydrological, hydrogeological and hydraulical process are identical in karst and non-karst terrains, but the variations are more specific and numerous with regard to the flow in karst. In karst terrains, more than in most other terrains, the unexpected should always be expected (Atkinson, 1986).

Another problem is the strong interaction between surface water and groundwater in karst. The basic hydraulic and/or hydrologic principles of physics which underlie this interaction are not particularly complex and have been described in detail in the literature. The problems related to their interpretation appear only due to the fact that it is not easy to observe these processes in wide and non-homogeneous karst terrains. Numerous measurements and an accumulated stock of experience in organizing them are necessary to obtain accurate data undispensable for defining parameters reliable for hydrological analyses.

Karst terrains and their aquifers present special problems to the scientists and engineers. The varied and often spectacular surface landforms are merely a guide to the presence of unpredictable subsurface conduits, fissures and cavities. These underground features can occur even where surface karstic landforms are completely absent. As a result, the flow mechanism in complex heterogenous and anisotropic karst systems are less well understood as compared to the other media.

The majority of karst terrains and their aquifers in the world are still insufficiently researched from a hydrological and ecological point of view. One of the reasons is they are situated in less developed and less wealthy parts of the world. The second, and probably more relevant reason is the extreme heterogenity of the karst aquifer, which causes complexitiy for investigation and explanation. It is very hard to obtain reliable information, parameters and general conclusions on water circulation processes and aquifer characteristics (Bonacci and Roje-Bonacci, 2000).

The karst aquifers are two-component systems in which the major part of storage is in the form of true groundwater in narrow fissures, where laminar flow prevails. On the other hand, the majority of the water is transmitted through the karst underground by turbulent flows in solutinally enlarged conduits. Slow or so-called

diffuse flow occurs through karst fissures of small dimensions generally in the laminar regime. Turbulent fast flow, or conduit flow, occurs in large fissures through irregular karst conduits, with dimensions varying from 1 cm to few meters.

The determination of the catchment boundaries and the catchment areas of the karst aquifers is the starting point in all hydrological and water management analyses. In many karst terrains this is a difficult task, very often unsolved. The root causes are: 1) heterogeneous and anisotropic surface and underground morphologic karst forms; 2) existence of well developed, complex, deep and unknown underground karst conduits, fissures, joints and cracks; 3) strong interaction between circulation of surface water and groundwater in karst; 4) high and fast oscillations of groundwater in karst (few hundreds of meters); 5) strong connection between inflow (swallow-holes) and outflow (karst springs); 6) small storage capacity of the karst medium and fast groundwater transport through karst; 8) natural endogenetic and exogenetic processes; 9) influence of man's induced structures and activities (water abstraction, dam and reservoir construction etc.)

The karst aquifers are highly sensitive and vulnerable to imposed stress. They usually lack resilience in the face of such stresses. The response of karst water to such processes is highly distinctive and sets the karst aquifers environment apart from other underground reservoirs. Karst groundwater vulnerability depends on infiltration conditions as well as on the spatial and temporal distribution of hydraulic conductivity (Drew and Hötzl, 1999).

The necessity of identifying a karst aquifer system is becoming more significant, primarily due to the fact that karst terrains have been more densely populated recently which has resulted in a greater demands for water.

3. EXAMPLE OF THE CETINA RIVER

The Cetina River is a typical karst watercourse in the deep and well developed Dinaric karst. The total length of the Cetina River open streamflow, which is completely situated in the Republic of Croatia, from its spring to the mouth in the Adriatic Sea, is about 105 km. The catchment area of the Cetina River (Figure 1b) is estimated to cover about 4000 km^2 although the precise hydrological catchment area and boundaries are not known (Bonacci and Roje-Bonacci, 2003). Figure 1a is the map of Croatia showing the position of the Cetina River catchment (study area 1).

Figure 1b presents the most probable basin limit of the Cetina River. The state boundary between Croatia and Bosnia-Herzegovina is drown on it. It generally coincides with topographic basin limit. The western part of the catchment is referred to as "direct" or topographic catchment and is almost entirely situated in the Republic of Croatia. The eastern part of the catchment is referred to as "indirect" catchment, which is mainly situated in the Bosnia-Herzegovina. Water from the "indirect" catchment emerges in the western "direct" catchment in numerous permanent and temporary karst springs.

Since 1960, numerous hydrotechnical works have been carried out on the Cetina River and within its catchment. Five hydroelectric power plants (HEPP),

five reservoirs, three long tunnels and pipelines were built (Figure 1b). Their operation significantly altered the natural hydrological-hydrogeological regime. The realisation was possible in former Yugoslavia, which was established in 1945 after the Second World War and disintegrated in 1991 to five independent states.

It should be added that all transboundary hydrotechnical systems in former Yugoslavia were built without detailed considerations of inter-republics (now states) boundaries, as the possibility of disintegration of the former Yugoslav federation has not been taken seriously. Further complications arise from the fact that hydrotechnical systems have been built on the basis of "agreemental socialistic" instead of on a market economy. As a consequence, all the problems have not been clearly distinguished.

The Cetina River catchment is a typical example an unclear relationship between water in open streamflow and groundwater in internationally shared karst aquifers. However, even though more systematic work within the management of boundary and transboundary water resources between Croatia and Bosnia-Herzegovina hasn't started yet, it is positive that both sides left the solutions for better times.

4. EXAMPLE OF THE TREBISNJICA RIVER AND THE OMBLA SPRING

Figure 1a is the map of Croatia showing the position of the Trebisnjica River and the Ombla Spring as study area 2. Figure 2 shows state boundary between Croatia and Bosnia-Herzegovina with indicated reservoirs and HEPP-s of the hydrotechnical system constructed on the Trebisnjica River catchment. This area, of abouth 5000 km^2, is part of deep Dinaric karst. The population is concentrated in several poljes in the karst and in towns located on the Adriatic Sea cost. The poljes are situated at three levels: 1) high poljes at about 800 m above sea level (m a.s.l.). 2) middle poljes (Dabarsko, Fatnicko etc.) at 400-550 m a.s.l.; 3) Popovo polje at the altitude from 150 to 330 m a.s.l. All poljes are hydrologicaly-hydrogeologicaly connected by underground karst conduits.

The Bileca Reservoir has useful capacity of $1100x10^6$ m^3 of water and presents one of the largest artificial reservoir in karst all over the world. After the construction of 123 m high Grancarevo Dam a large and permanent karst spring of the Trebisnjica River was permanently flooded by 75 m deep average water level. The analyses (Milanovic, 1986) show that the flooding of the Trebisnjica Spring strongly influenced the hydrological regime of the upstream and downstream poljes, aquifers and catchments. There is evidence of formation of a new and large karst underground reservoir, i.e. significant increase of natural karst aquifer. Upstream and downstream karst aquifers are under strong influence of the Bileca Reservoir.

The Trebisnjica River karst aquifer is internationally shared between Croatia and Bosnia-Herzegovina. There are very complex connections between the Trebisnjica River aquifer and the Ombla Spring aquifer (Figures 2 and 3). The section of an open streamflow of the Trebisnjica River is included in the catchment of the Ombla Spring. There are permanent water losses into the karst underground

along the given section caused by the cracks located at the bottom and banks of the Trebisnjica River. The water losses of the open streamflow along this section, flowing through the Ombla Spring hydrologic catchment, depend upon the inflow discharge and the groundwater levels. The infiltrated water feeds the spring. Thus, the spring catchment area is increased, whereas the open streamflow catchment area is decreased respectively. This relation changes in time.

In 1978 the river bed of the Trebisnjica River was regulated by building a concrete canal for the discharge of 45 m^3/s. As a consequence the average annual discharge of the Ombla Spring decreased from 30 m^3/s to 22 m^3/s, whereas changes in minimum and maximum annual discharges were not measured (Bonacci, 1995).

There is the plan to build the HEPP Ombla, which will exclusively use groundwater from the Ombla Spring aquifer. Figure 3 shows cross-section A-A given on the Figure 2 with designated positions of the Ombla Spring, the HEPP Ombla underground dam (in project), the state boundary between Croatia and Bosnia-Herzegovina, the Trebisnjica River and the inferred Ombla Spring basin limit. The HEPP Ombla will use groundwater from internationally shared karst aquifer.

Definitively, it is time to start building new institutional, legal and technical framework for the insurance of a stable and fair management of internationally shared karst aquifers.

5. CONCLUSIONS

The karst aquifers show the extreme heterogeneity and variability of hydrogeologic, hydrologic, hydraulic, ecological and other parameters in time and space. Such a complex system needs multi- and interdisciplinary approach, especially in case when it is internationally shared. A first and essential step is to create the best possible definition of the aquifer characteristics, the catchment areas and parameters of its water budget. Without this data, it is not possible to create a strategy for sustainable development and management of internationally shared groundwater.

Water related problems will be better and more efficiently solved if professional and scientific principles are fully recognised and not affected or influenced by daily politics. In case of the states, which were established after disintegration of former Yugoslavia, official contacts of hydrotechnical experts should be strengthened. Friendship and appreciation between experts and institutions that were created over many years, and privately still exist, should be used at best for efficient solution of current problems that do not have political background. Unfortunately, at the present, some positive experiences from the former country and political system are insufficiently used due to the opinion that nothing from the former system was good.

Of paramount importance is to ensure a stable exchange of technical information and to create institutions and space where a public and open discussion among all partners in the process will be conducted. It is the way to create a long-term strategy for a more efficient internationally shared karst aquifers management respecting the principles of sustainable development.

Transboundary karst aquifer management should evolve gradually respecting the following basic concept:

1) Each and every karst aquifer is unique;
2) Karst aquifer management should benefit people of all countries which share it;
3) Karst aquifer management should enhance quality of peoples' life and reinforce their interactions with environment;
4) The demands and priorities of different uses in each transboundary karst aquifer and the suitability of the system for those users vary from place to place and over time;
5) The transboundary karst aquifer management should be connected with integrated water management of all countries.

In order to apply those valuable principles in practice, it is necessary to fulfil numerous prerequisites. Of paramount importance is to establish a legal and administrative framework for bilateral or/and multilateral co-operation while at the same time reconstructing and modernizing the existing monitoring of ground- and surface water quantity and quality.

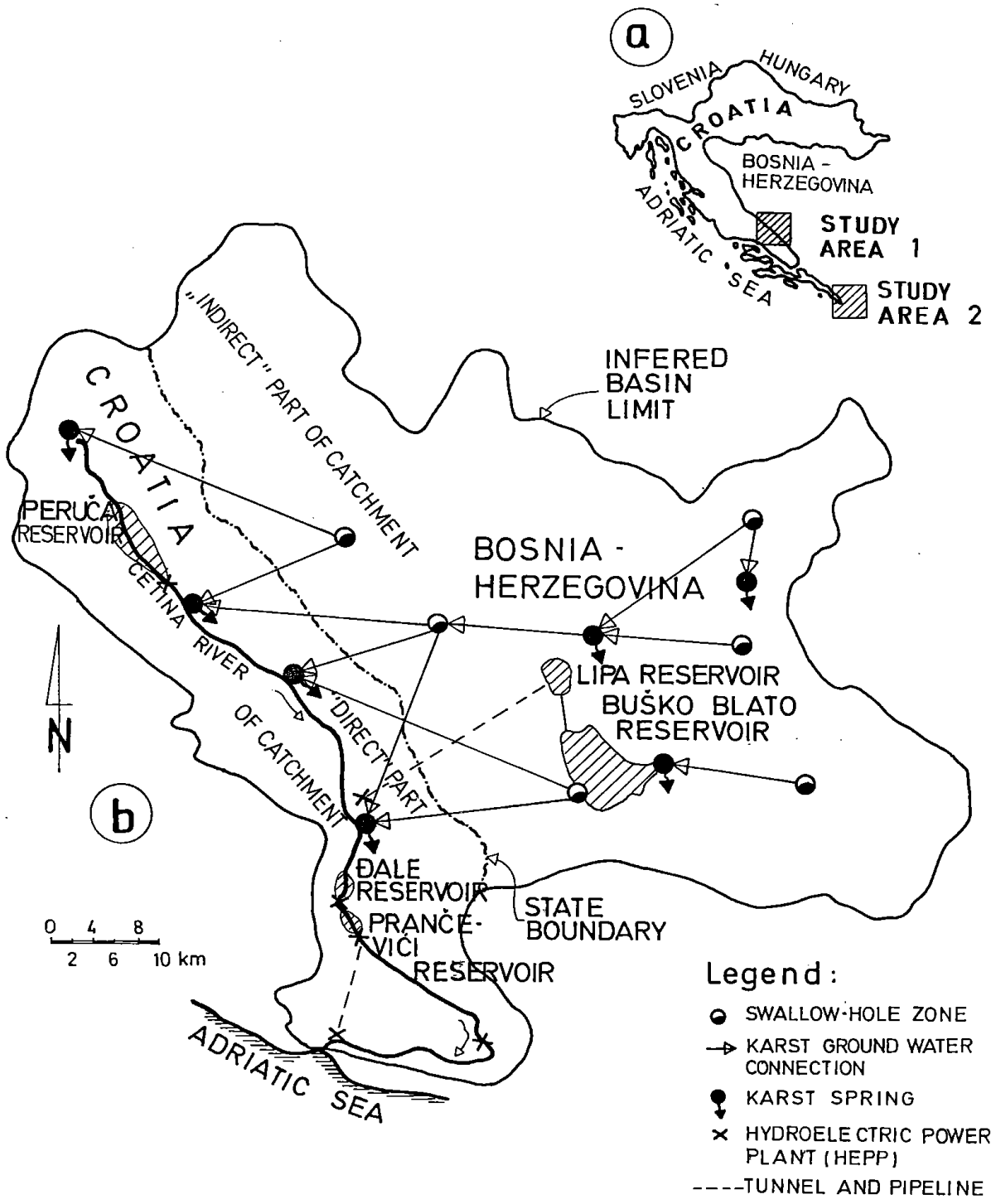

***Figure 1*: The maps of two study area (a) and the Cetina River catchment (b)**

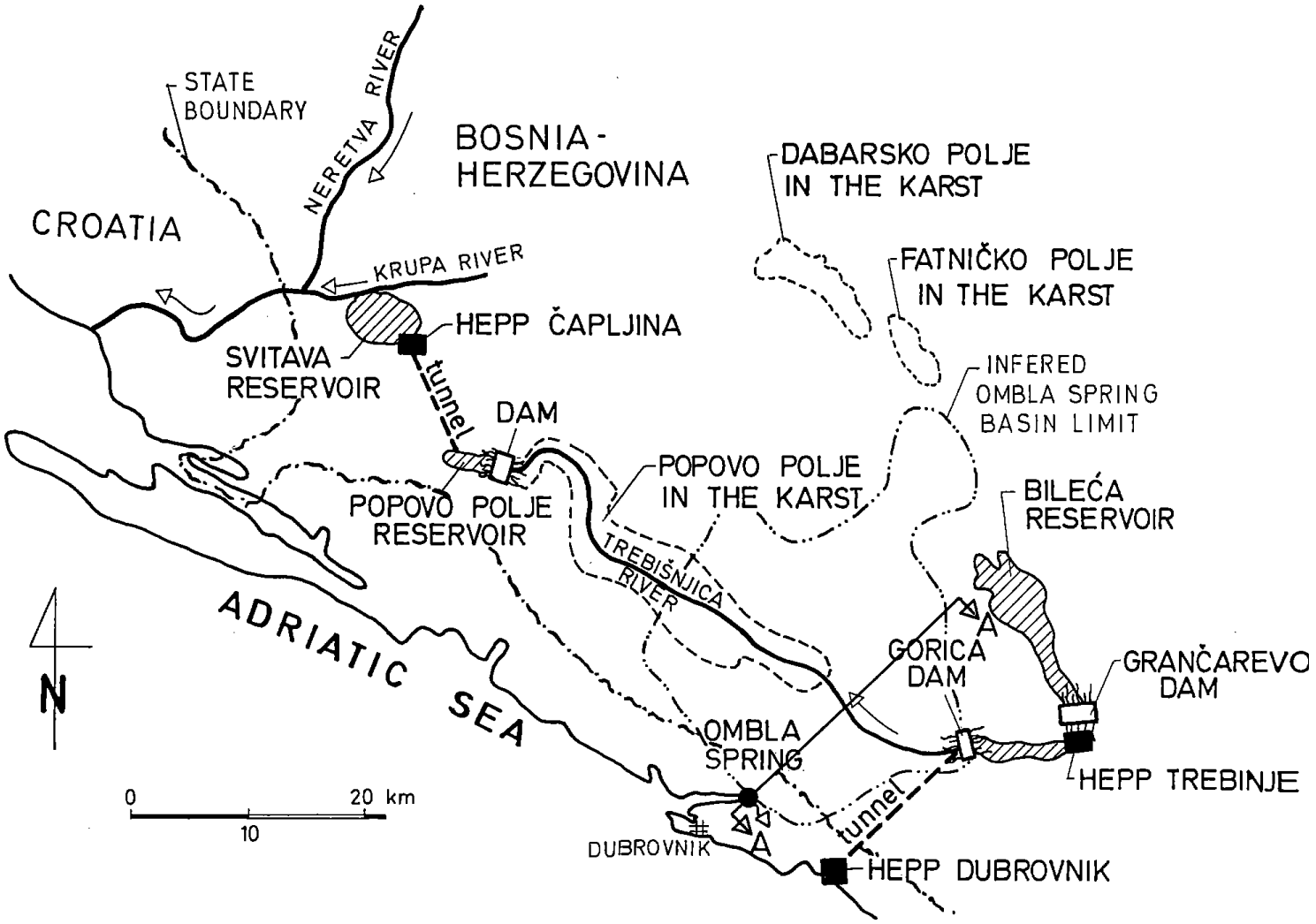

***Figure 2*: The map of the study area 2 with designated state boundary between Croatia and Bosnia-Herzegovina, reservoirs and HEPP-s of the hydrotechnical system constructed on the Trebisnjica River catchment**

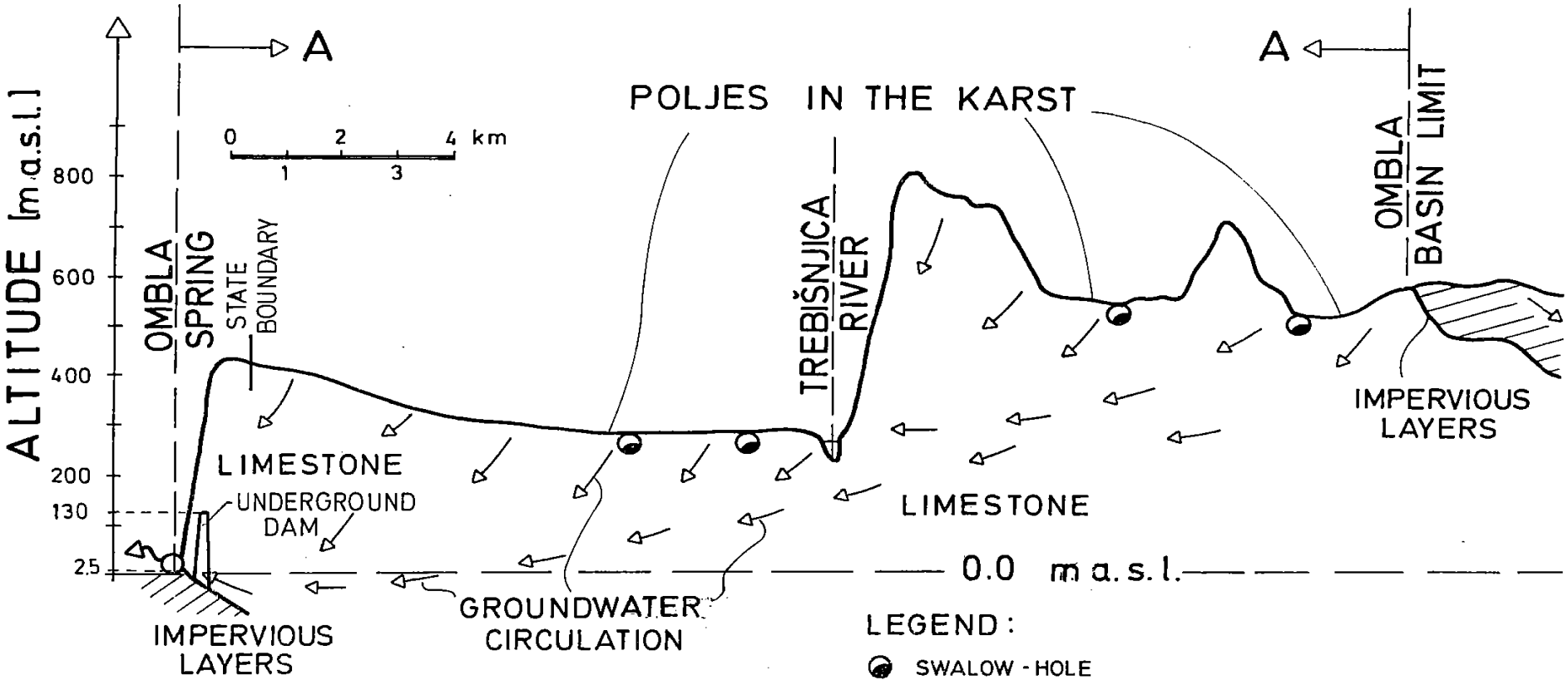

***Figure 3*: The cross-section A-A given on the Figure 2 with designated positions of the Ombla Spring, the HEPP Ombla underground dam (in project), the state boundary between Croatia and Bosnia-Herzegovina, the Trebisnjica River and the inferred Ombla Spring basin limit.**

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ENLARGING THE PIE? IDENTIFYING, SHARING AND CREATING BENEFITS

CO-OPERATION ON INTERNATIONAL RIVERS: A CONTINUUM FOR CAPTURING BENEFITS

Claudia Sadoff[19] and David Grey[20]

1. INTRODUCTION

Some 40% of the world's population live within international river basins and over 90% of the world's population live in countries that share international rivers[21]. These rivers wind through the histories and cultures of nations, raising national expectations –both within and beyond the borders of basins– of the benefits these rivers can bring. As populations and economies grow, and as less contentious national water resources become more fully exploited, an increasing share of the remaining development opportunities will be on international rivers. Development of these rivers can elicit extremes of co-operation or dispute, or a host of dynamics in between. Achieving international co-operation is always a long and complex journey, for which there is no single path and few short cuts. Instead, there are many routes to be followed and many steps to be taken, with various options to consider and choices to be made.

This paper summarises ongoing work on a framework for achieving co-operation on international rivers, which requires progressive movement from unilateral national agendas to national agendas that incorporate significant co-operation and increasingly converge upon a shared co-operative agenda. The extent to which this will occur will be determined by each party's perception of the benefits it can capture. Progressive convergence towards a co-operative agenda will be facilitated by several important and practical steps. First, the range and extent of perceived benefits needs to be broadened to the extent possible, from the obvious to the less apparent. Second, alternative levels of co-operation need to be recognised and appropriate level of co-operation identified to capture the greatest net benefits. Third, the distribution of benefits, and benefit sharing opportunities to redistribute the costs and benefits of co-operation, must be explored to promote a co-operative agenda that will be perceived as fair by all parties. Each of these steps is examined below.

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[21] This paper builds upon an earlier paper 'Beyond the River: the Benefits of Co-operation on International Rivers', by Sadoff and Grey (2002). As in the earlier paper, in this paper, freshwater flows (whether surface water or groundwater), and the lakes and wetlands which some of these flows may pass through, derive from or terminate within, are described, very loosely and evocatively, as 'rivers'. The term 'international rivers' is used in this text to refer to freshwaters whose basins are situated within the borders of more than one state.

2. NATIONAL AND CO-OPERATIVE AGENDAS: CONVERGING TOWARD CO-OPERATION

That each sovereign country will have its own national agenda on an international river is obvious, rational and legitimate. That this national agenda may, to a greater or lesser extent, be a unilateral one may also be rational, even though these unilateral actions may negatively affect other co-riparian states. Thus, in a river basin shared by two states there will be two separate national agendas. There may also be a third, co-operative agenda of some scale – from very limited to substantial. As the benefits of this co-operation are progressively identified and captured, this third agenda may grow, with the two national agendas converging into a co-operative agenda for the two nations – each of which will still view the co-operative agenda as their national agenda. In this case the single co-operative agenda will need to provide benefits that exceed the sum of the two non-co-operative national agendas, and will thus have become the rational choice (and the national – but co-operative – agenda) of each sovereign nation.

3. BENEFITS BEYOND THE RIVER: RECOGNIZING THE RANGE OF CO-OPERATIVE BENEFITS

A first step in motivating co-operation is to recognise the widest possible range of potential benefits that co-operation could bring. There will be no co-operation if benefits are perceived as inadequate relative to the costs of co-operation. Integrated, basin-wide water resources management is increasingly recognised as the goal for ensuring the sustainability and productivity of river systems and is a challenge in any setting, as the priorities and concerns of myriad users must be reconciled. In the context of international rivers, integrated management requires international co-operation. The complexity and costs of international co-operation can be very great, and must be achieved in the absence of any ultimate entity with the mandate and authority to impose a solution.

A useful framework for identifying the benefits of co-operation on international rivers categorises four types of co-operative benefits (Sadoff and Grey, 2002, see table). The first, is co-operation that enables better management of ecosystems, providing *benefits to the river*, and underpinning all other benefits that can be derived. The second, is the efficient, co-operative management and development of shared rivers that can yield major *benefits from the river*, in increased food and energy production, for example. The third, is co-operation that results in the *reduction of costs because of the river*, as tensions between co-riparian states will always be present, to a greater or lesser extent, and those tensions will generate costs. And finally, as international rivers can be catalytic agents, co-operation that yields benefits from the river and reduces costs because of the river can pave the way to much greater co-operation between states, even economic integration among states, generating a fourth category of *benefits beyond the river*.

While each of these four types of benefits could potentially be obtained in all international river basins, the scale, relative importance, and feasibility of capturing each type will vary greatly between basins, reflecting a wide range of political, geographic, economic and cultural circumstances.

A potentially powerful and practical tool for identifying, and promoting the recognition of, benefits of all four types is the Co-operative Regional Assessment (CRA). CRAs can be as simple as desk studies that reconcile national-level assessments, or they can be designed holistically on a basin-wide scale, bringing riparian specialists together in a process that builds common understanding and relationships. CRAs need to be strategic, highlighting the full range of potential projects and benefits, and the options and choices that are available to capture and share the benefits of co-operation. CRAs can be used as an integral part of the process of building trust and confidence, and, along with negotiations, they can help fuel an iterative process to define the appropriate level of co-operation, identifying opportunities for net co-operative gains in an increasingly basin-wide view.

***Table* 1: Types of Benefits on International Rivers**

Type	The Challenge	The Opportunities
Type 1 Increasing Benefits ***To the River***	Degraded water quality, watersheds, wetlands, & biodiversity	Improved water quality, riverflow characteristics, soil conservation, biodiversity and overall sustainability
Type 2 Increasing Benefits ***From the River***	Increasing demands for water, sub-optimal water resources management & development	Improved water resources management for hydropower & agricultural production, flood-drought management, navigation, environmental conservation, water quality & recreation
Type 3 Reducing Costs ***Because of the River***	Tense regional relations & political economy impacts	Policy shift to co-operation & development, away from dispute/conflict; from food (& energy) self-sufficiency to food (& energy) security; reduced dispute/conflict risk & military expenditure
Type 4 Increasing Benefits ***Beyond the River***	Regional fragmentation	Integration of regional infrastructure, markets & trade

(Sadoff and Grey, 2002)

This basin-wide view will facilitate convergence towards the co-operative agenda, and help to capture the benefits of co-operation. CRAs will then provide the point of departure for the (essentially political) negotiations needed to agree the co-operative agenda, including the actual mechanisms for sharing benefits and costs.

A CRA in a particular sector would provide a substantive, basin-wide analysis of development options relevant to that sector, and propose next steps for project identification and preparation. The CRA would also specifically include:

- Identifying and analysing the range of benefits of co-operation
- Identifying the appropriate level of co-operation to capture the greatest net benefits, taking account of the costs of co-operation
- Identifying the range of potential options for sharing the costs and benefits of co-operation

4. A CONTINUUM OF CO-OPERATION: IDENTIFYING THE APPROPRIATE LEVEL OF EFFORT

A second step in promoting co-operation is to identify the various levels of co-operation that could be adopted, and determine the appropriate level of co-operative effort to achieve a particular goal. The optimal level of co-operation will vary with the hydrologic and investment opportunities in each basin. A continuum of co-operation can be conceived from unilateral action (independent, non-co-operative national plans), to co-ordination (communication and information on national plans), to collaboration (adaptation of national plans for mutual benefits), to joint action (joint plans, management or investment) – see Figure 1.

If a basin were characterised by *unilateral action*, there would be no communication or information exchange over the management and development of the shared river. Not only do such arrangements forgo the opportunity to capture co-operative gains, but they can lead to situations where riparian countries' development and investment schemes undermine one another. The cumulative impact of these unco-ordinated developments may diminish or re-schedule flows or degrade water quality to the point that all activities may be compromised.

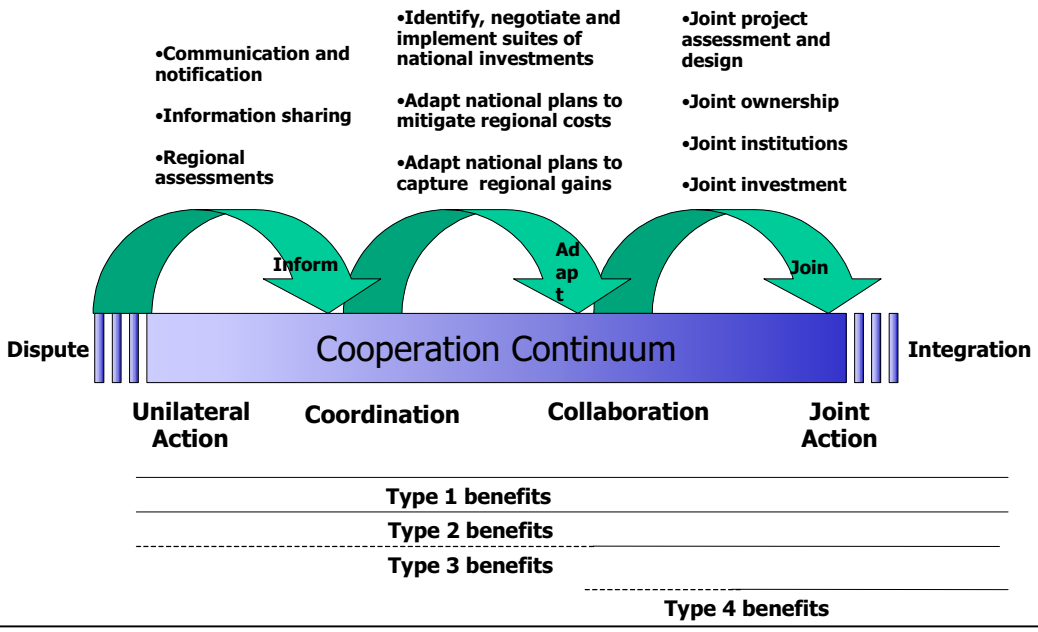
A shift from unilateral action to *co-ordination* could be achieved through the exchange of information in a basin. For example, the exchange of hydrologic information could generate a range of benefits, such as enabling improved flow forecasting and greater preparedness for floods and droughts. The exchange of information on development plans will help basin planners in different countries avoid conflicting projects, particularly where planners assess their national projects for impacts, costs and benefits – if any – extending beyond their borders[22]. Co-ordination on international rivers may enable water resource managers to capture some Type 1 and 2 benefits and, to some extent, Type 3 benefits, because tensions will reduce as trust grows.

[22] This raises an important point regarding the direction of the effects of development. While upstream extraction generates externalities downstream by diminishing or deteriorating flows physically, downstream extraction generates externalities upstream by diminishing future flows available for abstraction upstream, by virtue of perceptions of acquired rights to that water downstream and thus potential 'foreclosure of future use'.

A shift from co-ordination to *collaboration* results when national plans are adapted either to capture gains or to mitigate against harm in another basin country. Collaboration could capture benefits of all four types, and could be made simply through ad hoc adaptations of ongoing plans, or through agreed portfolios of national projects developed from a basin perspective. As with co-ordination, collaboration on international rivers may enable water resource managers to capture direct Type 1 and 2 benefits. Where co-operation is required to implement benefit-sharing arrangements, this may further bind countries together and build trust, leveraging Type 3 benefits, or even Type 4 benefits if the chosen benefit-sharing mechanism captures or redistributes benefits "beyond the river."

A shift from collaboration to *joint action* occurs when riparians act as partners in the design, investment and implementation of international rivers development. Benefit-sharing arrangements such as joint ownership and management of assets represent the highest level of co-operative effort. Situations that lend themselves to this type of co-operation would include basins in which there is strong co-operation, capacity and institutions. Joint action might include state-of-the-art management and investment scenarios that could optimise direct Type 1 and 2 benefits, as well as indirect Type 3 and 4 benefits.

***Figure 1*: Types of Cooperation – The Cooperation Continuum**



It is important to recognise that this co-operation continuum is dynamic, as there will be varying points on the continuum that are appropriate for different activities in a basin and at different times. Furthermore, although the continuum is constructed to portray increasing levels of co-operative effort, it is not intended to

suggest that *more* co-operation is necessarily *better*. A major challenge for every basin is to identify the right level of co-operative effort – one in which the benefits of co-operation outweigh the costs, and the process and outcome is politically and socially acceptable. Riparian states will pursue co-operation only when they expect to receive greater benefits through co-operation than through unilateral action, and when they believe that benefits can be captured in a manner they perceive as feasible, cost-effective and fair. Some basins may capture a significant share of their potential co-operative gains with low levels of co-operation, and find that further co-operative efforts are not justified. Alternatively, some basins may require sizeable up-front investments in co-operation before any significant benefits are captured. The specific configuration of costs and range of benefits in a basin will determine the level of co-operation that is called for in order to capture co-operative benefits. The challenge then is to share these benefits fairly.

5. FAIR SHARES: PRINCIPLES AND MECHANISMS FOR BENEFIT SHARING

A key step in facilitating the convergence of national agendas, is an examination of the distribution of benefits from co-operation and the benefit sharing options available to redistribute costs and benefits. Benefit sharing can be defined as any action designed to change the allocation of costs and benefits associated with co-operation. This would include benefits of all four types, and all costs of co-operation. These could be costs directly associated with the institutional or physical costs of river development and management (for example, river regulation and storage costs), or any other costs that the negotiating parties choose to include for consideration (for example, hydropower interconnection and distribution costs.)

In most cases, benefit sharing will require some sort of redistribution or compensation, which will be highly situation-specific. Mechanisms for sharing benefits can be classified under five headings: (1) water sharing by assigning rights or by direct payments for water; (2) direct payments for benefits or compensation for lost benefits; (3) purchase agreements (for power, agriculture products, etc.), where the terms or price will effect benefit transfer; (4) financing and ownership arrangements (e.g., for infrastructure), where the deal structure will effect benefit transfer; and (5) developing a broader bundle of benefits including the provision of unrelated goods and services.

Water sharing by assigning water rights has characterised the 20th Century and remains today the main path of co-operation between riparian states sharing international rivers. However, the assigning of water rights may often be inefficient, as water use will likely be optimised within individual states and not across the basin. Furthermore, as populations and economies grow, in many river basins there will increasingly be insufficient water to apportion "reasonably and equitably" between riparian states.

Water sharing by direct payments for water itself is an alternative mechanism to assigning water rights that will allocate water between states. This mechanism would typically be used in a basin where the assignment of water rights was clear, and where a co-operative scheme called for increased abstraction by one riparian. International water markets could provide a flexible mechanism for reallocating water use among riparians within an agreed compensation structure. Such markets

would allow riparians to buy and sell fixed-term water use rights that would not necessarily affect any existing water treaty rights. The price and quantity of water use rights could be decided by market forces, or they could be negotiated. Agreements regarding the price of water, the volume of water to be made available, or the eligibility of buyers would all affect the distribution of benefits derived from that water.

Direct payments for benefits (or compensation for the loss of benefits) might be provided in the context of a co-operative scheme. Riparians can be compensated, for example, for land inundation as a consequence of water impoundment. In some instances it might be appropriate to compensate upstream riparians for watershed management as a form of benefit sharing. Stewardship of headwaters and watersheds might entitle upstream riparians to share some portion of the downstream benefits that their stewardship helps to facilitate. Seen the other way around, if they did not protect the watershed it would impose costs on downstream riparians.

Purchase agreements can be structured as flexible tools for benefit sharing. Purchase agreements are generally negotiated for power, but they can also be negotiated for water supply or even fisheries. The negotiated price in the purchase agreement can effectively re-allocate the benefits of water use among riparians. While they would clearly be made better off by the purchase if they were willing to enter into the trade, a higher agreed price would transfer proportionally more benefits to the selling riparian, while a lower agreed price would apportion more benefits to the buying riparian. Purchase agreements can enable a range of mutually beneficial scenarios. Most obviously, when one riparian has water resources or hydropower capacity but insufficient national demand for water and/or power, while the other has meagre water resources and hydropower capacity but significant demand, both will benefit from this trade. Purchase agreements can also provide revenue guarantees when such guarantees are required to secure financing for large-scale projects.

Financing and ownership arrangements can be used to effect benefit transfer and sharing through the structure of the deal, especially when co-operative management calls for large-scale infrastructure investments. One riparian could provide financing for another as a means of facilitating investment, and, if the financing agreement were not concluded at strictly market terms, as a means of reapportioning gains. Joint financing of co-operative projects has also been a successful means of facilitating co-operation and sharing gains by embedding a redistribution of returns into the deal structure.

Bundling of broader benefits can also be seen as a mechanism for sharing benefits. It may be difficult in some cases to find a configuration of benefits that satisfies all parties. In such cases, the broader the range under discussion, the more likely riparians will be able to find a configuration of benefits that is mutually acceptable. If, for example, it is difficult to negotiate the benefits of a hydropower investment, the bundle could be broadened to include watershed management in the area of the reservoir, or power transmission, interconnection and distribution. In addition to water use-related benefits, even unrelated projects, such as transport infrastructure, or areas of mutual interest, such as trade, immigration,

communications, and environmental protection can be incorporated in international rivers negotiations. The full range of benefit sharing mechanisms could then be brought to bear on this broader bundle of benefits in order to reach an acceptable solution.

Different levels of co-operative effort will create different options for benefit sharing, and similarly different benefit sharing mechanisms will require different levels of co-operation. Payments for water and payments for benefits, for example, could be fairly straightforward. The establishment of water markets for iterative trading of water user rights would require greater levels of co-operative effort, as would purchase agreements and co-operative financing or ownership and management. Benefit sharing mechanisms themselves thus become vehicles for co-operation, and ties that bind riparians together.

6. BUILDING MOMENTUM: THE REINFORCING DYNAMICS OF CO-OPERATION

Good faith co-operative efforts will be self-reinforcing – co-operation will promote a willingness to co-operate. Co-operation can start anywhere, at any level of effort, in pursuit of any shared goal. In many cases it will be strategic to focus initial efforts opportunistically, in the areas where there is the greatest clarity over potential benefits and the least adaptation required from national agendas. The dynamics of co-operation are such that progress in any area will help to develop co-operative processes, establish relationships and gain momentum to facilitate more difficult undertakings. Initial hopes for achieving high levels of co-operation and large-scale comprehensive activities should not preclude efforts to capture more modest co-operative benefits, but all co-operative activities should be designed to strengthen the co-operative process and to identify opportunities for more beneficial co-operation.

These dynamics are in part a reflection of the iterative nature of co-operation on international rivers. Rivers will remain, water needs will grow, and co-operation will become increasingly important. All interactions on international rivers are therefore undertaken in an iterative context – it is assumed that in the future similar interactions will occur, and that current actions will inform and affect future decisions. Thus current good faith co-operation should promote future good faith co-operation, and the opposite.

The dynamics are also a reflection of the changes both in perceptions and realities that result from co-operative experiences. The experience of successful co-operation can yield concrete benefits and build trust and relationships. This changes perceptions with regard to the potential benefits of co-operation, and to the feasibility of working co-operatively with co-riparians. Realities may also change as co-operation progresses. As opportunities are identified, as precedents, institutions, and relationships are established to facilitate co-operation, the real costs and benefits of co-operation will change.

7. CONCLUSIONS

In all international river basins, there is a need to move from unilateral national agendas to include some level of co-operation, converging on a co-operative agenda. The extent to which this will occur will be a consequence of the perceptions of benefits that co-operation will bring. Co-operation in the management and development of international rivers can and should take many forms. The continuum presented in this paper offers a menu of co-operative options that may assist riparians in determining the right level of co-operation for their basin. This continuum is not static, but conceived as iterative, adaptive and dynamic. For some basins, movement along the continuum may be a constructive goal over time. In other basins, different points along the continuum may be the right choice for capturing specific gains. The continuum is also not intended to be directive or normative in any way, it is not the case that greater levels of co-operation are necessarily "better" or that they will reap greater net gains. The uniqueness of each international basin will offer a different set of potential co-operative benefits, calling for a different level of co-operative efforts and a different set of co-operative and benefit sharing mechanisms.

LESSONS ON CO-OPERATION BUILDING TO MANAGE WATER CONFLICTS IN THE ARAL SEA BASIN

Vadim SOKOLOV[23]

ABSTRACT

The Aral Sea Basin is worldwilde known as an example of the rapacious attitude of the command system of water management to nature. During the last 10 years, Central Asia has established conditions for independent development on the base of mutual respect, mutual approaches and a clear political will of presidents and governments of the five states to save and strengthen joint water management. Its framework is based on the previous soviet practice and principles, which should be transformed in new economic conditions. The water authorities of five countries co-operate under the umbrella of the ICWC – Interstate Commission for Water Co-ordination, which celebrated its 10 th anniversary in February 2002. This co-operation is progressing in spite of complexities and differences in the social, political and environmental situation of states and gaps between there level of development. This co-operation should guarantee future success, giving objective appraisal to achievements and drawbacks as well as ways for survival. From those positions, the Aral Sea Basin was selected as an acceptable case study for PCCP program. We expect to learn some lessons from the difficult conditions of an economy in transition.

1. BACKGROUND

The Aral Sea basin is located in the heart of the Asian continent, and covers the whole territory of Tajikistan, Turkmenistan, Uzbekistan, the southern part of Kyrgyz Republic and the southern part of Kazakhstan (Fig. 1). A part of the basin is located in the northern part of Afghanistan and Iran (about 8 %), as well as in China (less than 0.1 %).

***Figure 1*: The Aral Sea Basin**

[23] Scientific-Information Center of ICWC, Uzbekistan

Two main rivers cross the Aral Sea basin from the south east to the north west, falling into the Aral Sea. Before 1960, the Aral was the world's fourth largest lake in area, but since then, the sea declined precipitously. The river Amu Darya is the biggest river (in terms of water availability) in the region. The river Syr Darya is the longest one. The total average available surface water in the basin is an estimated 116.5 km^3 per year.

The prosperity of Central Asia, an agrarian region since ancient times, was always very closely related to land use. From this point of view, the fertile soils formed the framework for prosperity of the rural population. Out of the total land resources of about 154.9 million hectares, some 59.4 million hectares are considered cultivable, of which only about 10.1 million hectares are actually used. Half of the cultivated lands are located in the oasis. The other half of the land requires a complicated and expensive set of reclamative measures, including not only drainage and levelling, but also improvement of soil structure. The total irrigated area is about 7.9 million hectares in former Soviet republics and about 0.5 million ha in the Afghan part of Aral Sea Basin.

During the past decades, the large-scale development of water resources, mostly for irrigation, has changed the hydrological cycle in the region and created serious environmental problems in the Aral Sea Basin. The most dramatic effect has been the shrinking of the Aral Sea and it's ecosystem disruption. One of the main problems here are the losses of biological productivity and especially fish species due to increasing salinity and toxic contamination. Other problems are degradation of the rivers deltas;deforestation of the tugay forests; transfer of dust and salts from drying bed of sea; lowering of ground water levels and the desertification of Aral Sea shores.

In other parts of the basin different problems can be spotted as well, such as: (a) soil degradation as a result of waterlogging and salinization of irrigated land (b) crop diseases and insect infestation, due to the cotton mono-culture (c) adverse health effects from the poor water quality and wind-blown chemicals from the exposed sea bottom, (d) erosion of land in upper watershed, and (e) local climate changes.

***Table 1*: The basic parameters of water-land resources development in the Aral Sea Basin**

Indicator	Unit	1960	1970	1980	1990	2000
Population	10^6	14.6	20.3	26.8	33.6	41.8
Irrigated area	x1000 ha	4510	5150	6920	7600	7896
Irrigated area per capita	ha/capita	0.31	0.27	0.26	0.23	0.19
Total water diversion	km^3/year	60.61	94.56	120.69	116.27	105.0
Incl. irrigation	km^3/year	56.15	86.84	106.79	106.4	94.66
Specific diversion per	m^3 /ha	12450	16860	15430	14000	11850

Indicator	Unit	1960	1970	1980	1990	2000
1 ha						
Specific diversion per capita	m^3 /capita	4270	4730	4500	3460	2530
GNP	Bln.$	16.1	32.4	48.1	74.0	55.3
Including agricultural production	Bln.$	5.8	8.9	18.3	22.0	15.0

The total population within the Aral Sea Basin was 41.8 million in 2000, of which almost 63.6% were rural. Populationgrowth, especially in rural areas resulted in a demographic pressure, a weak spot in the social life of the region. It was mostly felt in oasises, such as Fergana valley, Zerafshan valley, Khorezm, Gissar valley, where the populationdensity is between 300 and 500 inhabitants per squire km. Consequences of this situation are unemployment, low level of life standards, and failure of well being. During last five years, the average annual population growth was 1.5%, ranging from 2.2% in Uzbekistan to 0.4% in Kazakhstan.

3. THE PROBLEM GROWTH

The use of water resources in Central Asia, mainly for irrigation, began more than 6000 years ago. Central Asia during the Soviet era produced mainly raw materials and served as the agricultural appendix of area. As a result there is low level of processing and big dependence from the metropoly. Intensive use of water resources started in the XX century, mainly after 1960. The increase in water use was a result of a fast growth of the population, intensive development of industries and irrigation. The one side development without complexity of processing and without orientation to endproducts, requested an increase of waterdelivery from the rivers. The total water diversion in 1960 in the Aral Sea Basin was 60,6 billion m^3. By 1990 it has increased up to 116,271 million m^3 per year, or 1.8 times. During that same period the population increased 2.7 times, the irrigation area increased 1.7 times, the production of agriculture 3 times, while the gross national product multiplied almost by 6 times (Table 1). The disintegration of the Soviet Union in 1991 went along with a general economic degradation and the total use of water in the region began to reduce. After 1994, as a result of the co-ordinated water saving policy, accepted by Interstate Co-ordination Water Commission (ICWC) of the states of Central Asia, the decrease of common water intake became the target tendency. In 2000 general water intake was on 11.2 km^3 less, than in 1990 and has made 104,955 million m^3.

During the last three decades of the Soviet era (1960 -1990), the irrigated agriculture and the sectors of economy related to water management (processing of the agricultural production, hydropower, construction and some others), contributed more than 50 % to the GNP. The collapse of the former USSR and disappearance of the unified currency zone (Russian Ruble) created an economic setback for the Central Asian countries. The sharp disruption of production, trade and financial relations were the main reasons for the drop of general output and agricultural output especially. Uzbekistan has experienced the smallest output decline among the Central Asian countries, as well as the shortest period of

contraction – 5 years compared to 6 years in Kyrgyz Republic, 7 years in Tajikistan and Turkmenistan, 8 years in Kazakhstan – within ten years of market reforms (1991-2001). The depth of decline in Uzbekistan, as measured by the reversion of output level, was equal to the size of its GDP in the early 1980s. While in Tajikistan and Turkmenistan it was equal to that at the beginning of 1960s or even earlier. In Kazakhstan and in the Kyrgyz Republic the decline could be compared with the size of its GDP respectively at the late 1960s and the beginning of 1970s. Accordingly to the general decline, the overall agricultural production now contributes to the GDP between 10% (Kazakhstan) and 46% (Kyrgyz Republic).

***Table 2*: Changes in the economic situation during the transition period**

Country	GNP per Capita, US$		By Sectors of Economy, %					
			Industry and Construction		Agriculture, Forestry and Fishery		Services Sphere	
	1990	2000	1990	2000	1990	2000	1990	2000
Kazakhstan	2310	1493	36.1	34.2	28	21.3	35.9	44.5
Kyrgyz Republic	1240	365	35.9	30.4	34.6	34.1	29.5	35.5
Tajikistan	910	321	33.7	27.9	27.1	23.8	39.2	48.3
Turkmenistan	1490	820	33.6	35.1	28.6	17.9	37.8	47
Uzbekistan	1700	985	32.5	19.9	31.3	34	36.2	46.1

It is necessary to underline that in all countries agricultural output fell less than GDP and much less than industrial output. As a whole, in Central Asia, changes in agricultural production are related to an increased in share of food crops output (again except Kazakhstan). Further reforms with more price incentives to the farmers and a better legal framework for land and water use are important matters to promote labour productivity, the living standards of farmers and rural population in general, i.e. the majority of population (63%) of all countries within the Aral Sea Basin. Despite the relative decline of agriculture's share, it still plays a significant role in the Aral Sea Basin, especially in Kyrgyz Republic, Tajikistan and Uzbekistan. It is rather important in Turkmenistan (cotton and wheat) and Kazakhstan (grain) as well. Independence after the Soviet Union collapse was accompanied by a big social threat for the majority of the population in the region. Thus, Central Asia, despite a high level of human development and social services, now has poverty levels comparable to some African countries and is on the same level as in Pakistan and India.

4. WATER RELATED CONFLICTS IN THE REGION

In local practice the word "conflict" has another meaning than in the western understanding. We use the word "conflict" only as a situation which can be assessed as a threshold of real struggle, a deviation from what was agreed or routine order of actions, activity, decisions, which caused proper damage or harm for other participants of process.

In western approach "conflict" means "meeting of interests". Such understanding is not correct for water practices. Each person who is involved in water management needs to decide every day how to combine interests of many water users. because Permanent hydrological changes, especially when confronted with a situation of water scarcity, request from water specialists an immediately reallocation of the water with a minimum of constrains for each participant. Nobody is assessing such a situation as conflict – it's routine work. Thus, the conflicts in water management within the Aral Sea Basin can be perceived as a disagreement of interests, ideas and principles, and can cause deviations from regular of water requirements for users and nature. Conflict issues in the integrated water resources management process can be listed as the following:

4.1. Social-Ecological Conflicts Of Water Use

Usually, one acknowledges the social and ecological dimension of water. Unfortunately, the economic and social needs were given priority over the ecological ones. As a result we note a disaster at the Aral Sea and Aral Sea coast, where its lake lost about 70 % of volume and 60 % of its surface area. There are huge processes of desertification (1,6 million hectares). Losses of bio-diversity took place and more than 80 types of species has disappeared from the water fauna and flora.

Another problem is salinization and waterlogging in irrigated areas (approximately 5,0 million hectares require artificial drainage). Irrigation creates return flow as a source of environment threats. This polluted water constitutes more then 30 % of totally available water resources in the region. As a result, river water salinization increases sometimes up to 2,5 g/l. Furthermore, one perceives a decline in groundwater quality due to the chemical industry. The above-mentioned factors resulted in an increase of several diseases as well as in a degree of mortality in the downstream reaches of the the Syr Darya and the Amu Darya rivers.

4.2. Economic Conflicts In Water Use

Competition for limited water resources occurs among agricultural, rural, urban, industrial and environmental uses in the region. One the one hand, irrigated agriculture is a major source for food security and simultaneously the biggest water consumer (about 90 % of total water resources used for irrigation), on the other hand, there is an increase of ecological requirements and industrial and municipal needs. From this point of view, there are a few fields of potential conflicts of water management in region:

- Among countries in water sharing – for quantity, delivery schedule and shares of expenses to cover water management costs within basin.
- Upstream and downstream relations concerning water allocation, schedule of water release from reservoirs and quality of water.
- Among sectors (irrigation, power generation and environment) – for water allocation, use of water reservoirs and water sharing for the Aral Sea coastal zone, rivers itself (sanitary and ecological flows).

In order to avoid these conflicts, it is necessary to create an efficient framework for the use of water, including a legal and institutional basis for a fair and equitable sharing of the beneficial water together with strict regulations for all institutions in their activity on operation, management and maintenance.

4.3. Legal Conflicts: Rules In Water Utilization And Principles For Water Allocation

There is a lack of an universal system of water rights and legal instruments in the management of transboundary river basins. The main reason is the lack of trust among riparian countries in period of initial independence. Simultaneously, some indefiniteness in international water law didn't permit the new independent states to elaborate strict rules and recommendations. Therefore, the water specialists recognized the necessity to adopt the integrated water resources management concept into actual water management and use. Already some steps were made towards to implementation of the new doctrine – absolute territorial integrity.

4.4. Water Conflicts In Perspective

Water is a limiting factor (not only in terms of volume, but also in terms of quality) for some zones in the Aral Sea basin. It means that future sustainable development is coming under stress. Also there is the unclear impact of global climate change on the availability of water resources in the region. A growth of average temperature of $1^{o}C$ was noted for the last 35 years and reducing the capacity of glaciers by 22 % (in the Pamiro-Alay system). Different scenarios predicted a water deficit in 2020 as a result of evaporation increase. In this context, conflicts about water management could appear when dealing with different national approaches to the planning of national development scenarios. It is desirable to establish proper interstate co-operation to promote an universal conduct of planning process.

4.5. Potential For Increase Of Water Use By Non Members Of ICWC

A conflict concerning the increase water consumption might arise in the future with the two states which are presently not members of ICWC: namely Afghanistan and China (Tsincjen) Future negotiations between the members of ICWC and the above-mentioned States, and a possible involvement of Afghanistan in the activities of ICWC is preferable.

It should be noted that there are some limiting factors with regard to conflict resolution in the region. Amongst them are the lack of information and transparency and the lack of a proper communication system between different levels of water related players being:

- The inter-sector level within the countries and regions.
- The interstate level between water specialists and water users;
- Water organizations and NGOs.

To establish proper mechanisms for the above-mentioned conflict prevention and resolution, it is necessary to concentrate on the following directions: (a) institutionalisaton at the national and regional levels; (b) creation of a legal

framework; (c) establishment of proper financial mechanisms; (d) technical perfection and capacity building.

5. RECOMMENDATIONS ON THE BASIS OF LESSONS LEARNT

Existing shortcomings in water management can be eliminated and water use effectiveness can be achieved via real regional partnership and integration efforts in the following six directions:

- Integration of the countries efforts in water basin management and conservation through the partnership at interstate (regional) level.
- Integration of economics and environmental interests through inter-sector partnership in each state with regard for environmental requirements.
- Integration of water management system hierarchic levels through vertical partnership in the chain: "state-water system-territorial water and administrative bodies-water users and water consumers".
- Integration of water users and water management organizations through water users involvement at all levels to water management hierarchy as well as partnership between governmental and non-governmental bodies.
- Integration of knowledge and practice through partnership of science with water users and water organizations (using such tools as base of knowledge, training, consultation, extension service).
- Integration of international donors and the region though co-ordination and partnership of international financial organizations and the region's countries.

The following action program is suggested for different efforts of integration:

The preparation of a regional water partnership via the establishment of the "Aral Sea Basin Water Council". The ASB Water Council should operate under IFAS umbrella and in close co-operation with ICWC and CSD. A recommended scheme of partnership is shown in Figure 2. Furthermore it is necessary to prepare the ASB Water Council status and regulate its interaction with the respective partners.

Under the ASB Water Council one could organize thematic groups of experts (including leading specialists from region) to search for solutions with regard to integrated water resources management. Considering existing regional problems, it is suggested to create four thematic groups:

- Technical aspects;
- Legal questions;
- Institutional issues – for water partnership platform/governance creation;
- Financial aspects.

Each thematic group should assess a problem and work out an action plan in order to develop general recommendations for decision makers. The ASB Water Council would approve democratically elected leaders of the thematic groups to represent all different levels as well as fund sources.

Successful development and co-ordination of regional and national water strategies could be realized by using the existing scientific potential. ICWC and CSD should be involved through their scientific and public expertise. One should focus on financial and co-ordination aspects as well as on the organization of seminars and conferences for free exchange of opinions and consensus achieving. Science together with public awareness will promote rational water use and management.

An electronic communication system among the participants of the regional partnership is a necessary condition for a successful activity. Ministries and national centers have to be included, as well as provincial and basin organizations, major NGOs and WUAs. This will allow the about 200-250 organizations to organize "electronic conferences", and by that way to increase the level of trust between partners and participants.

Successful development of the region should be supported by appropriate institutional, legal and financial provisions – both at the level of interstate relations and at the level of national policy. The following issues could be recommended:

At the national level:

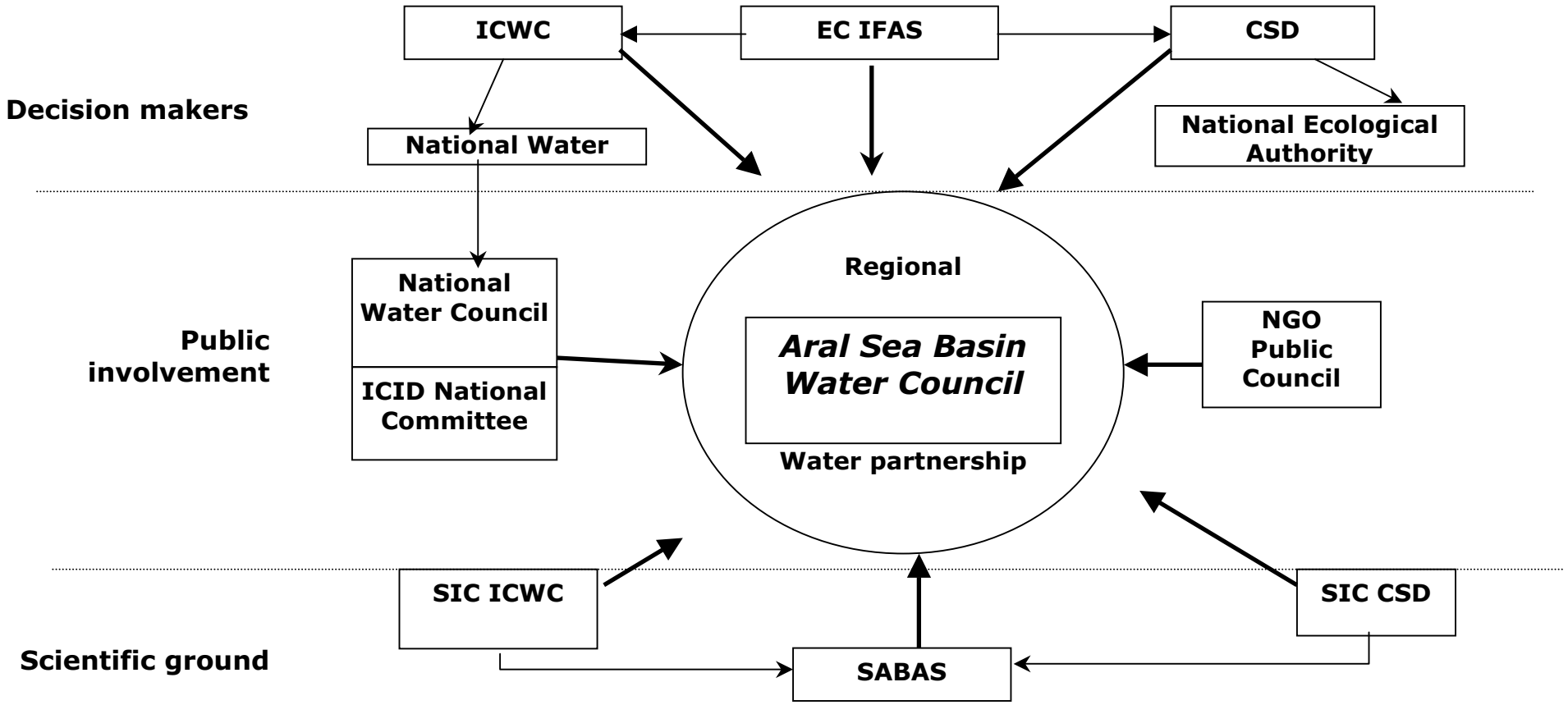
- Reversion to powerful inter-sectoral structures of water management at the state level, with functions of strictly pursuing water protection and water use policy of the state;
- Extensive and all-round implementation of "integrated water resources management", released from administrative influence of local authorities, in which all interested provinces and districts will be represented and enjoying equal rights to participate in basin, sub-basin and system organizations of water management;
- Participation of water users, alongside with the state, in management and funding of operational activity (as land profitability increases, the share of the state is to be reduced);
- Facilitating establishment of WUAs in agriculture and WUO in other branches the of economy;
- Establishment of extension services in water management and agriculture with training centers and demonstrative plots networks;
- Introduction of water use charges in accordance with increasing block rates tariffs: minimum payment for water use within the quota for crop biological water demand (technological demand of production), which increases in case of overuse;
- Payment for pollution of water sources;
- Implementation of mandatory water accounting at all levels of water hierarchy;
- Mandatory introduction of water rotation;
- Development of legislation, which promotes water conservation and environment protection;
- Establishment of extensive transparent information practice and access to information system, database and knowledge base.

At the interstate level

- Assume absolute territorial integrity (common use) doctrine as a basis for inter-sector water relations;
- Strengthen regional bodies of ICWC along the lines of enhancing their rights, authorities and responsibilities with mandatory including in this organizations not only representatives of water management from the countries of the region, but also hydro-energy, water-delivery specialists, ecologists, etc.; granting them diplomatic status and freeing from necessity to follow decisions taken by the country of their stay;
- Reliable financial support by the states of all water management agencies, various hydro meteorological services, nature protection authorities responsible for flow formation and delta zones;
- As a substitution for fuel/energy – water exchange, implement payments for flow regulation in reservoirs (over year, seasonal, etc.) and participation of all countries of the Aral Sea Basin in covering expenses for flow formation, as well as deltas protection;
- Set well-defined limits on water withdrawal from the basins, taking into account ecologically permissible volume of water in the river, and allocate them between the countries in an equitable and reasonable manner;
- Implement on the basis of these limits payments for exceeding the set limits on water withdrawal at the amount of the price for water as resource, and utilize this money for development in the basin of joint water saving activities;
- Conclude a set of agreements, strictly regulating procedures and interaction of the countries as to water resources management, use and protection (unfortunately, this process has been delayed for several years);
- Set well-defined regulations for operation of regional organizations under various conditions and in different situations (water scarcity, floods, etc.); make these activities be equitable, multinational, parity and transparent;
- Equip all head-works of BWOs with automatic control and management systems (SCADA), preventing any possibility of uncontrolled water withdrawal from the river;
- Lay down regulations for joint design, construction and operation of multi-objective works (similar to Kambarata, Ragun dams, etc.), which will ensure impossibility of these complex hydro-structures use in the interests of the only one country;
- Develop the system of education, professional improvement and training, etc.;
- Work out regulations of setting limits for return water disposal into transboundary rivers.

The countries of the region have acquired broad experience, mutual interactions and understanding of their responsibility which is combined with political will. The abandoned ambitions could allow the region not just to survive, but to become for the world an example of rational water resources use in a large scale transboundary basin.

Figure 2: **Scheme of Water Partnership in Central Asia**



BIG CHALLENGES AND LIMITED OPPORTUNITIES: WHAT ARE THE CONSTRAINTS ON COOPERATION?

Victor A. Dukhovny[24]

1. WATER FOR NATURE AND WATER FOR SOCIETY

Although the world community has proclaimed the need to regard water as the most important of all natural resources, only some really environmentally concerned states have reflected this in their rules, regulations, and laws and – what is more important – in actions following these provisions. Among these states are Switzerland, Canada, the Netherlands, and the Scandinavian countries. All other countries treat this imperative more as a slogan than as a guide to action. The United States has blamed the Aral Sea Basin states for the Aral Sea disaster, but many similar situations have occurred in its own territory – for example, in and around the Mono Lake, the Great Salt Lake, and the deltas of the San Joaquin and Colorado rivers – when the needs of a market economy and a growing society took the dominant position in a competition between nature and economic demands.

The Dublin Resolution also plays an unproductive role here. It announces the environmental and social values of water, but at the same time makes the declaration null and void by proclaiming in its conclusions "the fourth principle of Dublin," which contains the provision "Water is an economic good," thus permitting followers of pure global market principles to ignore all ecological requirements. Actually these market principles – being driven by "His Excellency Commodity Interest" – ignore most of nature's requirements. The UN should strictly reinforce nature's right to water, proceeding from an approach similar to that taken to human rights, and consider the possibility of engaging the Security Council in resolving this issue. The following principle must be proclaimed:

> All states must embody in their own laws, interstate agreements, and treaties a framework that considers future generations' needs and satisfies minimal water demands for natural health (sanitary flows, the needs of deltas and natural water bodies, riverbeds, lakes, and so on), and on the basis of this must define a *permitted volume of used water resources.*
> (PVUWR)

If, for example, such limits had been set for the Aral Sea basin fifty years ago – 80 km^3 of water from 130 km^3 of total resources – today's Aral Sea crisis would not have ensued.

2. WATER FOR FOOD

Irrigation represents the only way of surviving in arid zones. The era of cheap irrigation is over: the cost of newly developed irrigated lands now exceeds $8–12,000 per hectare, while the cost of rehabilitating existing irrigated land to a level permitting the use of ecologically acceptable methods, taking into account proper expenses for environmental protection, amounts to no less than $4–5,000 per

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hectare. At the same time, world prices for food and raw agricultural products have halved over the last twenty years and IFPRI forecasts indicate that they will continue to fall. Our modeling shows that a return of investment on irrigation is possible after a period of 10–12 years only if the cost of one hectare of newly irrigated land is limited to $3,000, and the cost of restoring one hectare of irrigated land is reduced by $1,600 per hectare.

The current food policy pursued by developed states, which subsidize their food production and food export markets, has thus been destroying the water sector in the developing world, offering them only two alternatives: to close their own markets for imports through the use of fixed prices, or to remain permanent food importers from the developed world, a course of action that can only increase poverty, vulnerability, and the needs of the poor. Of course, such a situation is welcomed by food suppliers who might eventually acquire a permanent right to dictate terms to those countries.

There is an alternative. The developed world and international financial organizations should promote improvements by developing countries in their own irrigation systems and advanced irrigated agriculture, and in water supply networks, especially in developing states located in arid zones, and share the cost of this work with them. This would guarantee the future self-sufficiency of these countries in food and other agricultural produce in quantities that would permit a guaranteed return on investments, while providing a return to farmers and water users. It should also prevent possible future profiteering on the world food market. The first priority in this case should be given to developing networks of demonstration plots, operating under contrasting natural conditions and farming regimes. These could form a basis for consulting services for farmers and water users' associations (WUAs), which can help them unlock the potential productivity offered by the water available to them under market conditions.

3. RIGHTS FOR WATER FOR EVERYBODY: HYDROSOLIDARITY OR HYDROEGOISM?

The body of law governing rights to water should be based primarily on moral values of humanity, democracy, and society responsibility – of society's responsibility to each individual, and of each person's responsibility to the wider community. From this point of view, the modern "hydrosolidarity" movement offers an appealing antithesis to the "hydroegoism" that prevails under the severe limitations imposed by strict market priorities.

The hydrosolidarity movement has arisen in democratic and economically developed countries (Sweden, Norway, Denmark, the Netherlands), where the need to preserve the natural environment for future generations is combined with equality for all in water quantity and quality provision for different zones. But we can only rely upon citizens hundreds of kilometers from a perceived area of shortage to share their water if a partner's troubles and needs are clearly visible, and morally oblige people to risk exposing themselves to certain difficulties in order to ease the problems of others. This "natural mass expression of charity" is unlikely to occur if it is not encouraged by tax reductions or other rewards, particularly in developing countries.

Thus, hydrosolidarity should be fostered by the state, religion, education, and the development of moral awareness. Unfortunately there are many examples of situations in states affected by water shortage where, despite official schemes for planned equitable water distribution between upstream and downstream zones, upstream use exceeds agreed limits and downstream areas are left to make do – "Out of sight, out of mind"; "Not our problem." Water allocation in the Amudarya basin in 2001 offers a typical example. While Uzbekistan and Turkmenistan as a whole received their shares (75 percent of the previous year's limit), upstream regions in both countries received 85–100 percent of the limit but downstream areas (Karakalpakstan in Uzbekistan and Dashauz in Turkmenistan) had less than 50 percent! These regions are certainly not "enemies" to each other, but they are driven by their own individual interests, and cannot leave water unexploited for unknown "others" without moral or economic incentives such as rewards or publicity. Other incentives may include the risk of punishment or damage to one's own interests, or a sense of high moral responsibility. It is hard for modern society to arm itself with the latter, however, due to the natural egoism of human beings – a pattern of behavior that is enhanced continuously as civil societies evolve. At present, strict state regulation prevails only when deviation from these rules and juridical provisions leads to punishment or discredit.

The development of hydrosolidarity within a country is also encouraged by a vision of the future and by prediction of future difficulties. Concern about the needs of future generations should encourage people to choose a mode of behavior that will not create threats of drought or flood, or even endanger future survival permanently. In this light, public forecasting with regard to such factors as population growth, urbanization, and industrialization is very important (M. Falkenmark). This understanding should be supported by information dissemination, and by the creation of a respectful attitude to water. Understanding the essential human right for water is also very important. Gleick's proposal on human rights with regard to the allocation of potable and municipal water (≈100 m^3/year) is good for tropical humid zones: here human beings' survival is not dictated by the need to grow food. In an arid zone, however, food can be produced only through irrigation: because of this, people should have a right to water in order to produce a minimum quantity of food (3,000 calories), this allocation being set with regard to maximum water productivity. This amount of water is not 100 m^3/year but 900–1,000 m^3/year, and for developed countries like Israel even 400 m^3/year! This right should be assured by the state or by groups of states.

Therefore, to the five conditions of hydrosolidarity mentioned by M. Falkenmark, namely:• motivation using broad information

- organizational structures for finding compromise solutions
- making public participation socially acceptable
- addressing social implications of changing the current manner in which natural resources are used, and
- addressing the use of resources that damages the interests of other users,

four additional ones should be added:

- state governance on the principle of national hydrosolidarity
- public involvement in the promotion of moral awareness
- creation of a regulating system of laws and provisions
- forecasting.

In the case of international basins, regulations, agreements, organizational tools, and joint action are even more important, but modern international water law offers little assistance. Deeper consideration of modern international water law has increasingly convinced the writer that juridical methods alone can never guarantee the right of people all over the world to even a minimum water supply and also ensure the hydrological conditions needed to preserve the natural environment. Who can protect the interests of nature or the poor if key UN documents are so contradictory that everyone can use them to substantiate their own points of view?

In reality, Chapter 18 of the UN Rio Declaration declares simultaneously that water has natural value *and* is a commodity. On the basis of this resolution the Parliament of the Kyrgyz Republic insists that downstream countries should pay for water that has run for millennia along river channels. Kazakhstan and Uzbekistan, meanwhile, require that the Kyrgyz Republic provide minimum discharges equaling those that took place before regulation, on the basis that water is a natural commodity! But nobody can put forward any claims because, according to both the Convention of 1992 and that of 1997, riparian countries should inform each other of their actions and come to agreements but need not satisfy mutual requirements. Thus, international law and UN regulations remind us of the "mother-in-law," to whom everybody may listen; it is up to each "son-in-law", however, to decide what action should be taken.

The consequences of this could be seen at the Bonn Conference, where six hundred delegates had been discussing the notions of "transboundary" or "international" waters for more than two hours when states occupying the upper reaches of rivers, notably Turkey and China, blocked agreement even on the meaning of the word "transboundary." Because of this, the slogan "everybody lives downstream" is useful to demonstrate good intentions, but decision makers only remember it when they themselves have an immediate concern. Perhaps a concept of "hydrosolidarity" should be launched by the UN and its Security Council? Maybe it would be expedient for them to agree upon a range of principal provisions to be followed by all (developed and developing) countries. Developed countries could then become the prophets of the following ideas worldwide:

- Nobody has the right to take water from a river in amounts that result in reduction of discharge to a level below a minimum flow value observed before any impacts on the river resulting from regulation and other anthropogenic activities, or which affects discrete elements of the river (deltas, old channels, flood plains), maybe ending their existence as natural phenomena.
- Every country should ensure, with due regard to potential water productivity, that each of its citizens gets the amount of water necessary for minimal well-being and each agricultural producer receives what is necessary for crop production.
- Each country has the right to use water resources for its own needs if this does not cause damage to downstream countries and their natural complexes, rivers, and water bodies (for instance, by threatening deltas and estuaries or river water quality).

An international intolerance of selfish treatment of water, or the natural environment, should be fostered. If a state has more water than the "minimal life right for water" prescribes, it should give water to any country that needs it! It is clear that global bodies like the UN and its sub-organizations should be careful

when declaring rules and principles, and must become less tolerant of those who hinder the elimination of poverty, hunger, and damage to environment. An important activity here should be joint work by international lawyers, water specialists, ecologists, and economists on revision and improvement of international water rights.

This latter aspect is especially important from the perspective of integrated water resource management (IWRM). IWRM requires strong and strict interrelations between different levels in the water hierarchy to avoid unproductive losses at the boundaries between those levels, while simultaneously ensuring sustainability in water supplies to farmers, WUAs, and other users. International water law (enshrined in two conventions and other international legal acts) and the systems for implementing its principles must be revised so that they can provide effective guidance in maintaining good relationships among riparian states sharing transboundary watercourses. This could ensure stability in actions at the first (and most important) level of the international water basin management hierarchy.

4. SPONSORSHIP OF INTERSTATE WATER MANAGEMENT AND DEVELOPMENT

Financial contributions by IFOs and donor states are of great importance in maintaining collaboration between developing states on transboundary waters. Certainly, levels of regional cooperation depend heavily on funding and the development of joint actions, but they are also often affected by the lack of possibilities for appropriate communication – to meet and exchange information, experiences, lessons learned, and so on. We have enjoyed excellent examples of real collaboration with such donors as CIDA, SDC, the EU, "Copernicus," "Science for Peace," and NATO, all of which adhere strictly to the following very useful and efficient rules in their sponsorship:

- Donors and recipients are partners: both participate in the development of action plans and common methodology, and they work together in the same way.
- Broad use is made of local expertise and project implementation under the control of an independent steering committee, with participation from donors. SDC, for example, authorized ICWC and BWO "Syrdarya" to contract the local company "Sigma," which operated a SCADA system for half a year at a cost per gate of only $6,000 per unit (instead of the $30–40,000 expended on similar structures by other donors using their own labor and equipment).
- Payment for work should be made only after its completion, and after acceptance of the output by the beneficiaries.

However, the respective involvements of the IFO and donor states often change to the kind of collaboration between "the horse" and "the rider," with recipients having to adhere strictly to guidelines and orders issued by donors. In addition, donors may use recipient states as a base for economic penetration of a region, exerting pressure and obtaining local initiative and "know-how" without payment. What is more, some donors employ their own staff and consultants in implementing 80 percent of the so-called "grants." The Aral Sea Basin experience can provide many examples of these situations. There are examples of projects executed by foreign consultants or other bodies that achieve no results in the long run, as well as of cases where the activities of various donors sometime duplicate, overlap, and even

contradict each other. Wider acceptance by other donors of the rules and type of interrelation between donors and recipients adopted by the EU, SDC, CIDA, and NATO – along with stricter coordination of programs between donors, and between donors and recipients – should assist in improving efficiency in the use of donors' scarce financial resources.

It is also important that donor activity on transboundary rivers supports as many regional programs as possible, and assists actions on which riparian states and their representatives should work together, increasing cooperation, trust, consensus, and mutual understanding. Our experience of the implementation of regional programs, especially in regional training and mutual preparation of action plans and strategies, shows the relative efficiency of such work, compared to that arising from attempts by donors to satisfy the needs of individual riparian states rather than considering regional interests.

The development of partnerships undertaken by donors along with WMOs, stakeholders, and NGOs is very useful. Sometimes, however, donors select NGOs as their partners not on the basis of real achievements but because they are swayed by image. NGOs have achieved a high profile in society of late, but those promoting partnership should be aware of the difference between NGOs that really work within a society along with stakeholders and decision makers and those that only pretend to do so. It appears at present that these latter NGOs are the first both to receive aid from donors and to criticize everything that happens around them.

5. FROM THEORY TO PRACTICE?

A large number of outstanding fora, conferences, meetings, and declarations related to water have promoted a broader understanding among societies and decision makers of water as the most important factor for human survival. However, the efficacy of decisions and declarations, especially on the global scale, depends on maintaining appropriate support, using a reliable system that ensures effective monitoring of the impacts exerted by these events and their results.

The proposals of SDC and the International Conference in Ruschlicon (Switzerland) should lead to participants at all international events deciding to create a proper UN monitoring body for water use improvement. This would be very helpful in transforming the content of so many papers, reports, resolutions, and visions into real action!

6. SUPPORT FROM INTERSTATE REGIONAL ORGANIZATIONS

Interstate basin water management organizations, where they have already been created or are to be organized in future, should be accepted as bodies working under the auspices of the UN in order to properly ensure their independence, diplomatic status, and ability to carry out reasonable and equitable interstate water management work. In this work their strict responsibility is not only to the states that established them but also to nature, to the world, and to future generations.

TRANS-BOUNDARY FRESH WATER CONFLICT INDICATORS

A COMPARATIVE CONFLICT INDICATOR ANALYSIS OF A GLOBAL SELECTION OF TWELVE LARGE TRANS-BOUNDARY FRESH WATERS

Jan-Herman Clevering[25]

Paper related to poster

1. INTRODUCTION

As long as humans exist there has been competition and conflict over scarce natural resources, whether it be fertile soils, fossil fuels or fresh water. Growing populations and an increasing standard of living in many parts of the world today, have lead to growing and increasingly competing demands on the available fresh water resources. As a result, states are seeking means to increase the exploitation of freshwaters for consumption, sanitation, agriculture, industry and energy production purposes. Since internal sources as aquifers, groundwater and surface waters are often inadequate to meet these demands; states are increasingly attempting to exploit trans-boundary freshwaters. These exploitations frequently lead to the emergence of conflict between the riparian states that share the same river basin or lake. The intensity of these conflicts varies from basin to basin. Stages that can be identified are: harmony, institutional mechanism, informal mechanism, tension, diplomatic action, open dispute, armed conflict and war. (Green Cross) Although no war occurred that was fought primarily over freshwater in recent history, competition over international fresh waters is growing and the intensity of conflicts over freshwater is expected to increase.
Nevertheless has history proven that international freshwaters not only are a source of conflict but also can form a starting point for collaboration. There are numerous examples of states collaborating in the exploitation and management of international waters. This because the costs of conflict are just too high in proportion to the benefits.
States that are searching for means to exploit international freshwaters thus have the choice to either ignite conflict or seek co-operation. This choice is based on an analysis of benefits and costs of freshwater exploitation and the potentially resulting conflicts.

2. OBJECTIVES

The objectives of this research are to identify the factors that strengthen and accelerate the development of conflicts between riparian states and those factors that diminish the development of conflicts. This will be done by analysing and comparing the political, geographical, social, historical, economical and cultural

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Master of Science thesis research

circumstances for twelve selected trans-boundary freshwaters. This selection of twelve trans-boundary freshwaters is based on river size, conflict intensity, and information availability.

This research will be based on the theoretical concepts of conflict and international relations. These theories will be projected on the political, geographical, social, historical, economical and cultural circumstances in the selected trans-boundary fresh waters. The uniqueness of this research lies in the fact that this analysis covers a global selection of large trans-boundary fresh waters of which the conflict indicators will be compared and relations between conflict indicators and conflict intensity and will be identified. Results of this indicator analyses are a source to predict the emergence of conflicts in an early stage and to estimate the potential intensity of international conflicts. Improved insight in the relation between conflict indicators and conflict emergence and development will make it easier to prioritise and adapt conflict prevention programmes.

3. RESEARCH QUESTIONS

The main research questions that will be asked to focus this research are:

- Which trans-boundary freshwater conflict indicators can be distinguished?
- Which types of trans-boundary fresh water conflicts can be identified?
- Which relations between conflict intensity and indicator type can be identified?

Selected trans-boundary freshwaters

Selection of trans-boundary waters is based on river size, conflict intensity and information availability. Twelve trans-boundary waters are selected. Two for each continent. These are:

- Asia — Ganges-Brahmaputra and Mekong
- Middle East — Jordan and Tigris-Euphrates
- Europe — Rhine and Danube
- Africa — Nile and Zambesi,
- North America — Great Lakes and Rio Grande
- South America — Rio de la Plata and the Plateau of Ecuador.

This Master of Science thesis research will be performed under supervision of Prof. J. Leentvaar and Drs. I. Frijters, both employed by the Dutch Ministry of Transport, Public Works and Water Management.

PUBLIC AND PRIVATE PARTNERSHIPS ON DIFFERENT SCALES

MARKETS-ETHICS-LAW: WHAT CAN EACH CONTRIBUTE?

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ABSTRACT

In a world in which demand for water grows exponentially, but the supply essentially is constant, severe challenges are emerging regarding the allocation and protection of water resources. The result is disagreements and disputes among neighboring water users and neighboring communities. Markets, ethics, and law each have some role to play in resolving these disagreements in disputes. These roles are to some extent complementary and contradictory at the same time. Law provides a body of principles distilled from centuries of practice and experimentation. Furthermore, while law may not have an independent role to play in these matters, it remains an essential mechanism for facilitating and regulating markets for water, and for making ethics and markets effective.

1. INTRODUCTION

We live in a world in which demand for water is growing exponentially, while the supply of water essentially is constant. Fresh water is, after all, one of the most essential resources for human survival, let alone for human thriving. There has been a nine-fold increase in *per capita* consumption of water worldwide since 1900, arising from changing technologies and changing personal habits. (Commission on Sustainable Development 1997; Postel 1992) The burgeoning global population further increases demand, at least in societies that do not adjust their water consumption patterns to current realities. (Dellapenna 1997a) As a result, many legal regimes are stressed as they struggle to respond to the increasing and changing demands for water without unduly destabilizing existing expectations expressed in investments in water use facilities. (Brans *et al.* 1997; Postel 1992)

The predictable result is disagreements and disputes among neighboring water users and neighboring communities, with a high potential for serious conflict. (Starr) There are four mechanisms for resolving such disagreements or disputes: violence; markets; ethics; and law. In ordinary civil societies, markets, ethics, and law are used to resolve such problems, with law mediating the operation of markets and ethics, all with a goal of minimizing or eliminating violence. In the international arena, however, markets, ethics, and law have remained relatively undeveloped, leading in many contexts to resort to violence. If "water wars" is to remain a metaphor rather than become a reality, we must develop markets and ethics to the extent possible as effective means for coping with international disagreements and disputes over water. If markets and ethics are to be developed effectively, law must be developed so that it can assume its mediating role if markets and ethics are to function effectively.

2. A ROLE OF MARKETS?

Economists and others advance private property and markets for global, national, or local environmental management processes in general and for problems of local,

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national, and international water management in particular, as an automatic and nearly painless means for resolving problems of water allocation, distribution, and preservation. (Anderson & Snyder 1997; Dinar & Letey 1991; Wolfrum 1996) Markets, we are told, will introduce the necessary flexibility into water management while allowing the appropriate integration of water quality and water quantity issues into a single managerial model. They anticipate that the results will be accorded the strong presumption of validity that market-based allocations have always been accorded capitalist societies, a presumption strengthened by the utter failure of classic socialism.

Actual markets for free-flowing water have always been rare. (Dellapenna 2000, pp. 324-26, 349-58; McCormick 1994; Wahl 1989) Such markets as there have been were for the transfer of water among small-scale similar users. (Chatterton & Chatterton 2001; Thompson 1993) Water markets have seldom accomplished significant changes in water usage. (Pigram & Hooper 1990) So-called markets that were used to bring about major changes in water usage have functioned only through the rather heavy-handed state intervention. (Dellapenna 2000; National Research Council 1992) This pattern ought to give rise to an all too obvious, question: If markets for water are so good, why are they so seldom used? Supporters of markets seldom address this question except to denigrate their critics as holding cultural, religious, even mystical prejudices about water. Water, however, is not like other resources.

Water is not only one of our most essential resources, it has also long been considered to be the quintessential "public good." A public good shares two qualities: indivisibility and publicness. (Kaul, Grunberg, & Stern 1999) Indivisibility means that goods cannot be divided up among the consuming public in such a way as to allow the exclusion of other consumers from the resource. Publicness means that the resource is shared freely (if not equally) among the group—consumption by one person does not, at least under most circumstances, interfere with consumption by others. Because a good is indivisible, one cannot simply divide it up and buy as much as one wants, and because it is public, it is impossible to keep others from accessing and enjoying the good so long as it is accessible and enjoyable by anyone. In other words, a public good is one that all within the relevant public must enjoy more or less equally, or none will enjoy the good at all.

Public goods generally are free goods as far as markets are concerned because consumers cannot be excluded from enjoying the good. How much can one charge others for viewing the blue sky over one's property? The only costs, if any, associated with a public good are the costs of capture, transportation, and delivery, not a cost for the good itself. This creates an important problem: If you invest in developing or improving a public good, others who invest or pay nothing will enjoy the benefits of your investment. You cannot exclude them from enjoying the good. (Coase 1974) Such others are known as "free riders" and are seen as a serious inhibition to investment unless the government (or some other institution) takes responsibility for assuring that all (or nearly all) in fact pay for the benefits they receive.

Water is, of course, not indivisible and public in the strictest sense, and a few economists therefore have denied that it is a public good. But few things are strictly indivisible and public. Economists are in fact so accustomed to considering water a paradigm of a public good that they use water metaphors to discuss public goods

generally: "common pool resource," "spill over effects," and so on. Moreover, what a culture treats as a public good is not determined just by its physical characteristics, but also by its social and economic characteristics. Consider public education, for example. When the costs to exclude others would be so high that it is impractical to exclude others from access to the good, or when there are other (perhaps cultural) reasons why a society will not exclude some of its members from access to the good, the good is treated as if it were a public good. (Dellapenna 2000, pp. 329-36)

The social or economic characteristic that usually leads to treating something as a public good is because transaction costs are so high that no market can function with even minimal effectiveness. (Howe, Boggs, & Butler 1990; Shelanski & Klein 1995) Another reason for treating something as a public good is because the society's values require that all receive a "fair" share of the resource. When transaction costs make markets impossible yet a good is considered essential for the minimum well-being of members of society, the government undertakes to provide the good to all without direct charge. Such goods could be termed socially created public goods. Examples of socially created public goods include fire protection or public education.

Water is just such a commodity. (Dellapenna 2000, pp. 331-35) This is most obvious for the protection of instream flows. Less obvious, but no less true, is the public nature of water when withdrawn for private use. While it is easy enough for someone to own and manage water unilaterally in small amounts (for example, bottled water), a river is an ambient resource that can never be fully controlled or owned. Doing something to water on a large scale necessarily affects many others, making it difficult to procure the contractual assent of all significantly affected persons. Without requiring such complete assent, however, results in non-consenting third parties being effectively deprived of their property (the right to use water) without compensation. Wealth is transferred from those who formerly used water to those who thereafter would use water. (Easter & Hearne 1995; Gray 1994; Harbison 1991, pp. 553-59; O'Brien & Gunning 1994, pp. 1078-83) Typically the ones who lose out are small users without capital resources or alternative sources of supply of water. In the end, allowing such uncompensated transactions result in the transfer of wealth from the poor to the better off in society.

Transaction costs on all but the smallest waterbodies quickly become prohibitive. Theoretically it might be possible for a properly structured market to cope with these concerns. In any hydrologically large and complex system, the difficulty and expense of structuring the necessary transactions (transaction costs) in fact prevent markets from developing unless the law chooses to disregard the externalities. (Dellapenna 2000) When one user attempts to convey a water right to another, particularly to one seeking to make a completely different use of the water, the problem of "externalities" arises. The law, however, protects against such externalities by a rule, found in most legal systems, that one cannot alter the time, place, or manner in which one uses water without the consent of other affected holders of water rights. (Gould 1988)

The classic example of what happens when a buyer seeks water for a fundamentally different use than that of the seller is the attempt of the City of Denver to trade its sewage water for a brewery's "clear mountain stream." (*City of Denver v. Fulton Irrigating Ditch Co.* 1972) The Co-ors Beer Company, a popular brewer in the

suburbs of the city of Denver, known for the high quality of the water used in its brewing, was unable to produce enough beer to satisfy the demand for its product without a greatly enlarged supply of water. Denver, consistently one of the fastest growing cities in the United States, is always looking for new sources of potable water for its residents and businesses. Denver offered a swap that Co-ors was all too ready to accept. Denver would take Co-ors' clear mountain stream; Co-ors would have the right to use unlimited quantities of Denver sewage water in its brewery. The transaction failed to occur not because of fear of possible outrage on the part of beer drinkers, but because farmers downstream from Denver (organized as the Fulton Irrigating Ditch Co.) obtained an injunction against the trade because it would have deprived them of the water they relied on—even though the farmers had, 30 years earlier, contractually recognized the seniority of Denver's rights over their own.

This reality underlies the treating of water as a free good—a good available to all at no cost for the water itself; costs are assessed only for the cost of capturing, transporting, and purifying the water. Advocates of markets for allocating and managing water are not completely wrong in their view. They are demanding an end to the treatment of water as a free good. Water should not be a free good. Economic incentives including fees, taxes, and "water banks", should be introduced for those who use water so they will more realistically evaluate the social consequences of their conduct. (Wolfrum 1996) But resort to economic incentives should not obscure the fact that water remains the prime example of a public good for which prices cannot be set in a marketplace. The reality of transaction costs should give even the most free-market oriented economist pause to consider whether true markets could function effectively for water resources. (Dellapenna 2000; Howe, Boggs, & Butler 1990) Ultimately, true markets must remain marginal to the management of large quantities of water for numerous diverse users.

3. A ROLE FOR ETHICS?

Space does not allow a full discussion of what a system of ethics related to water use might encompass. Here I discuss only the question of what sort of property rights would be ethically superior relative to water. While I have a particular answer to that question, my main point is to raise the question rather than to answer it. Far too little has been written or said about ethics and water to claim that there presently are definitive answers to such questions.

In thinking about "property" in water, one is likely to have in mind a system of rules that define rights and duties pertaining to water in clear and certain terms, with law serving to protect these entitlements except insofar as changes occur through market transactions. A close model of such an arrangement is the American law of appropriative rights; similar systems are found in other countries as well. (Dellapenna 1991, ch. 8) A rule that permits anyone to use a "common pool resource" so long as the use is "reasonable" hardly seems like a rule of property at all. Such a rule leaves courts to sort out conflicting claims of right to the common resource only through a rule prohibiting tortuous interference with other water users. (Dellapenna 1991, ch. 7) This amounts to a rule of common property, rather than a rule of private property. The American law of riparian rights is the prime example of such a legal regime; the Roman law of flowing water was similar. The third possibility is active public management of the common resource. The newest system of American law for the allocation of surface water, 'regulated

riparianism', corresponds to such a public ownership model; examples are found in a growing number of other countries as well. (Dellapenna 1991, ch. 9)

While actual legal regimes often mix aspects of two or all three of these systems, analyzing these "pure types" makes clear the strengths and weaknesses of each approach. (Harris 1995) The correspondence of forms of water law to theoretical models enables us to predict with some certainty whether a form is adaptable to changing circumstances, or whether an entirely new form must be substituted when water demand or supply changes dramatically. (Abrams 1989) Conclusions drawn from the American experience are largely translatable to other societies. (Teclaff 1985) Treating water as common property leads to tragic over exploitation as soon as water begins to be scarce. It seems increasingly clear that a common property system cannot survive. (Hardin 1969; Rose 1991) Which system should be substituted, however, is less clear. Because of the severe limits on the utility of markets for water generally, private property systems are experiencing increasing stress as demands surge and unappropriated water becomes rare. What works best (albeit imperfectly) is treating water as inherently public property for which basic allocation decisions must be made by public agencies.

Private-property or market systems—the best mechanism for allocating resources when it works—fail if there are significant barriers to the functioning of a market. (Coase 1960) As already discussed, markets do not work well for ambient resources like water. Because of the protection of third-party rights under appropriative rights, small-scale transfers of water rights among farmers or ranchers making roughly similar uses at similar locations are the only ones that regularly occur without heavy state intervention. (National Research Council 1992) As a result, treating water as private property tends to freeze patterns of use rather than to create a market. A variation on the private property system is to allow each person with lawful access to a water source to use as much water as the person wants without regard to the effect on anyone else. An example is the "absolute dominion rule" apply in many societies to groundwater. As demand approaches supply, such a rule generates a "race to pump," which in turn leads back to the tragedy of the commons.

Today, both eastern and western states in the United States are increasingly turning to active public management of water resources. (Dellapenna 1991, ch. 9; Dellapenna 1997b) State governments have concluded that, despite the considerable difficulties in defining what are the proper public goals or in making the right decisions to achieve those goals, a transition to public property offers significant advantages over common and private property in terms of efficiency and distributive justice. The core concept of public property in water as found in regulated riparian statutes is that all uses qualifying for a permit must be "reasonable." (Dellapenna 1991, § 9.03(b)) The decision whether a proposed use is reasonable is made before investment in the use through issuance or denial of a permit. The administering agency includes an analysis of generalized interests widely diffused among the public that were only theoretically recognized in traditional riparian rights. Such a program of public management might very well fall short of its goals.

Administration of a public property system will be less than perfect. Whether such a permit process is superior to traditional riparian rights, appropriative rights, a pure market system (if such were possible), or some other regulatory system is hotly

debated. (Dellapenna 1991, ch. 9; Dellapenna 2000; Komesar 1994; Rose 1990) Still, one cannot have much confidence in a private property/market system given the scarcity of actual empirical evidence that such a system can work and the transaction costs and externalities as barriers to the successful operation of a market for water rights.

Ethical appeals can mobilize the political will to prevent such adverse outcomes as the tragedy of the commons or the freezing of markets. By themselves, however, ethical appeals cannot solve these problems. Consider, for example, the Canadian lobster—fished nearly to extinction in Nova Scotia. Concerned persons could make a strong ethical appeal for more careful fishing practices or even a moratorium on fishing of lobsters to enable the species to revive. If I am a lobsterman in Nova Scotia, and if I head the appeal, I actually would not help the lobster. I would simply leave more for the other lobstermen to catch—and they would catch them. If I consider the problem carefully, I will realize this, and I will decide that the only rational course is for me to catch as many lobsters as I can before others catch them. The ethical appeal will fail in the face of yet another tragedy of the commons, unless we (Canadians, Nova Scotians, or simply lobstermen) can create a legal regime to protect the lobster.
Adequate attention to externalities is central to a sound, ethically based legal regime. A sound, ethically based legal regime would incorporate economic incentives as a management tool, as well as, when necessary, a command and control system. One should not confuse economic incentives with markets, however. (Dellapenna 2000) Economic incentives are created and operate differently than markets. (Brown & Holahan)

4. WHAT ABOUT WATER EXPORTS?

The International Joint Commission, which exercises regulatory authority over the Great Lakes on behalf of Canada and the United States, has recently taken the position that no water exports should be allowed from the Great Lakes basin if the export would injure the "ecology" in any way. That virtually means that no water will be allowed to be exported from the basin. Is this an ethically sound decision?
Considering Indiana. The boundary of the Great Lakes is just south of the water boundary of the Lakes. Formed by glacial moraines, it is less than 10 kilometers south of Lake Michigan in northern Indiana. Does ethics require that Indiana be limited to using water from Lake Michigan only within that narrow strip of land within the basin boundary when small, medium, and large communities in the state need water and are less than 100 kilometers outside the boundary? Or consider the Nile basin. The ten states that share the Nile basin have 300,000,000 people, but only about 160,000,000 live within the basin itself. Does ethics demand that the other 140,000,000 have no access to the use of Nile water?

5. WHAT CAN LAW CONTRIBUTE?

The answer has already been suggested in this paper. At the national level, law defines property systems and creates incentives for responsible water management. Law has accumulated a vast store of experience on such issues over the centuries, distilling that experience into precepts, rules, and systems of dispute resolution. Such knowledge can be used to stiffen and make effective what sound ethics recommends. Such knowledge can also facilitate markets, and when markets

are unworkable, can substitute systems of economic incentives to increase the likelihood of compliance with the mandates of sound ethics.
Water has another quality that, combined with water's unusual importance, gives rise to a considerable risk of conflict among neighboring communities. Water is an ambient resource that largely ignores human boundaries. Some 264 river basins in the world—including all the larger rivers and home to about 40 percent of the world's population—are shared by more than one nation. Cordial and co-operative neighboring states have found it difficult to achieve acceptable arrangements for governing transboundary surface waters even in relatively humid regions. (Teclaff 1967) No wonder English derives the word 'rival' from the Latin word *rivalis,* meaning persons living on opposite banks of a river. Considerable evidence, however, suggests that co-operative solutions to water scarcity problems are more likely than prolonged conflict. (Dellapenna 1997a; Wolf 1998) Historian Robert Collins summarized this same reality in a comment on the rivalries in the Nile basin: '[M]an will always need water; and in the end this may drive him to drink with his enemies.' (Collins 1990, at 300)

A well-developed body of international law addresses transboundary water problems. Water's status as a public good is central here as well. (Kaul, Grunberg, & Stern 1999; Merrett 1997) As such, it usually cannot simply be parceled out among competing users. The international community must co-operate to increase trust and eliminate water as a possible reason for going to war. International law (particularly customary international law) by itself cannot solve this problem, yet international law is an essential element of any solution.

Space does not allow full development of the possible contribution of international law, customary or otherwise. The international legal system lacks the specialized institutions—executive, legislative, and judicial—of modern national legal systems. Customary international law consists of practices of states undertaken out of a sense of legal obligation—a sense that the practice is required by law. (Wolfke 1993) Despite the obvious difficulties in determining the precise content of customary international law, the system has been remarkably successful. No form of international life could exist without shared norms that are largely self-effectuating in the conduct of that life. (Henkin 1979) Focusing exclusively on a relatively few highly dramatic instances of international legal failure creates an impression of entire ineffectiveness.

Successful areas of customary law have tended to be codified under United Nations auspices. A rich body of customary law regarding internationally shared fresh water has emerged, largely in the last century or so. (Dellapenna 1994; International Law Association 1966; Schwebel 1982) That law was codified in the *UN Convention on the Law of Non-Navigational Uses of International Watercourses,* approved by the General Assembly on May 21, 1997, by a vote of 104-3. (United Nations 1997) The *Convention* will come into effect if 35 states ratify it. The *Convention* already serves as the best statement of the customary international law. (*Danube River Case* 1997, 78, 85) Under customary law, only riparian states—states across which, or along which, a river flows—have any legal right, absent agreement, to use the water of a surface water source. (United Nations 1997, arts. 2(c), 4) Riparian states in turn are bound by the rule of "equitable utilization." (*Permanent Commission of the River Oder Case,* 1929; United Nations 1997, art. 5) The *UN Convention* also introduces a second obligation on the part of states sharing a watercourse—sustainable use. (United Nations 1997, art. 5)

Equitable utilization requires each state to use water in such a way as not to injure unreasonably other riparian states. Some might argue that "equitable" sharing must mean equal sharing. The merest perusal of the standards for equitable utilization demonstrates that while access is guaranteed, equal shares are not. Thus even if each interested state always agrees to the rule of equitable utilization, states would still dispute what should be the common standard for sharing and the proper application of the agreed standard. The rule of equitable utilization is simply too general and too vague to be applied without the interested states filling in the details in what remains merely an obligation of fairness. Non-lawyers, particularly engineers and hydrologists, sometimes see in the list of factors for determining equitable utilization a poorly stated equation. By this view, if one simply fills in numerical values for each factor, one could somehow calculate each watercourse state's share of the water without reference to political or other non-quantitative variables. This simply ignores that the *UN Convention* is a legal document that ultimately is addressed to judges. Judges make judgments, and in the English language, at least, the word judgment carries a connotation that the result is not dictated in any immediate sense by the factual and other inputs that the judge relies upon in exercising judgment. Any attempt to treat the list of relevant factors as an algorithm simply misses the point entirely.

Reliance on customary international law, however, to allocate surface or subsurface waters among states is too cumbersome and uncertain for the satisfactory resolution of disputes over interstate sources of water and too primitive to solve the continuing management problems in a timely fashion. (Benvenisti 1996; Dellapenna 1997a) Furthermore, relying upon an informal legal system alone to legitimate and limit claims to use shared water resources is inherently unstable. Yet without an effective legal mechanism for resolving of disputes over water, the disputes can only lead back to the law of the vendetta. Serious conflict in one form or another can only be avoided under the rule of equitable utilization through a clear definition of the precise standards for managing the shared waters and the creation of a peaceful, legal mechanism for the orderly investigation and resolution of the disputes characteristic of the rule. Thus, although the customary international law for managing internationally shared waters fails to solve these problems, no solution is possible without the creation of the necessary law.

If a co-operative management system is to be put in place for internationally shared fresh waters, that system must entail some sort of a legal mechanism for the orderly investigation and resolution of the disputes characteristic of that theory. (Dellapenna,1994; Kliot, Shmueli, & Shamir 1998) Recurring bitter disputes, even overt military conflict, would inevitably continue if there is no effective alternative mechanism for resolving disputes. While stress on water resources itself creates real pressures for co-operative solutions to the problems confronting communities sharing the resource, the creation of a formal legal system is a necessary prerequisite to preventing conflict over water in any set of communities where water resources are under stress. Co-operative management has taken many forms around the world. Solutions have ranged from continuing consultations, to active co-operative management that remains in the hands of the participating states, to the creation of regional institutions capable of making and enforcing their decisions directly. (Dellapenna 1994; Utton 1996) Which of these approaches is appropriate to a particular basin depends on the hydrologic, economic, engineering, and political characteristics of the communities sharing the basin. Still, the long-term

trend is towards greater integration; transboundary co-operation that begins in limited ways seldom remains at such levels, tending to progress towards greater co-operation as the need is recognized.

6. A WORD ABOUT GROUNDWATER INTERNATIONALLY

In contrast to the considerable state practice regarding the sharing of surface water sources, remarkably little state practice exists regarding the sharing of underground sources of water. Before the spread of vertical turbine pumps after World War II, ground water was a strictly local resource that could not be pumped in large enough volumes to affect users at any considerable distance away. With the newer technologies, and with the exponential growth in the demand for water of the last several decades, ground water has emerged as a critical transnational resource that has increasingly become the focus of disputes between nations yet for which no consistent body of state practice has emerged. All too typical example are the several treaties dealing with waters shared between the United States and Mexico; despite the growing importance of ground water in the border regions, the treaties are silent on ground water with potentially disastrous results. (Rodgers & Utton 1985) Most legal scholars have concluded ground water must be subject to the same rule of equitable utilization as applies to surface sources. (Barberis 1991; Hayton & Utton 1989; International Law Association 1986; Rodgers & Utton 1985; Teclaff & Utton 1981) As the hydrologic, economic, and engineering variables involved are the same for surface and subsurface water sources, the law must also be the same for both sources. Ground water and surface water are not merely similar, they are in fact the same thing. Ground water and surface water are simply water moving in differing stages of the hydrologic cycle. The *UN Convention* did not, however, include ground waters except to the extent that they are tributary to an international watercourse. (United Nations 1997, art. 1)

7. THE INTERNATIONAL LAW ASSOCIATION AND THE REDRAFTING OF THE *HELSINKI RULES*

A landmark in the development of international water law was the approval of the *Helsinki Rules on the Use of Waters of International Rivers* in 1966. (International Law Association 1966) The Water Resources Committee of the International Law Association has been working to develop a comprehensive revision of the *Helsinki Rules* since 1996. This draft takes into account the development since 1966 of an important and impressive body of international environmental law, developments in international humanitarian law, and the approval by the General Assembly of the United Nations of the *UN Convention.* The most significant developments not directly reflected in the current body of rules formulated by the International Law Association and not fully developed in the *UN Convention* are the emergence of environmental concerns, integrated management, and sustainable use as central principles of international resource law and international environmental law. (Jurgielewicz 1996; Kiss & Shelton 2000) The concepts of international environmental law, either completely unknown or of peripheral importance in 1966, have become the organizing principles of a large and increasingly effective body of law of which the law of transboundary waters is properly a special instance rather than an independent and competing set of rules. At the same time, customary international law has come to recognize the right of people affected by

governmental decisions to have a voice in those decisions, as well as certain specific procedural rights regarding environmental decision making.

As envisioned by the Water Resources Committee, the result is a new paradigm of international water management. That paradigm includes principles relating to the duty of co-operate among states, the obligation of sustainable use, and the right of public participation. The duty of co-operate is realized through the principle of equitable utilization and the need to build regional institutions for water management. The obligation of sustainable use requires protection of fundamental ecological integrity, the minimization of environmental harm, application of the precautionary principle, and economic responsibility of those who use resources. The right of public participation requires procedures to assure a voice by those affected by the decisions in question, to assure that affected persons have access to necessary information in order to participate effectively, and to assure that affected persons have effective legal remedies when their rights are violated.

Law can be effective when its proper uses are understood. Law can only be as good as its constituents want it to be. Persons who need law—to avoid violence and to facilitate effective and ethically sound water management—must become more familiar with the limits and potential of law. And they might have to be ready to accept an expansion of the potential and a reduction in the limits.

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THE RELATIONSHIP BETWEEN THE OWNERSHIP AND PERFORMANCE OF MUNICIPAL WATER UTILITIES[27]

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ABSTRACT

The purpose of this paper is to critically assess what is known regarding the relationship between the ownership and performance of municipal water utilities. The paper begins by reviewing the theoretical arguments that predict public ownership leads to poorer performance than private ownership. It is shown that these theoretical models are not without their limitations. As a result, the paper turns to the empirical evidence from Europe and North America. Using a variety of performance indicators, the paper finds that the available observations demonstrate there is no compelling evidence of private utilities outperforming public utilities or that privatizing water utilities leads to unambiguous improvements in performance. The paper concludes by considering a promising direction for water utilities operations and water resources management: public-private partnerships.

1. INTRODUCTION

There is a growing concern about the operations of the municipal agencies responsible for supplying potable water and treating sewage (Spulber and Sabbaghi, 1998; Easter, Feder, Le Moigne and Duda, 1993). In particular, the spotlight has focused upon an examination of whether the ownership of water utilities is a factor explaining their behaviour and whether changing the ownership of municipalities will lead to improvements in their operations.

In a recent survey of the empirical literature related to the impacts of privatization, Megginson and Netter (2001) conclude "privatization appears to improve performance measured in many different ways, in many different countries" (p. 347). It is interesting to note, however, that that Megginson and Netter do not report any studies related to privatizing water utilities and they acknowledge that "the justification for privatization is less compelling in markets for public goods and natural monopolies where competitive considerations are weaker." (p. 330). The purpose of this article is to critically assess what is known regarding the relationship between the ownership and performance of municipal water utilities. There are theoretical arguments that suggest that public ownership will lead to poorer performance than private ownership. These theoretical models, however, are not without their limitations and critics. This is especially true when considerations such as changes in ownership and the degree of competition in output markets are taken into account. As a result, we turn to the empirical

[27] This paper was completed while both authors were Visiting Scholars at CSERGE (Centre for Social and Economic Research on the Global Environment), University of East Anglia, Norwich, UK. The authors would like to thank their research assistants, Jenna Sudds and Meghan Ihrig, and to acknowledge the financial support of the Canada Donner Foundation. All errors and omissions remain the sole responsibility of the authors.
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literature and examine this topic from two perspectives. First, we ask whether there is empirical evidence that public water utilities perform worse than comparable private water utilities. Second, we ask whether there is evidence that privatizing water utility operations (either entirely or in part) improves their performance.

2. OWNERSHIP AND PERFORMANCE: THEORY

There are many reasons why two firms might differ in their performance. These reasons include differences in scale of operations, the degree of competition faced, managerial skills, agency objectives and ownership. It has been commonly argued that, holding all other factors constant, privately owned firms will outperform publicly owned firms (Megginson and Netter, 2001). The theoretical basis for this contention derives from several perspectives. These include principal-agent theory, property rights theory and public choice theory. Each of these perspectives predicts, for differing reasons, that private firms will create an environment in which incentives for efficient behaviour are stronger than those in public agencies. However, as we will discuss at the end of this section, these theories are not without their limitations.

Principal-Agent (PA) theory is a useful starting point in trying to understand the influence of ownership on the performance of water utilities. In a PA relationship, the task of the owner is to design a contract that provides the manager an incentive to choose the strategy that maximizes the owner's welfare. The challenge for the owner, of course, is that in a world of asymmetric information and uncertainty, the manager's effort can not be monitored and contracts can not be enforced costlessly. A significant issue, then, in comparing public and private ownership is their relative efficacy in providing managers with appropriate incentives.

One of the factors that may be expected to influence owners' desire to monitor the actions of managers is the potential pay-off to them from improving managerial effort. Property Rights (PR) theory argues that private sector owners, as residual claimants, have more clearly defined incentives to push for efficient decision-making by managers. The same logic applies to the firm's creditors and also to owners of other firms considering a potential takeover. In contrast, politicians, senior bureaucrats and taxpayers have attenuated property rights to the gains associated with improved public sector agency behaviour and, as a result, have diminished incentives to push for improvements. In addition to public sector owners having a reduced incentive to monitor behaviour, Public Choice (PC) theory emphasizes the potential for inefficient behaviour on the part of public sector managers. This is because Public Choice theory typically assumes that the latter act in their own self interest- for example, by seeking to expand the size of their own budget. Thus, the combination of a lack of oversight and self-interested managers provides the opportunity for managerial discretion and inefficient behaviour.

Thus, in comparison to the private sector, public sector owners have less incentive to provide oversight and discipline while public sector managers have more incentive to pursue goals other than those of their agency. The lack of costlessly enforceable contracts that anticipate every contingency means public agencies will exhibit poorer performance as compared to their private counterparts.

These arguments have been criticized on both theoretical and empirical grounds. The most important counter-argument to their prediction with the observation that one must be very careful to separate the role of ownership from the important role played by the degree of competition faced by the firm. Namely, performance may depend as much on the structure of the market as it does on ownership. As Vickers and Yarrow conclude: "Indeed, it can be argued that the degree of product market competition and the effectiveness of regulatory policy typically have rather larger effects on performance than ownership per se" (Vickers and Yarrow, 1989, p3). Since water utilities operate largely under monopolistic conditions, mere privatization of these firms is unlikely to lead to better performance unless the firms are heavily regulated.

Secondly, in the presence of regulations, incomplete information and transactions costs, capital markets may not be efficient sources of discipline. This means that threats of take-over and bankruptcy do not always provide perfect incentive mechanisms for efficient choices by managers (Hodge, 2000; Saal and Parker, 2001). Finally, while bureaucrats may wish to behave in the manner predicted by Public Choice Theory, there is, first of all, little empirical evidence to support this (Martin and Parker (1997).

3. OWNERSHIP AND PERFORMANCE: MEASUREMENT ISSUES

In describing the performance of a firm, there are a number of different aspects that have been considered. While economists have tended to focus upon the particular goal of efficiency as being capable of defining the best performance attainable, a number of other performance indicators such as productivity and profitability have also been used. Given the space limitations, we restrict our attention to efficiency measures.

Efficiency can be described along a number of dimensions. A firm is technically efficient if it either produces the largest level of output possible given the quantity of input used or if, for a given mix of inputs, it employs the least levels of those inputs necessary to produce a given level of output.[30] Suppose a firm could choose from amongst three technologies: A, B, and C, all of which could produce a given level of output which we will call Q^0. The factors that distinguish these three technologies are the absolute quantities of inputs used and/or the relative intensities of inputs used. Suppose A uses 3 units of labour and 3 units of capital to produce Q^0 while B uses 4 units of labour and 3 units of capital and C uses 2 units of labour and 4 units of capital. In a comparison of A and B, it is clear that B is technically inefficient since it uses more labour and the same amount of capital as A to produce the given output level. We can relate the impact of being inefficient to the cost of production. Namely, if the firm is using more input than is necessary to produce a given output, its cost of production is higher than the cost of production for the best practice or more efficient firm. Thus, when compared to B, A is allocatively efficient.

What can we say about A and C? They are both potentially technically efficient (assuming there are no other technologies that could produce the given output using less of at least one of the inputs), but are they both allocatively efficient?

[30] The latter is known as the Farrell measure of technical efficiency (Farrell, 1957).

Suppose we knew the costs of the inputs, then if A cost less than C to produce the given output of Q^0, we would say that C is allocatively inefficient. That is, by rearranging the mix of inputs in technology C we could reduce the cost of producing a given level of output.

In practice, there are a number of ways used by economists to measure these different levels of efficiency. The first is the econometric or parametric approach which is based on a stochastic representation of the production function (Fox and Hofler, 1986). Unlike the usual econometric model of production, a model that incorporates inefficiency has two error terms. The first is the normal error component. This measures unobservable factors such as measurement error, so it can be positive and negative. The second term is the technical inefficiency error term. This can only be positive since it represents the distance a firm is from the best practice production level. By estimating the stochastic production frontier the researcher is limited to an analysis of technical efficiency. In order to look at allocative efficiency, the researcher can obtain parametric measures of inefficiency by specifying either a dual cost or restricted profit function. The extent to which a firm's costs (profits) are greater (smaller) than those identified by the frontier indicates the extent of inefficiency. In this case, both technical and allocative efficiency are measured, however, the additional burden imposed upon the researcher is that she requires data on input prices.

The alternative approach to the measurement of inefficiency uses a linear programming method called data envelopment analysis (DEA) (Dupont, Grafton, Kirkley and Squires, 2001). Typically, this approach finds the most efficient firm in the data set and then makes comparisons between it and all other firms. This is a non-stochastic, so one weakness is that the researcher is unable to undertake hypothesis testing of the significance of the results. A second weakness is that all deviations from the frontier are assumed to be due to inefficiency.

4. OWNERSHIP AND PERFORMANCE: EMPIRICAL EVIDENCE

Three developed countries provide us with most of the empirical studies conducted to date. These are the United States, the United Kingdom, and France. We examine the literature that has compared public and private utilities in America and France and studied the impacts of the privatization of water utilities in the United Kingdom. Table 1 provides a summary of the studies discussed below.

The American Experience

The United States provides a potentially valuable environment for comparing public and private water utilities. A recent survey (Seidenstat, Nadol, and Hakim, 2000) reports that there are approximately 50,000 community water systems in the United States. Of these, 43% are publicly owned, 33% privately owned and 24% are classified as "ancillary systems" (i.e., systems serving very small communities such as trailer parks). However, because most private systems are relatively small, public water systems serve 86% of American households while private systems supply only 13%.

The earliest studies examining the link between ownership and performance estimated an aggregate cost function for water utilities and usually included a dummy variable to test for ownership effects. The results of these efforts were mixed. Morgan (1977) and Crain and Zardkoohi (1978) find that private water utilities have, on average, lower costs. Conversely, Bruggink (1982), Feigenbaum and Teeples (1983) and Teeples and Gyler (1987a, 1987b) find either no cost difference or that public utilities have lower costs. However, as McGuire and Ohsfeldt (1986) point out, a problem with these studies is that they assume cost minimizing behaviour by both public and private utilities. However, the theoretical arguments presented in the previous section indicate that public utilities may, in fact, not engage in cost-minimizing activities. As a result of this type of criticism, researchers began to make use of measurement techniques that allowed them to relax the assumption of cost minimization. Lambert, Dichev and Raffiee (1993) and Bhattacharyya et. al. (1993), for example, use a DEA approach to estimate a production frontier for a sample of public and private U.S. water utilities. The authors find that public utilities display higher overall and higher technical efficiency while the latter study finds private utilities to be slightly more efficient than public ones (91.3% versus 90%). Other researchers have employed econometric methods to estimate stochastic cost frontiers. Byrnes (1991) estimates a cost frontier and finds no statistical difference in cost frontiers for public and private utilities. Bhattacharyya et al. (1995a) also estimate a stochastic cost frontier for private and public utilities and find that the impact of ownership on performance interacts with the scale of the utility. Thus, large public utilities are less inefficient than comparable private utilities while the reverse is true for small utilities.

Thus, it would appear that the most conclusive statement that can be made regarding the American experience is that there is no strong evidence that private water utilities are demonstrably more productive than public water utilities. Having said this, it is important to be mindful of the relatively small number studies available and the possibility that past studies have not fully accounted for the differing tax rules and regulations (Nadon, Seidenstat and Hakim, 2000).

The United Kingdom Experience

The privatization of water and sewage utilities in England and Wales has been the largest effort so far to sell off public water agencies (Cowan, 1998). As such, it provides a natural experiment for the impacts of a change in ownership on the performance of water and sewage utilities. At the time of the privatization, the British government argued that the change in ownership was necessary to improve the agencies' performance (Littlechild, 1988). The privatization effort involved several components. The most important component, of course, was the sale of the water and sewage utilities themselves. This sale was facilitated by the government's writing off £4.95 billion of industry debts and providing £1.5 billion in cash to help pay for needed investments (thereby significantly reducing the proceeds from the sales of the utilities-cf. the estimates in Shaoul, 1997).

Once privatized, the water utilities were subject to a variety of environmental and financial regulations. In particular, the firms were faced with the recently adopted and stringent EU water quality regulations. It widely believed that these regulations were the primary reason for the significant increase in capital spending undertaken by the privatized water utilities (Cowan, 1998; Ashton, 2000). The other important form of regulation concerned the permitted pricing behaviour of the water utilities.

The government adopted a RPI+K form of price regulation where the aggregate price for a bundle of the utilities' outputs was allowed to rise by the retail price index plus a K factor (Littlechild, 1988; Cowan, 1994). The most important feature of the adopted price regulation is the fact that any individual firm's allowed rate of price increase is a function of the cost performance of its competitors. The 'benchmark' feature of price regulation is supposed to provide the firms' with an incentive to innovate and reduce costs as each firm's allowed price is related to the average of the other firms' unit costs.

The empirical evidence on the impacts of the British privatization is definitely mixed. On the one hand, there is little evidence that the change in ownership, *per se*, has led to measurable improvements in performance. Shaoul (1997) conducts a financial analysis of the United Kingdom water industry pre and post-privatization. The author finds higher costs, prices and profits but little improvement in the level of net investment or service quality (the latter being measured by frequency of customer complaints and of utility-mandated water use restrictions). Saal and Parker (2001) conduct a productivity analysis of the privatized industry. The authors find that while labour productivity improved after privatization, total factor productivity declined. The authors conclude that privatization resulted in higher profits but few efficiency gains. In contrast, there is some evidence that the combination of environmental and price regulation did improve performance especially after a review and tightening of the price regulation in 1995. More stringent environmental regulations have led to improved drinking and river water quality (Saal and Parker, 2001). In addition, the British government's recent downward revisions of the allowable rate of price increases appear to have induced cost reductions and improved efficiencies. Saal and Parker (2000), for example, estimate a cost function for the U.K. water industry and include time dummy variables in order to test whether either privatization or tightened price regulation has affected industry costs. The privatization dummy is insignificant but the price regulation dummy's coefficient is negative and significant. This results suggests that only price regulation has had a discernible influence on costs.

The French Experience

In France, municipalities ("Communes") have the legal authority to supply water or to delegate that responsibility to another party (Chret, 1994). Prior to WWII, most local water supply was carried out directly by public agencies. However, an important post-war innovation has been the development of contractual relationships ("delegated management") between Communes and private firms in which the latter participated in local water supply. By 1992, 75% of French population was supplied by some form of a public-private joint operation although these partnerships are concentrated in large and medium-sized municipalities.

There were originally two forms of delegated management. The first, a lease contract ("affermage"), specifies a relatively short-term relationship (10-12 years) in which the firm is responsible for operating a facility while the Commune is responsible for building and financing any facilities. The second, a concession contract, is a longer-term relationship in which the firm not only operates a facility but is also involved in financing and building the facility. The contracts also specify how prices are to be determined and what form of payment is to be paid to the private firm. Over time, however, a variety of hybrid, intermediary forms of relationships have developed (Ménard and Saussier, 2000).

There are surprisingly few studies (in English language journals, at least) comparing the relative performance of French water suppliers under alternative contractual relationships. Despite this, the theoretical arguments presented above would suggest that the possibility of having a number of private firms bidding for the right to run a municipal water system should introduce a strong degree of competition and, thus, efficiency, into the local water supply system. There are several factors, however, that reduce the potential benefits of private participation in the French water supply industry. These include restrictions on the participation of foreign firms in French water supply (Orwin, 1999) and the distorting effects of large subsidies from senior levels of French government (Orwin, 1999). Another important problem stems from the sovereignty of French communes in decision-making related to water supplies. Garcia and Alban (2001) demonstrate the presence of both scale and scope economies for small local water systems and argue that the failure of small communes to amalgamate their supply networks leads to significantly higher costs. The councils of these small communities may also experience an imbalance in bargaining power between themselves and the large private firms that dominate the French water industry (Buller, 1996). Finally, under French law, a mayor may not protect himself or herself from the liability arising from damages caused through the negligent operation of a directly managed supply network. If the operation of that network is delegated to a private firm, however, then the mayor's personal liability is removed (Clark and Mondello, 2000). This situation creates a conflict of interest for mayors in their choice between direct and delegated operations and may distort their decision-making.

Because of the lack of studies, there is limited empirical evidence regarding the relative performance of alternative forms of French local water agencies. For example, Orwin (1999) presents evidence that demonstrates that private suppliers have higher prices than directly administered (i.e. public) systems but Buller (1996) argues that this may be to the higher frequency of privatized systems in areas where costs of supply are higher (due to, for example, reliance on groundwater supplies). Ménard and Saussier (2000) examine the factors influencing the direct versus delegated administration decision and compare the performance of the two forms of organization. The authors find that, once differences in raw water quality are accounted for, there is no difference in performance between direct and delegated management.

5. CONCLUSIONS

This paper has discussed how the theoretical economic literature predicts that private ownership will exhibit higher levels of efficiency than public ownership. However, the paper also shows that the empirical literature is lacking in conclusive evidence that privately owned water utilities are more efficient than comparable publicly owned water utilities. One might argue that, in practice, we rarely see a purely private or purely public firm since the potential range of public-private partnerships is wide and this makes the assessment of these types of arrangements difficult. And, while there is some anecdotal evidence that public-private partnerships may lower the costs of constructing and operating new facilities, whether these arrangements are welfare-improving depends crucially on the details of the partnership. Particularly important are issues related to the structure of incentives and risk sharing.

Given our inability to find strong empirical evidence to support theoretical arguments about the superiority of private operations, we have looked to see whether there might be any mitigating factors. Firstly, the regulatory environment in which firms must operate has a large influence upon choices and behaviour. For example, in instances where public and private utilities operate under the same regulatory environment, certain regulations may act to stifle the ability of the private firm to achieve cost savings. Moreover, in the interests of public health and safety, regulators may impose specific drinking water quality and environmental protection regulations that may prove to be the determining factors in choice of technology and capital.

Secondly, water utilities, whether private or public, have been shown to adopt inefficient pricing policies and cost accounting practices that do not take into account the full costs of providing potable water. To the extent that both groups systematically make these types of decisions, then their forecasting and demand management will also result in inefficient decisions that will have welfare costs for society. A third reason for our finding that the empirical work on behaviour of water utilities does not support the theoretical models is that the data available on operations may not be good enough. This is especially the case for the key variables including the cost of capital, the quality of output, features of the cities in which utilities operate and quantification of the impacts of regulations (especially differing tax regulations for public and private utilities).

The final factor that may provide a piece of the puzzle is the fact that water utilities have unique features not found in other industries that have been privatized. In particular, we argued earlier about the importance of a competitive environment for achieving efficiency gains. In other sectors (telecommunications, airlines, railroads), privatization has been accompanied by de-regulation. That is, state-owned enterprises have been sold and forced to compete in order to survive. In the case of water, it is difficult to imagine how municipal water utilities could be compelled to compete. For example, OFWAT's efforts to promote competition in the English water industry seem to may been only partially successful (Sawkins, 2001). This is because water utilities are subject to increasing returns to scale. Thus, forcing competition might mean the existence of smaller and more costly firms, thereby defeating the objective.[31]

***Table 1*: Empirical Water Utility Performance Studies**

Author	**Country**	**Method**	**Results**
Morgan (1977)	U.S.	Cost function	Private has lower costs
Crain and Zardkoohi (1978)	U.S.	Cost function	Private has lower costs
Bruggink (1982)	U.S.	Cost function	Public cost lower by 20%
Feigenbaum	U.S.	Hedonic cost	No difference in costs

[31] Some alternatives include: contracting out some or all of a utility's operations through a competitive bidding process and then regularly re-opening the contract for re-bids; competition induced in the equity market; competition for large customers (in particular, the United Kingdom has put some effort into introducing some competition this way).

and Teeples (1983)		function	
Fox and Hofler (1986)	U.S.	Combined production-cost function	cost 'over-runs' of 46% and 43% for private and public, respectively
Byrnes, Grosskopf and Hayes (1986)	U.S.	DEA	No difference in efficiency
Teeples and Gyler (1987a,b)	U.S.	Hedonic cost function	No cost difference in most general model
Byrnes (1991)	U.S.	Cost frontier	No differences in costs
Lambert, Dichev and Raffiee (1993)	U.S.	DEA	Public more efficient
Raffiee, et. al (1993).	U.S.	Cost function	Public and private exhibit 17% and 22% deviation from minimum cost, respectively
Lynk (1993)	U.K.	Cost frontier	Private and public are 11.5% and 2% above respective cost frontiers
Bhattacharyya, Parker and Raffiee (1994)	U.S.	Cost function	No difference in over-all efficiency but private are technically more inefficient
Bhattacharyya, et. al (1995a)	U.S.	Cost frontier	Public and private exhibit 10% and 19% deviation from minimum cost, respectively
Bhattacharyya, et. al (1995b)	U.S.	DEA	Private are 91% efficient while public are 85-90% efficient.
Shaoul (1997)	U.K.	Financial analysis	Privatization raised profits but little else.
Cubbin and Tzanidakis (1998)	U.K.	Cost function and DEA	Methods yield different rankings of relative efficiency.
Ashton (2000)	U.K.	Cost function	Post-privatization average efficiency is 85% and range is 77%-100%.
Saal and Parker (2000)	U.K.	Cost function	Tightened price regulation lowered costs but privatization didn't.
Ménard and Saussier (2000)	France	Regression model	No difference in compliance with water quality regulations
Saal and Parker (2001)	U.K.	Productivity analysis	Privatization increased profits but not productivity.

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CLIMATIC, SOCIAL AND TECHNOLOGICAL CHANGES AND THEIR IMPACTS

WATER RESOURCES CONFLICTS AND CLIMATIC CHANGE

Slobodan P. Simonovic[32]

ABSTRACT

Hydrological changes associated with a greenhouse warming, whether it will rain more or less, for example, are more speculative than temperature projections, especially at the regional and local geographic scales of interest to water resources managers and planners. The most recent analyses suggest that a greenhouse warming will have multiple effects on water supplies. Conflicts could be sparked by the additional pressures. The links among climate change, water availability, food production, population growth, and economic growth are multiple and complex. But climate change is likely to add to economic and political tensions, particularly in regions that already have scarce water resources. A number of important water systems are shared by two or more nations, and in several cases there have already been international conflicts. The system dynamics modeling approach is used to analyze the nature of major links and recommend a strategy that will minimize the potential for conflict and offer sustainable management of available water resources under additional pressure caused by climate variability and change.

1. INTRODUCTION

The IPCC analysis (Intergovernmental Panel on Climate Change, 1998) suggests that a greenhouse warming will have the following effects on water supplies: (1)The timing and regional patterns of precipitation will change, and more intense precipitation days are likely; (2) General circulation models (GCMs) used to predict climate change suggest that a 1.5 to 4.5^{o} C rise in global mean temperature would increase global mean precipitation about 3 to 15 percent; (3) Although the regional distribution is uncertain, precipitation is expected to increase in higher latitudes, particularly in winter; (4) Rise in potential evapotranspiration (ET) -- water evaporated from the surface and transpired from plants -- even in areas with increased precipitation, may lead to reduced runoff, implying a possible reduction in renewable water supplies; (5) More annual runoff caused by increased precipitation is likely in the high latitudes. In contrast, some lower latitude basins may experience large reductions in runoff and increased water shortages as a result of a combination of increased evaporation and decreased precipitation; (6) Flood frequencies are likely to increase in many areas, although the amount of increase for any given climate scenario is uncertain and impacts will vary among basins. Floods may become less frequent in some areas; (7) The frequency and severity of droughts could increase in some areas as a result of a decrease in total rainfall, more frequent dry spells, and higher ET; (8) ☐The hydrology of arid and semiarid areas is particularly sensitive to climate variations; (9) Relatively small changes in temperature and precipitation in these areas could result in large percentage changes in runoff, increasing the likelihood and severity of droughts and/or floods; (10) Seasonal disruptions might occur in the water supplies of mountainous areas if more precipitation falls as rain than snow and if the length of the snow storage season is reduced; (11) Water quality problems may increase where there is less flow to dilute contaminants introduced from natural and human sources.

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Let me quote the words of 100 Nobel Prize winners (2001):

> *The most profound danger to world peace in the coming years will stem not from the irrational acts of states or individuals but from the legitimate demands of the world's dispossessed. Of these poor and disenfranchised the majority live a marginal existence in equatorial climates. Global warming, not of their making but originating with the wealthy few, will affect their fragile ecologies most. Their situation will be desperate, and manifestly unjust. It cannot be expected, therefore, that in all cases they will be content to await the beneficence of the rich. If, then, we permit the devastating power of modern weaponry to spread through this combustible human landscape, we invite a conflagration that can engulf both rich and poor.*

New supplies must be developed and existing supplies used more efficiently. Long-term management strategies should include: regulations and technologies for directly controlling land and water use, incentives and taxes for indirectly affecting behavior, the construction of new reservoirs and pipelines to boost supplies, and improvements in water-management operations and institutions. Other adaptation measures can include removing levees to maintain flood plains, protecting waterside vegetation, restoring river channels to their natural form, and reducing water pollution.

Next section of the paper will briefly discuss the scientific basis of the climatic variation and change. Limitations of climate models to accurately predict the future are addressed next. Discussion of impacts of climate change on water resources follows. The final section of the paper presents the possible solution strategy.

2. CLIMATE CHANGE

2.1. The Scientific Basis

Weather and climate have a profound influence on life on Earth. They are part of the daily experience of human beings and are essential for health, food production and well-being. In common parlance the notions "weather" and "climate" are loosely defined. The "weather", is the fluctuating state of the atmosphere characterized by the temperature, wind, precipitation, clouds and other weather elements. Weather has only limited predictability. Beyond a week or two, individual weather systems are unpredictable. "Climate" refers to the average weather in terms of the mean and its temporal and spatial variability. Climate varies from place to place, depending on latitude, distance to the sea, vegetation, presence or absence of mountains or other geographical factors. Climate varies also in time; from season to season, year to year, decade to decade or on much longer time-scales. Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). "Climate change" may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. "Climate variability" refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability).

2.2. Observed Climate Variability And Change

Earlier studies concluded that, on a global average, land-surface air and sea surface temperature rose by between 0.3°C and 0.6°C between the late 19th century and 1994. Recent IPCC report (2001) re-examined earlier findings, using updated data. Final results are shown in the Figure 1. According to IPCC the global average surface temperature (the average of near surface air temperature over land, and sea surface temperature) has increased since 1861. Over the 20th century the increase has been 0.6 ± 0.2°C. These numbers take into account various adjustments, including urban heat island effects. The record shows a great deal of variability; for example, most of the warming occurred during the 20th century, during two periods, 1910 to 1945 and 1976 to 2000. The satellite data show that there are very likely to have been decreases of about 10% in the extent of snow cover since the late 1960s, and ground-based observations show that there is very likely to have been a reduction of about two weeks in the annual duration of lake and river ice cover in the mid- and high latitudes of the Northern Hemisphere, over the 20th century. Tide gauge data show that global average sea level rose between 0.1 and 0.2 meters during the 20th century.

2.3. Climate Change Predictions

Climate variations and change, caused by external forcings, may be partly predictable, particularly on the larger, continental and global, spatial scales. Because human activities, such as the emission of greenhouse gases or land-use change, do result in external forcing, it is believed that the large-scale aspects of human-induced climate change are also partly predictable. However the ability to actually do so is limited because we cannot accurately predict population change, economic change, technological development, and other relevant characteristics of future human activity. In practice, therefore, one has to rely on carefully constructed scenarios of human behavior and determine climate projections on the basis of such scenarios.
Climate models project the response of many climate variables – such as increases in global surface temperature and sea level – to various scenarios of greenhouse gas and other human-related emissions. Figure 2 (a) shows the CO_2 emissions of the six illustrative scenarios; (b) shows projected CO_2 concentrations; (c) shows anthropogenic SO_2 emissions; (d) and (e) shows the temperature and sea level rise.

Under all IPCC scenarios models predict the rise in both, global average temperature and sea level. The globally averaged surface temperature is projected to increase by 1.4 to 5.8°C over the period 1990 to 2100 (Figure 2 (d)). These results are for the full range of 35 scenarios, based on a number of climate models. Global mean sea level is projected to rise by 0.09 to 0.88 meters between 1990 and 2100 (Figure 2 (e)).

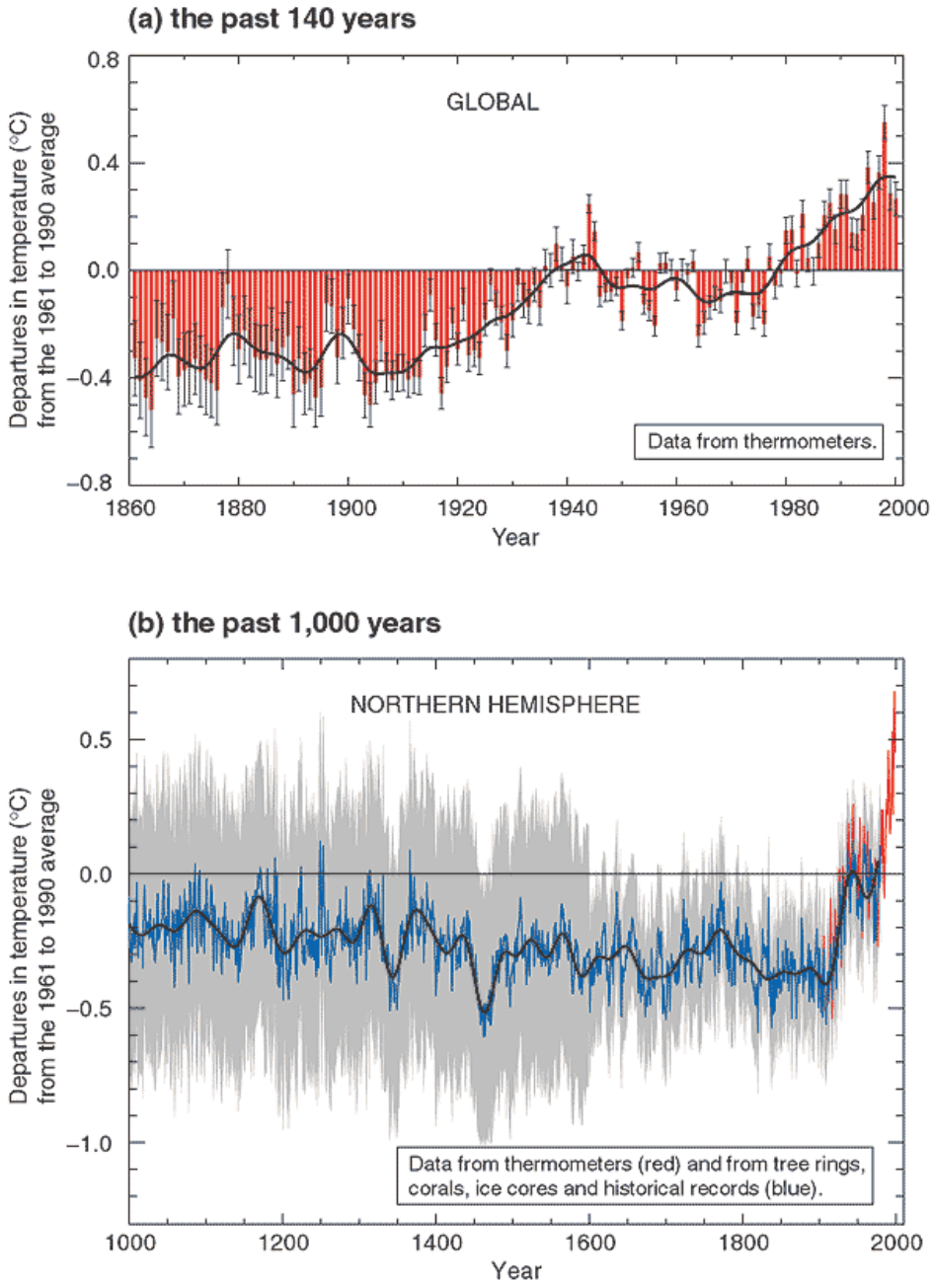

***Figure 1*: Variations of the Earth's surface temperature, after (IPCC, 2001)**

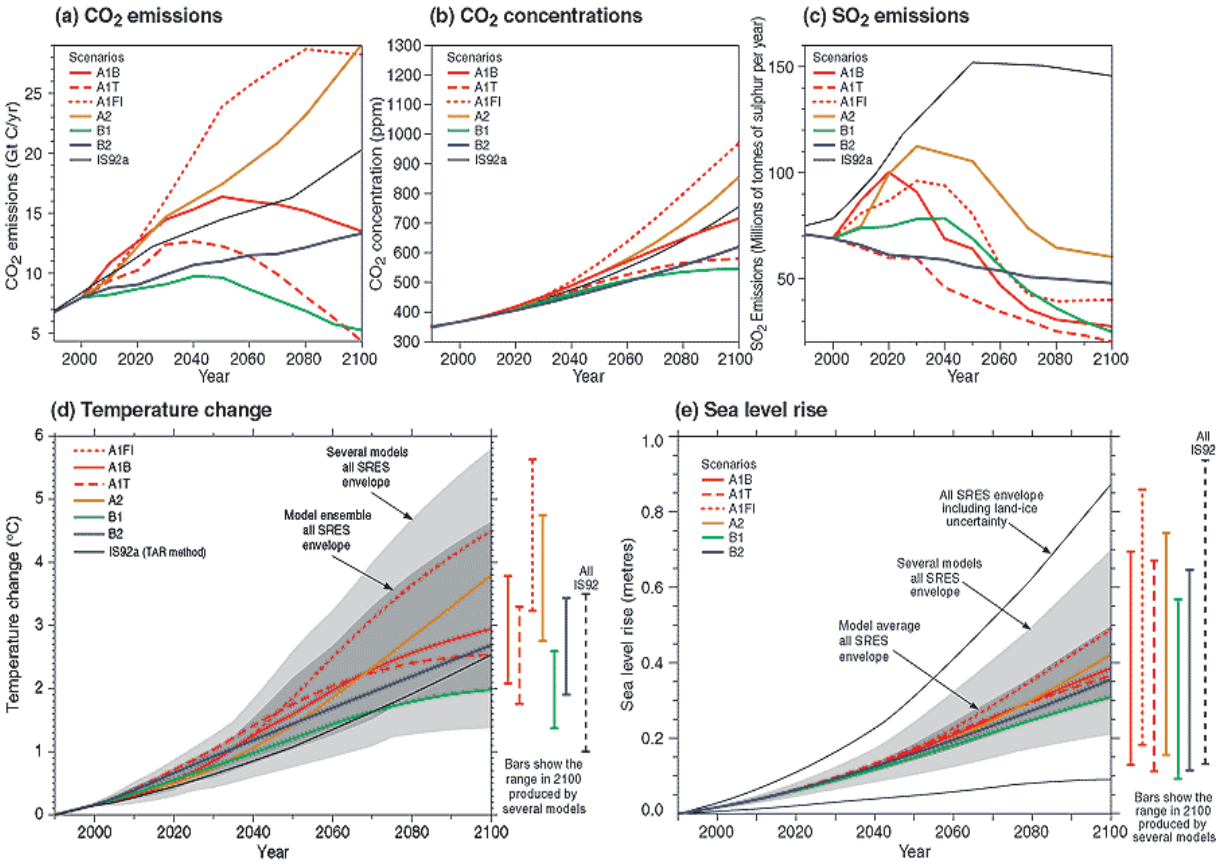

***Figure 2*: The global climate of the 21st century, after (IPCC, 2001)**

3. WATER RESOURCES AND CLIMATE CHANGE

UNEP in the Climate Change Information Sheet 13 identified the following set of impacts on water resources:

Climate change will lead to more precipitation - but also to more evaporation. In general, this acceleration of the hydrological cycle will result in a wetter world. The question is, how much of this wetness will end up where it is needed?

Precipitation will probably increase in some areas and decline in others. Climate models are still unable to make precise regional predictions. In addition, the hydrological cycle is extremely complex: a change in precipitation may affect surface wetness, reflectivity, and vegetation, which then affect evapo-transpiration and cloud formation, which in turn affect precipitation. Meanwhile, the hydrological system is also responding to other human activities such as deforestation, urbanization, and the over-use of water supplies.

Changing precipitation patterns will affect how much water can be captured. Several models suggest that downpours will become more intense. This would increase floods and runoff while reducing the ability of water to infiltrate the soil. Changes in seasonal patterns may affect the regional distribution of both ground and surface water supplies.

The drier the climate, the more sensitive is the local hydrology. Relatively small changes in temperature and precipitation could cause relatively large changes in runoff. Arid and semi-arid regions will therefore be particularly sensitive to reduced rainfall and to increased evaporation and plant transpiration.

High-latitude regions may see more runoff due to greater precipitation. Runoff would also be affected by a reduction in snowfall, deep snow, and glacier ice, particularly in the spring and summertime when it is traditionally used for hydroelectricity and agriculture. All climate change models show increased wintertime soil moisture in the high northern latitudes, with a reduction of moisture in some areas. Most models produce less soil moisture in summer in northern mid latitudes, including some important grain producing areas; these projections are more consistent for Europe than for North America.

The effects on the tropics are harder to predict. Different climate models produce different results for the future intensity and distribution of tropical rainfall.

Reservoirs and wells would be affected. Changes at the surface would influence the recharging of groundwater supplies and, in the longer term, aquifers. Water quality may also respond to changes in the amount and timing of precipitation.

New patterns of runoff and evaporation will also affect natural ecosystems. Freshwater ecosystems will respond to altered flood regimes and water levels. Changes in water temperatures and in the thermal structure of fresh waters could affect the survival and growth of certain organisms, and the diversity and productivity of ecosystems. Changes in runoff, groundwater flows, and precipitation directly over lakes and streams would affect nutrients and dissolved organic oxygen, and therefore the quality and clarity of the water.

Rising seas could invade coastal freshwater supplies. Coastal aquifers may be damaged by saline intrusion as salty groundwater rises. The movement of the salt-front up estuaries would affect freshwater pumping plants upriver.

Reduced water supplies would place additional stress on people, agriculture, and the environment. Regional water supplies, particularly in developing countries, will come under many stresses in the 21st century. Climate change will exacerbate the stresses caused by pollution and by growing populations and economies. The most vulnerable regions are arid and semi-arid areas, some low-lying coasts, deltas, and small islands.

Precipitation, temperature, and carbon dioxide levels can affect the demand for water (Frederick, 1997) as well as the supply.

Irrigation, the most climate-sensitive use of water, accounts for 81 percent of consumptive use (that part of the water withdrawn that is evaporated, transpired, incorporated into crops, or otherwise removed from the immediate water supply). The yields and profitability of irrigated relative to dryland farming tend to increase as conditions become hotter and drier. Consequently, in areas with available and affordable water supplies, hotter and drier conditions would increase both the land under irrigation and the amount of water applied per irrigated acre.

Domestic use. Water for normal household purposes -- drinking, preparing food, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens -- accounts for 20 percent of withdrawals and 5 percent of consumptive use Aggregate annual domestic water use is not very sensitive to changes in temperature and precipitation; estimates suggest that a 1 percent rise in temperature would increase use from 0.02 to 3.8 percent and a 1 percent decrease in precipitation would increase residential water use from 0.02 to 0.31 percent.

Industrial and thermoelectric power uses. Industrial use -- which includes water for purposes such as processing, washing, and cooling in facilities that manufacture products -- accounts for 1 percent of withdrawals and 2 percent of consumptive use. A rise in water temperature would reduce the efficiency of cooling systems, contributing to an increased demand for cooling water. Since more than 95 percent of the freshwater withdrawn for industrial and thermoelectric power use is now returned to ground and surface water sources, this increased demand would not represent a major increase in consumptive use. Global warming would also have indirect effects on industrial and thermoelectric water use. For instance, summer energy use for air conditioning would rise, and winter demand for space heating would decline. Changes in the temporal and perhaps the spatial demand for energy would alter the demand for cooling water.

Instream uses. Changes in the quantity, quality, and timing of runoff stemming from greenhouse warming would affect instream water uses such as hydroelectric power generation, navigation, recreation, and maintenance of ecosystems. These changes might also affect instream water demands, directly or indirectly. For example, changes in streamflows would alter actual and potential hydroelectric power generation, which in turn would affect the demand for substitute sources of electricity. Since thermoelectric cooling is one of the largest withdrawal uses of water, shifts in hydroelectric power production could have a significant impact on the demand for water within a watershed. A warming would increase the potential length of the navigation season on some northern lakes and rivers that typically freeze in winter. To the extent that lake depth and river flow are constraints on navigation, demand could increase for water to facilitate navigation during the extended ice-free period. Similarly, seasonal water demands associated with recreational uses such as swimming, boating, and fishing might rise.

4. WATER CONFLICTS AND CLIMATE CHANGE

Pressures imposed on world water supplies as well as on the demand for water can easily contribute to water conflicts. The links among climate change, water availability, food production, population growth, and economic growth are many and complex. Climate change is likely to add to economic and political tensions, particularly in regions that already have scarce water resources. Understanding the links is one of the research priorities.

Simonovic (2002) developed the *WorldWater* system dynamics simulation model to improve understanding of major links between water resources and development. It contains seven sectors: population, agriculture (food production, land fertility, and land development and loss), nonrenewable resources, economy (industrial output, services output, and jobs), persistent pollution, water quantity and water quality. The total water stock in the model includes the precipitation, ocean resources and nonrenewable groundwater resources. The model is also taking into account water recycling as a portion of water use. The water use side is modeled in a traditional way to include: municipal water use for the needs of population, industrial, and agricultural water needs.

WorldWater simulations are clearly demonstrating the strong feedback relations between water availability and different aspects of world development. Results of numerous simulations are contradictory to the assumption made by the most of global modelers that water is not an issue on the global scale. It is quite clear that water is an important resource on the global scale and its limits do affect food production, total population growth and industrial development (Figure 3). Graphs

in the Figure 3 describe the state of the world according to the model and one development scenario.

WorldWater provides detailed insight into the dynamics of water use over the simulation horizon. Figure 4 shows predicted water use patterns for the set of data from the standard scenario run. Two major observations can be made from this simulation. First, the use of clean water for dilution and transport of wastewater, if not dealt in other ways, imposes a major stress on the global world water balance. Using conservative data on wastewater disposal and rate of dilution from Shiklomanov (2000) and IHP (2000) it is shown that this use exceeds the total water use by six times. Therefore the main conclusion of the global water assessment modeling is that the water pollution is the most important future water issue on the global scale. Second, water use by different sectors is demonstrating quite different dynamics then predicted by classical forecasting tools and other water-models. Inherent linkages between water quantity and quality sectors with food, industry, persistent pollution, technology, and nonrenewable resources sectors of the model create an overshoot and collapse behavior in water use dynamics.
For the standard run simulation, water use is increasing in all sectors by the year 2015. Use of water for agriculture stops growing after 2015 but afterwards remains at the approximately same level since the food production is starting to suffer from the impact of pollution (line 1 in Figure 4). Water use for municipal supply follows the total population and grows until 2015 and then collapses with the decrease in the total population. After 2060, when the water dilution and transport demand is brought under control, municipal water use

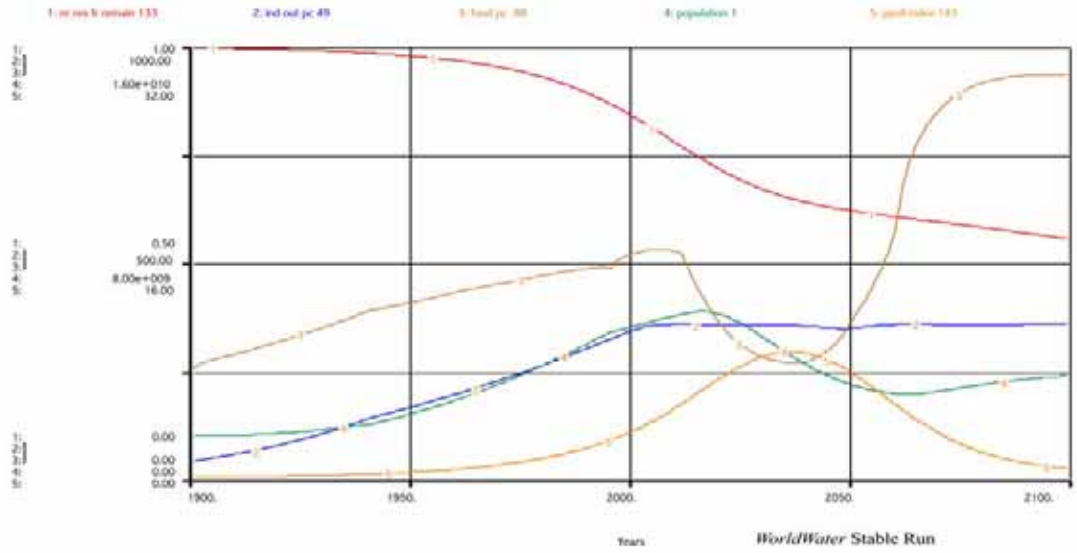

***Figure 3*: State of the World - 'Stable run' results of *WorldWater* model (after Simonovic, 2002)**

begins to rise again (line 3 in Figure 4). Industrial water use shows the very same behavior (line 2 in Figure 4). Reservoir losses rise with the moderate pace following the expected development of water storage around the world (line 4 in Figure 4). Use of water for dilution and transport of wastewater follows the dynamics of persistent pollution. It peaks around 2040 and then after reduction in the growth of food production and the population, starts to decrease. Potential stresses as illustrated in the scenario illustrated in Figures 3 and 4 can easily spark conflicts

between different water users. Strength of the feedback relationships is very high and therefore better understanding of the feedback relationships in work may assist in reaching sustainable solutions for all affected stakeholders.

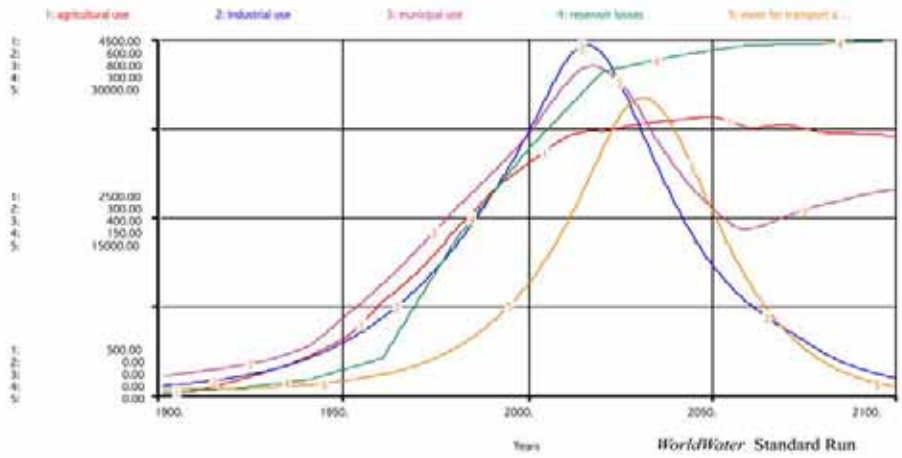

Figure 4*: Use of water - 'Standard run' results of *WorldWater

5. POSSIBLE SOLUTIONS

Climate change directly affects all the main loops describing human development, population growth, land use and food production, industrial development, energy supply, water use and health. One important point must be noted that all the causal loops are exhibiting positive or reinforcing behavior. Positive loops force the system further from the equilibrium state ending in exponential growth or decay.

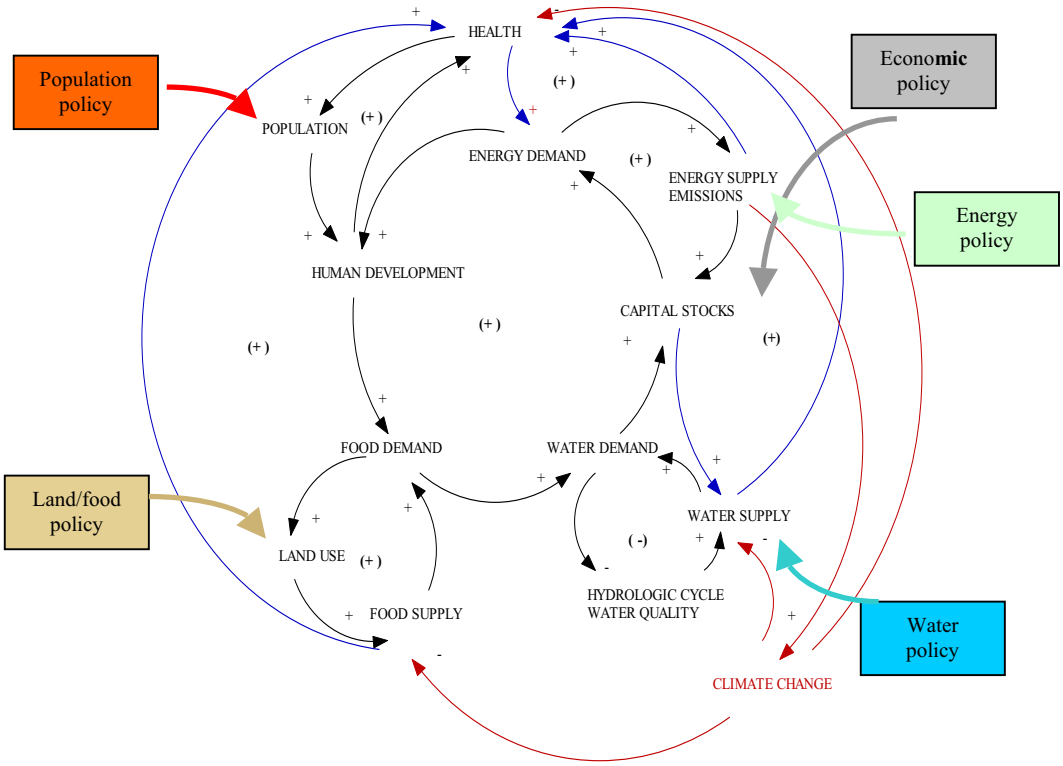

***Figure 5*: Global impacts of climate change: causal relationships and solution points.**

The only solution for the situation illustrated in Figure 5 is possible identification of action points that may change the positive feedback into the negative one. With appropriately set goals, the negative feedback (balancing force) will push the system towards the equilibrium state.

Five policy options are available that will allow for mitigation of negative impacts of climate variability and change. They are: (a) economic policy; (b) population policy; (c) land/food policy; (d) energy policy; and (e) water policy. Partial solutions will not lead to the better world, only delay the inevitable Time is clearly now to develop an integrated front that will mobilize all the forces and act in these five directions so that a sustainable compromise can be reached

6. CONCLUSIONS

I would like to finish this article using the quote from 100 Nobel Prize winners (Science, 2001):

> *The only hope for the future lies in co-operative international action, legitimized by democracy. It is time to turn our backs on the unilateral search for security, in which we seek to shelter behind walls. Instead we must persist in the quest for united action to counter both global warming and a weaponized world. These twin goals will constitute vital components of stability as we move toward the wider degree of social justice that alone gives hope of peace. Some of the needed legal instruments are already at hand, such as the Anti Ballistic Missile (ABM) Treaty, the Convention on Climate Change, the Strategic Arms Reduction Treaties (START), and the Comprehensive Test Ban Treaty. As concerned citizens we urge all governments to commit to these goals which constitute steps on the way to the replacement of war by law. To survive in the world we have transformed we must learn to think in a new way. As never before, the future of each depends on the good of all.*

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CONFLICTS ASSOCIATED WITH INCREASING POPULATION AND WATER NEEDS – CHALLENGES IN THE WATER RESOURCES MANAGEMENT IN INDIA

K. Shadananan Nair[33]

ABSTRACT

Increasing demands for water from various sectors and decreasing water availability due to overuse, pollution and inefficient water management leads to conflicts worldwide, either over allocation or over environmental issues. The situation is more serious in countries like India with a poor economy and increasing population. In India, inter-state water disputes have held up water development for many years, affecting food production, power generation and industrial growth. As India is a large country divided into several States and territories with differing climate and rainfall and there are many big river systems flowing through more than one State, there exist a number of disputes over water throughout the country between different regions and different users. Where as erratic monsoons give rise to disturbances in water scarce regions, high seasonality of rainfall causes problems in heavy rainfall regions. In both cases, improper management and lack of co-ordination between different Government departments can aggravate the problems. Increasing needs and deterioration of resources associated with the fast increasing population will generate new conflicts and worsen the existing ones in the near future. In addition to that is any possible reduction in rainfall or rise in temperature associated with a global change. This paper discusses the present status and change in behaviour of some of the major river disputes within India and with neighbouring countries. A comprehensive hydrometeorlogical study of the region has been made, incorporating the environmental changes. Suggestions for conflict resolution have been presented in view of the worsening conditions, taking into account economic, social and environmental factors.

1. INTRODUCTION

It is estimated that 145 countries are riparian to more than 261 international basins. Political, social and physiographic features of these basins make their management a difficult task (Neupane & Young, 2001). Even in river basins within a country, there are several issues like upstream – downstream sharing, distribution between different administrative divisions and between different sectors and different users. In India, domestic, agricultural and industrial needs, associated with a fast increasing population, degradation of the land, surface and groundwater and inadequate management of water lead to serious water disputes. Irrigation is the largest consumer of water in India and delay in projects due to conflicts has affected the economic and social development, as agriculture contributes nearly 30% of GNP. Equally it means employment for more than half of the population and is the primary source of livelihood in rural areas where three fourth of the Indians, especially the poor live. Even today, only 35% of the cultivable area in India is irrigated, when 70% of the water through rivers flows into the Seas unutilised. Most of the major rivers in India are transboundary in nature. Deficient monsoons reduce river runoff and give rise to disturbances in water scarce regions. Even in the heavy rainfall zones, the high seasonality of rainfall causes seasonal water shortages in non – rainy months. Decreasing water availability will generate new conflicts and

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worsen the existing ones in near future. In addition to that is the threat from any possible reduction in rainfall or rise in temperature associated with a global change.

2. PHYSIOGRAPHY AND RAINFALL

Physiographycally, India may be divided into seven well-defined regions: 1.The Northern Mountains, comprising the mighty Himalayan ranges; 2.The Great Plains, traversed by Indus and Ganga - Brahmaputra river systems - One third of this lies in the arid zone of western Rajasthan and the remaining area is mostly fertile plains; 3.The Central Highlands, consisting of a wide belt of hills running east-west, starting from Aravally ranges in the west and terminating in a steep escarpment in the east. The area lies between the Great plains and the Deccan plateau; 4.The Peninsular plateaus comprising the Western Ghats, Eastern Ghats, North Deccan Plateau, South Deccan Plateau and Eastern Plateau; 5.The east Coast, a belt of land about 100-130km wide, bordering the Bay of Bengal land lying to the east of Eastern Ghats; 6.The West Coast, a narrow belt of land about 10 to 25km wide bordering the Arabian Sea and lying to the west of the Western Ghats, and; 7.The islands, comprising the coral islands of Lakshadeep in the Arabian Sea and Andaman & Nicobar islands of the Bay of Bengal.

India receives an average annual rainfall of nearly 110cm, varying from less than 20cm in the western parts of Rajasthan to more than 300cm in the west coast and northeastern regions. Isolated locations in the northeast receive more than 1000cm and in the west coast receive more than 700cm of rainfall in a year. Most of the interior India is semi arid where rainfall is considerably less. The southwest monsoon (June–September) is the principal source of rainfall that gives 80% of the total for the country, except for the south-eastern coast. Generally, the northeast monsoon (October–December) is the dry period over the country outside northwest India and Tamil Nadu. Northern parts of India receive some winter rainfall from the Western Disturbances. During March to May, certain regions, especially the Peninsula receives some rainfall from the pre-monsoon thunderstorms. The monsoon rainfall over different parts of India shows considerable spatial and temporal variability. The disparity in the rainfall distribution is so great that droughts and floods occur at different parts of the country at the same period and in the same place at different periods of the year. The same is reflected in the water resources and is able to ignite serious disputes over water. Water resources, economy and food situation in India are largely depended on monsoons while the strength of the monsoon is a decisive factor in water resources management. Analysis of the last 100 years rainfall shows that mean rainfall deviation during this period was positive for almost all stations in India.

3. WATER RESOURCES AND WATER AVAILABILITY

Renewable water resources of India are about 4% of the global availability (IWRS, 1998). Today, around 83% of the population comes under the drinking water supply schemes. Only 35% of the cultivable land is irrigated, while 70% of the runoff wastefully joins the Sea. Water deliveries also rarely correspond in quantity and timing of the true requirements (Postel, 99). The annual precipitation in India is estimated to be

***Figure 1*: Major river basins of India**

4000billion cubic meter (Bm^3), of which 3000Bm^3 is in the southwest monsoon season (Central Water Commission, 2000). This precipitation contributes to the formation of twelve major river basins and eight other basins formed by the combinations of medium and minor basins (Figure 1). The major and medium river basins contribute over 90% of the total runoff in the country. Basinwise, the per capita annual water availability shows high spatial variability. In the Brahmaputra River it is as high as 18470m^3 while it is as low as 383m^3 in the basin of east-flowing rivers in the south (Table 1). Having 8% of the country's population, Rajasthan has just 1% of the country's water resource and thereby the basinwise per capita water use in Rajasthan is estimated to be only 562m^3, close to an absolute scarcity. On the other hand, about 40% of the utilisable surface water resource is in the Ganga-Brahmaputra-Meghana system. With 5.9% of the geographical area and 3.2% of the population of the country, the Brahmaputra sub-basin alone has 29% of annual water resource. The per capita annual availability for the rest of the country, excluding the Brahmaputra basin, is about 1500m^3, which falls under "water scarcity" category. The Cauvery, the Pennar, the Sabarmati and the east-flowing rivers are some of the basins, which also face water scarcity. The Indo- Gangetic planes have enormous amounts of water, but the current method of utilization is not appropriate (Serageldin, 98). Of the total water potential of 1869Bm^3, only 1122Bm^3 can be put to beneficial use. Out of this, 690Bm^3 is surface water and 432Bm^3 is replenishable groundwater (Ministry of Water Resources, 1998). There will be a considerable gap between the water need and availability in various sectors in two or three decades from now (UN Newsletter, 1999).

***Table 1*: Major river basins**

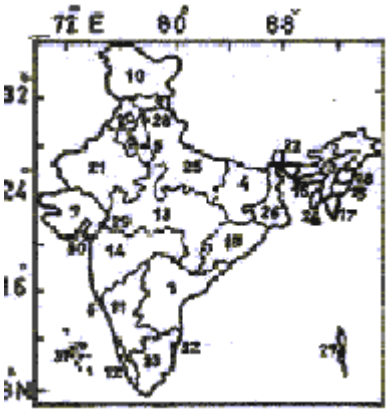
Basin	Length (km)/ Drainage area (km^2)	Surface water/ utilisable surface water/ present use (Mm^3)	Groundwater replenishable/ available for exploitation (Mm^3)	Basinwise Per capita Availability (m^3)
Indus	1114/321289	73.3/46/40	40/26.49/5.22	1749
Ganga	2525/ 861404	525/250/N.A.	170.99/96.37	1471

Brahmaputra	918/861404	585.6/24/N.A.	26.55/21.8	16589
Narmada	1312/98796	45.6/34.5/8	10.83/7.18	3109
Tapi	724/65145	18/14.5/4.5	8.27/3.97	1007
Brahmani-	799/39033	28.5/18.3/N.A	4.05/3.16	2915
Baitarni	355/12879			
Mahanadi	851/141589	66.9/50/17	16.46/13.02	2513
Godavari	1465/312812	110.5/76.3/41	40.65/24.94	2048
Krishna	1400/258948	78.1/58/50	26.41/14.5	1285
Pennar	597/55213	6.3/6.3/5	4.93/2.66	651
Cauvery	800/87900	21.4/19/18	12.3/4.67	728
Sabarmati	371/21674	3.8/1.9/1.8	N.A./N.A.	360

4. WATER AVAILABILITY

Reduction in per capita water availability associated with changes in hydrological balance can create unrest in communities and initiate new water related issues, especially in States with increasing trends for urbanisation, programmes in agricultural expansion and failure in controlling population growth.

***Figure 2*: States of India**



The study using the modified water balance model of Thornthwaite & Mather (1955) reveals that the present per capita availability of the surplus water (after meeting the requirements for evapotranspiration and soil moisture) from precipitation for major parts of the country (except regions with heavy rainfall and sparse population) is 2150m^3, if fully utilized (Table 2). Within 20 years, at the current rate of growth of population and with the predicted increase in global temperature, the availability will be drastically reduced to 972m^3. Even today four states and one Union Territory (Figure 2) have no surplus water on an annual basis. In almost all parts of India, water deficiencies indicate an increasing trend while the surpluses show a decreasing trend. Coming to the possible climate change, according to WMO, rainfall increase may be considerable in the northwest India, but, it may be very low in the south and north, where the increase in precipitation may not be able to compensate for the reduction in soil moisture due to rise in temperature (Bhalme, 1997). This possible increase in rainfall is not sufficient to meet even the existing demands in major parts. The north - eastern States and the Bay Islands have high values of per capita availability. In a changing environment, only the

north – eastern states with low population such as Meghalaya may be free from water shortages. States of Assam and Nagaland will face serious scarcities. Though rich in water, the very high population growth rate in the Bay Island will reduce the availability up to one-fifth of the present level by 2020. New water conflicts will arise in central India, interior Peninsula and in the north-east. Freshwater is always short in the Arabian Sea island of Lakshadweep. But, the particular social background prevents any unhappy events to turn violent. Almost all the existing disputes in the country are likely to worsen in near future. Seasonality of rainfall is reflected in the water surpluses and availability. If the rainfall is highly seasonal, there can be a seasonal surplus though the amount is small (needs for evapotranspiration and groundwater recharge are temporarily met here). It is evident that in India, population increase is a more serious issue compared to the effect of global warming on water resources. The figures of water availability presented are optimum values. If the degradation of water and land resources is considered, the actual availability of freshwater will be much less than expected.

***Table 2*: Per capita water availability in states**

States	Surplus from rainfall (cm)		Per capita water availability (M^3)	
	Present level	***By 2025***	***Present level***	***By 2025***
Andhra Pradesh	34	27	138	52
Arunachal Pradesh	343	299	30318	8882
Assam	313	269	1095	322
Bihar	137	107	283	202
Delhi	0	0	0	0
Goa	1495	1444	4732	2718
Gujarat	60	52	285	127
Haryana	0	0	0	0
Himachal Pradesh	795	787	8562	4558
Jammu & Kashmir	136	134	3909	2073
Karnataka	733	711	3125	1570
Kerala	1615	1542	3542	2113
Madhya Pradesh	358	322	2411	941
Maharashtra	71	57	277	101
Manipur	310	258	3768	1301
Meghalaya	1608	1579	20237	7950
Mizoram	313	261	9566	2519
Nagaland	320	269	4386	760
Orissa	0	0	0	0
Punjab	12	8	30	10
Rajastan	0	0	0	0
Sikkim	2100	2050	36662	15084
Tamil Nadu	96	79	224	113
Tripura	317	263	1206	399
Uttar Pradesh	451	410	954	397
West Bengal	1150	1108	243	102
Union Territory				
Andaman&Nicobar	1705	1626	50112	12325

Chandigarh	0	0	0	0
Dadra&Nagar Haveli	1438	1397	5098	1826
Daman & Diu	1470	1420	1620	659
Lakshadweep	128	105	78	25
Pondicherry	212	183	129	44

5. DOMESTIC WATER DISPUTES

Large areas of the interior part of India are semi arid or arid and there is permanent shortage of water. Even in water rich regions, the occasional shortage in non-rainy months creates tension, especially when the monsoon fails. Flowing rivers cannot respect state boundaries and there are always argument for the control and use of water. Constitutional and legal measures fail here because of political pressure and strong protest from groups of vested interests. Increasing needs associated with fast increasing population, degradation of land and water resources, inefficient water management and possible climate modification may initiate new disputes in several areas. Finding a solution to water disputes by proper allocation of the scarce water is critically important to the welfare of the country. Some of the major water related issues in India are discussed below.

The Krishna-Godavari water dispute: In this dispute among Maharashtra, Karnataka, Andhra Pradesh, Madhya Pradesh, and Orissa, relative success was achieved through negotiations and through the working of a tribunal. Karnataka and Andhra Pradesh are the lower riparian states on the river Krishna, while Maharashtra is the upper riparian state. The dispute was mainly about the utilization of untapped surplus water. The Krishna Tribunal verdict was made in 1973, and was published in 1976. Ruling of the Tribunal's were 1. Projects in operation or under consideration as in September 1960 should be preferred to contemplated uses and should be protected. Except by special consent of the parties, a project committed after 1960 should not be entitled to any priority over contemplated uses. 2. Waters of Krishna may be legally diverted to areas outside the river basin but within the political boundaries of the riparian states. 3. All existing uses based on diversion of water outside the basin would receive protection. After this verdict, the Godavari Tribunal started hearings in January 1974 and gave its final verdict in 1979. However, by this time the states made negotiations themselves, and reached agreements on allocating water through sub-basins.

The Cauvery dispute: This is the most dangerous domestic water issue in India with no satisfactory solution so far. River Cauvery rises in the Western Ghats in Karnataka and flows through 320km in Karnataka and 480km in Tamil Nadu to join the Bay of Bengal. The basin extends over an area of 811km2 in the states of Kerala, Karnataka, Tamil Nadu and Pondicherry. The dispute over Cauvery water distribution between Tamil Nadu and Karnataka dates back to 1807, between the then princely States of Mysore (present Karnataka) and Madras (present Tamil Nadu), when Madras opposed Mysore’s plan to construct a dam in Cauvery, arguing that water flows to agricultural lands in Tamil Nadu would decline. This ended in a war. In 1924, a 50-year agreement for sharing water was signed. After its expiry in 1974, political leaders failed to solve the problem and the dispute ended up in a tribunal in 1991. The tribunal directed Karnataka to release 205 TMC water from

Krishnarajasagar dam to Tamil Nadu. It also asked Karnataka not to expand area irrigated with Cauvery water beyond 11.2lakh acres. Notification of the interim award caused widespread riots and many lives were lost. Karnataka Government was forced to issue an order nullifying the award. Since then, there have been so many suggestions and orders by the Central Government and the Supreme Court of India. however, strong protests including suicides, road-blockings and attacks made no solution possible so far. More than 50% of the surface water potential of Tamil Nadu comes from the Cauvery. 33% of the population depends on it. The river doesn't flow through Kerala, but three of its important catchments are in this State and so water rich Kerala also claims some water. (Manorama year book, 1999).

The Ravi - Beas dispute**:** This is a decades old dispute over the two rivers between the rich agricultural states Punjab and Haryana. The inter-state meeting convened by the central government arrived after an agreement on the in 1955, however new disputes arose with the reorganization of Punjab in November 1966. Agricultural expansion in late 1960s put more pressure on waters of the rivers Ravi, Beas, Sutlej and Yamuna flowing through both these states. An agreement was reached in 1976 in which another state Rajasthan also was included. However, as a result of the opposition by Punjab a new agreement was accepted in 1981. Since then, vested political and personal interests have been making protests and this ended up in a tribunal in 1986. No final decision on the award has been taken yet, because of various political reasons.

The Mullapperiyar issue**:** The tussle here between the southern States Kerala and Tamil Nadu is dealing over the height of a dam in the river Mullapperiyar. The dam was built to divert water to Tamil Nadu on to the Periyar River that fully flows in the state Kerala and exceeds with its more than 100 years old the normal lifetime by more than 50 years. So, there is a concern about its safety. In 1979, Kerala, Tamil Nadu and the Central Water Commission came to an agreement that the maximum reservoir level should be kept low at 136 feet and additional spillways should be constructed to avoid the risk of water level rising in the reservoir. However, till now Tamil Nadu has not completed the construction of spillways. Tamil Nadu now wants the dam height to be raised to the original level of 152 feet. On the basis of the discussions and the directive of the court, a committee consisting of the representatives of the two States was formed to study the safety issues. Kerala had stated at the meeting that no decision affecting the safety of the populace could be taken, and that it would agree to the decisions of the committee only if they are unanimous. However, the committee so far could not arrive at consensus. Kerala is water rich and the problem here is just overuse, mismanagement and lack of awareness to protect national interests.

The Narmada Valley Issue: The Narmada Valley Development Project (NVDP) is a huge construction project, involving the erection of 3200 dams in the Narmada river basin over the course of 100 years. The Narmada River originates in Madhya Pradesh, flows westward through Gujarat to join the Arabian Sea. There is big controversy surrounding the Sardar Sarovar Dam and Irrigation Canal Project, the main feature of the NVDP regarding the technology adopted, safety, economic output, ecological and social impact etc. A 22-year long political and legal struggle ended up in the Narmada Waters Dispute Tribunal's ruling in 1979. The judgement produced a Master Plan for the NVDP, which allocates water to the beneficiary states Rajasthan, Maharashtra, Gujarat, and Madhya Pradesh. It also decided the power sharing and cost sharing for the Sardar Sarovar Project and the Narmada

Sagar Project (NSP). Problems like serious ecological imbalance and human rehabilitation lead to the formation of 'Save the Narmada Movement', which was a non-violent campaign to stop the construction of the dam. The creation of the Sardar Sarovar reservoir will submerge extensive forest and farmland, and will require the relocation of 237 villages. The struggle between environmentalists and Governments still continue.

There are several other disputes going on in sharing waters such as:
The Sone river water - between Uttar Pradesh, Madhya Pradesh and Bihar
The Yamuna river water - between Himachal Pradesh, Haryana, Uttar Pradesh and Delhi
The Tungabhadra river water - between Karnataka and Andhra Pradesh
The Betwa river water – Madhya Pradesh and Uttar Pradesh

There has been a reorganisation of the bigger states like Uttar Pradesh, Madhya Pradesh and Bihar to some new states. So the old agreements between states become insignificant. No doubt new disputes will arise very soon within these states.

6. INTERNATIONAL CONFLICTS AND CO-OPERATION

There have been several disputes on sharing transboundary river waters with India and neighboring countries. Most of them have been settled amicably and opened new areas of co-operation among the countries.

Indo-Bangladesh treaty on Ganga waters: Indo-Bangladesh relations became stronger with the signing of the Treaty by the Prime on 12th December, 1996 on sharing of Ganga waters for a period of thirty years. This mutually beneficial new treaty is an improvement of the agreement signed in 1977, which expired in 1988. As a follow up of the Treaty, Joint Committees have been set up on both sides for monitoring its implementation. Issues related to some other common rivers have been referred to expert group for joint scientific study.

Indo-Nepal co-operation: The scope for co-operation between India and Nepal is in the field of hydropower development of utilizing the rich potential of northern tributaries of Ganga flowing from Nepal to India. Both countries signed a Treaty on Integrated Development of Mahakali River including some barrages and projects in 1996. Still, there are some contentious issues and discussions which ask for a solution. Several projects have been identified and negotiations have been going on for a long time. Joint project offices and field offices have been set up for joint investigations for projects.

Indo-Bhutan projects: Appointment of the Central Water Commission of India as the design consultant for works of Tala Hydroelectric Project in Bhutan opened a new chapter in relations with Bhutan. The Commission successfully performed its responsibilities in hydropower development and establishment of hydrometeorological and flood forecasting network on rivers common to India and Bhutan. There are several other areas related to water resources where more co-operation is expected for mutual benefits.

Indo-Pakistan co-operation and Indus waters treaty: Negotiations held under the International Bank for Reconstruction and Development over the sharing of

irrigation water from the Indus system of rivers culminated in the signing of Indus Waters Treaty in 1960. Under the Treaty, India and Pakistan have created two permanent posts of Commissioner for Indus Waters, one each in India and Pakistan. Each Commissioner is a representative of his Government for all matters arising out of the Treaty and serves as the regular channel of communication on matters relating to implementation of the Treaty. The two Commissioners together form the Permanent Indus Commission.

It is quite interesting to note that the international disputes were easy to solve and they paved way to better and prosperous international relations, whereas the domestic issues remain unsolved and worsened with time.

7. ENVIRONMENTAL FACTORS AFFECTING QUALITY AND QUANTITY OF WATER

There are many factors that affect the quality and quantity of surface and groundwater. Tremendous increase in water for irrigation to meet the demands of a large population is going to be a big problem in the future. Agricultural expansion always has impact on water resources through water logging, fertilizers and insecticides, in addition to evaporation loss during conveyance. Growing industries also has their role in deterioration. Human impacts on groundwater will be a major hazard in freshwater availability. Modern technologies promoted unrestricted use of groundwater through tube wells and have resulted in lowering of water table in many regions and intrusion of saline water in coastal areas. During the latter half of last century, there has been a phenomenal increase in the growth of groundwater extraction structures in the country. In about 50 years the number of dug wells increased from around 4 million to 11 million, that of shallow tube wells from a mere 3000 to 6 million and public tube wells from 2400 to 70000. Overuse of surface and groundwater is so tremendous that in many watersheds it exceeded annual replenishable limits. The trend in overexploitation in some of the major states warns that in two decades from now, water will be a scarce resource in one third of the watersheds. Sand quarrying in rivers and watersheds lead to groundwater depletion and bank and surface soil erosion, affecting the ecology itself, in many river basins. Sand filling of paddy fields and wetlands, which is done against existing rules reduces the groundwater recharge. Deforestation in many water rich regions causes declination in groundwater level as well as summer flow in rivers and water shortages. Farm fisheries in the coastal regions invited seawater far inside, affecting groundwater quality. Some of the projects aimed at agricultural development have deteriorated the groundwater quality. For example, in the southern State of Kerala, the barrage to protect wetlands agriculture from saltwater intrusion and spillway to remove floodwater from the area, now creates serious environmental problems. Influx of pollutants and hazardous chemicals brought by rivers into the logged water in the wetlands made the well water unusable in the whole area. Groundwater pollution due to water logging and waste disposal has become common in many urban areas. Shifting of population to urban areas, most of them not well planned, exerts great pressure on water, disrupts waste removal and often leads to urban rural conflicts as well as to conflicts among different sectors of the urban population.

8. NATIONAL WATER POLICY AND THE INTER STATE ISSUES

Though late, India developed a national water policy in 1987. However, water disputes or any measures to settle them are not clearly mentioned. On the other hand, it warns for the serious shortages in the near future and suggests that water should be governed by national perspectives. In view of an increasing population, the greatest challenge India has to face is the amicable settlements in inter-state water disputes. As per the constitution, water is a State matter and the Union Government has only limited power to interfere in it. except with the consent of the Parliament. However, as long as water continues to be a State matter, it will not be easy to implement the national interest, due to the prevalence of the regional interests. Water-related environmental problems are also becoming transboundary as pollution spread across borders due to the pressure of population growth, increased fertilizer and pesticides, more industries and inadequate pollution controls. National level conflicts are increasingly apparent between the economic sectors due to conflicting requirements for urban, industrial, rural and agricultural uses. A renewed water policy was declared in 2002. However, considerable modification comparing to the previous one is not observed.

9. MEETING THE FUTURE CHALLENGES

Results of the study show a considerable reduction in water surplus and availability in India in the near future, which may worsen the existing disputes and lead to new ones in many parts of the country. Various issues related to water - sharing, diversion, environmental aspects and rehabilitation from project sites etc are likely to worsen in the future. The issues have to be solved in the initial stage itself, without allowing time to grow and to be exploited by vested interests. Unfortunately, the Government machineries in India are very slow. The weak Centre-State relations and regional politics affect the possibilities of amicable settlements. Protests from people or environmental organizations, often politically motivated, interrupt the completion and slow down the developments. This situation, after spending millions of rupees is pathetic because delays and re-estimates waste another millions and retards the development. A consensus should be reached among different political parties, States, communities and beneficiaries, while planning large projects. A policy for the rehabilitation and compensation for the thousands evacuated from project sites should be developed through negotiations. Project implementation should be made only after considering the technical, scientific, social, environmental and economic aspects.

Fairly large potential for harnessing water exists in some of the basins located in northeast India and throughout the west coast. A significant part of this is either not tapped or is wastefully flowing into the Sea, at the same moment when there are serious water shortages and increasing tensions in nearby areas. Efficient measures to conserve, manage and allocate this can settle many disputes. There are rich fertile lands in India where revolution in agriculture is possible if some more water is available. This is vital, as the economy and life are closely associated herewith. Water conservation measures can start from a domestic level. The low coast and environmental friendly traditional methods can solve the regional water problems to a good extend. Conserving the available water by modernization of the existing irrigation systems has to be given more attention so that optimum

utilization of water could be ensured and wastage avoided. Saved water could thus be utilized for extending irrigation facilities to new areas or for raising additional crops in the same area. Adjusting the time of agriculture and use of crop varieties that use less water can also solve the problem to a certain limit. Proper maintenance of the existing system is important, in addition to executing new projects. There should be strong measures to maintain water quality of surface and groundwater bodies and wetlands. Desilting of reservoirs, and measures to prevent land and water degradation are also important. Pollution, over exploitation, unwise use, deforestation in riverheads, sand quarrying in rivers and so on, pose serious threat to the resources. This can be overcome through people's awareness programmes and their active participation in projects. Planning satellite cities with well-planned water supply and wastewater treatment system, may effectively control urbanization.

All disputes concerning allocation, environmental issues and rehabilitations can be solved through effective negotiations, unless there are attempts to keep political, regional and vested interests. One major hazard in settling water disputes in India is that according to the constitution, water is a State matter and the Union government has only limited power to interfere in it. Though, with the consent of the Parliament, the Centre can interfere in case of disputes. However, the Parliament has not made much use of this constitutional provision, mainly due to political reasons. A frequently updated national water policy and a national water commission with judicial power, free from politics and representing different geographical regions can solve the water disputes in India. Of course, a stable government with strong political will is necessary to implement the suggestions. Water is to be considered as a national asset and the constitution needs to be amended to bring it under the direct control of the Central administration. Improved management practices and conservation techniques, joint investment of States in projects and transfer from power from the regional to the national level are some of the ways to minimise conflicts in the changing environment. Resolving the conflict can result in better management of resources, economic and social development and better co-operation among different classes of people. Coming to the international issues, a regional co-operation like the European Union can lead to overall development of the region. Governing water wisely is a key to peace in this century.

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THE SIGNIFICANCE OF CLIMATE CHANGE TO THE VIABILITY OF NIGERIA-NIGER JOINT COMMISSION AND LAKE CHAD BASIN COMMISSION.

Depo Adenle[34]

ABSTRACT

The current threatening water crisis in Africa (due to high population growth rate - 2.8+%, increased urbanization, increase in irrigation, farming and industrialization) is exacerbated by persistent drought in the Sahelian region of Sub-Saharan Africa. The persistent drought has been attributed to possible climate change.
This paper will start by considering the physical, environmental, socio-economic and political settings of the areas covered by the Nigeria-Niger Joint Commission (NNJC) for Co-operation and the Lake Chad basin Commission (LCBC). It will also review the various articles of the LCBC and the NNJC and considers the challenges that climate change pose to the sustainability of these Commissions. It will review the various important clauses and articles of the United Nations Convention on the Law of the Non-Navigational of International Watercourses as they relate to how these can be used to complement those of the Commissions to ensure the necessary co-operation which is at the core of the spirit behind the establishment of these Commissions, and which is threatened by the symptoms of climate change.

The paper will attempt to answer questions such as -

1. How can these Commissions be sustained in the face of declining surface water and groundwater resources, which are possible consequence of climate change, and which have been further compounded by increasing population and economic activities taking into consideration increased demand for water?
2. In the case of Nigeria, what has the water resources development along the Hadejia-Jama'are drainage system done to the downstream users/uses - The Nguru Wetlands, the Komadugu-Yobe flow along the Nigeria-Niger border, the threatened disappearance of Lake Chad, water scarcity in Niger?

1. INTRODUCTION

The LCBC and the NNJC are both river basin organizations (RBOs) that are responsible for the sustainable management of the Lake Chad and the Komadugu-Yobe drainage basins. The latter drainage basin could be regarded as a sub basin of the former, in that the Komadugu-Yobe drainage basin drains into the Lake Chad. Both are transboundary drainage basins and are at the southern fringe of the Sahara Desert. Cameroon, Niger, Nigeria, Chad, and Central African Republic are riparians of the Lake Chad Basin Drainage System, while Nigeria and Niger are the two riparians along the Komadugu-Yobe Drainage System.

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2. PHYSICAL SETTING

2.1.1. Climate

Climatically, the area of jurisdiction of both the Commissions has rainfall patterns that are characteristically Sahelian and are thus highly variable and unpredictable. Furthermore, the region has witnessed a continuous decline in rainfall and persistent drought since the early seventies. The first serious decline was in 1972 and 1973. This was followed by a further decline in 1983 and 1984. The fact that the two very serious droughts are separated by 10 years have led to the suspicion that what is happening here may not be real climate change but a sort of 10-year climatic cycle. This suspicion is further buttressed by the fact that at the beginning of the 1990s, there was some recovery in the Lake Chad level. Furthermore, IUCN (1994) claims that a consistent long-term trend caused by climate changes is not displayed in the Komadugu-Yobe River flow based on the data available, and that only cyclical trends are displayed. They further claim that all river flow data show three distinct low flow periods due to droughts: one in early Seventies (1972 and 1973), one in the mid Seventies (1976) and one in the mid Eighties (around 1984). The rebuttal about climate change had also been made with respect to the analysis of runoff of selected rivers in Asia-Pacific region by Cluis, D. and Laberge, C., (2001). The controversy about climate change is not the focus of this paper. However, the persistent drought between 1973 and 1990 has led to a shift in the isohyetal contours of mean annual rainfall shifting to the south by about 180 km.

2.2. Hydrology

Rivers

The Komadugu-Yobe drainage basin is the largest river basin in northeastern Nigeria, covering about 9 percent of Nigeria's land surface. The lower part of the Basin is the driest area of the country with rainfall in some years barely adequate to enable the cultivation of millet (a dry climate grain).

The Yobe River has two major tributaries – the River Jama'are (which flows from the Jos Plateau) and River Hadejia (which flows from the area around Kano). The river is later joined by River Komadugu Gana to form Komadugu-Yobe drainage system along the Nigeria/Niger border just west of Damask (a town in NE Nigeria) close to where it enters the Lake Chad.

The Hadejia is controlled by three dams at Tiga (1,400Mm³ reservoir), Challawa Gorge (948Mm³ reservoir) and the Hadejia (1,200Mm³ reservoir). These dams account for about eighty percent of the water in the River Hadejia system. Furthermore, a dam is planned on River Jama'are at Kafin Zaki, with a capacity of 2,700Mm³.

Chari and Logone Rivers, which rise in the Central African Republic, account for more than 90% of the inflow into Lake Chad. The conventional basin of the Lake covers more than 200,000 Km² of the entire northern part of the Central African Republic (CAR). Rainfall reaches 1,400mm/year on the Adamawa plateau of the Cameroon. This in effect means that virtually all the rivers that contribute flow to Lake Chad (which is in the Sahel Savannah climatic area) originate in the Guinea Savannah climatic area. As is being played out, the implication for the downstream areas around the Lake, if the upstream sections of such rivers are used without consideration is an environmental and socio-economic disaster.

Lake Chad

Lake Chad is a vast expanse of freshwater shared by Cameroon, Chad, Niger and Nigeria. Its area varies considerably with the amount of annual rainfall. It is considered the fourth largest closed lake in the world in terms of area.

A shallow Lake with a maximum depth of 10 to 11m, it lies in a closed basin. Its depth in the north is 4-8m, while in the south basin it is 2-4m. In normal years the average depth over the entire lake is 1.5m.

The "normal" Lake Chad, covering 22,000km² fell to the "small" Lake Chad of only 2,000km² between 1973 and 1976. Historically, it has undergone several serious natural fluctuations; for example, there were very high water levels in the 11^{th}, 12^{th} and 17^{th} centuries, while it has dried out for some years as well (for 20 to 25 years, i.e. for an entire generation) particularly in the second part of the 15^{th} century (LCBC, 1998).

Groundwater

Information about the hydrogeology of the area and about the availability of groundwater is scanty. Although groundwater is considered to be abundant, it is not always easy to exploit.

In the Nigeria part of the Chad Basin, there have been successful developments in the three zones of the Chad Formation - Upper, Middle and Lower Zone aquifers. The Upper zone extends from the surface to an average depth of 200ft and may reach 600ft locally. The Middle zone is separated from the Upper zone by a clay layer of between 200 and 1,000ft while the Lower zone occurs at depths of 1,390 to 1,676ft (Miller, R.E. et al. (1968).
The water in the Upper zone occurs under both confined and unconfined conditions. Where it is confined, the water in the Upper zone occurs under sub-artesian conditions. The water in the Middle and Lower zones are artesian. Artesian boreholes that were drilled to the Middle zone in the early sixties have heads as high as 70ft above land surface.

Isiorho et al. (1996) concluded that Lake Chad is hydraulically linked with the phreatic aquifer in the basin. They noted that water from the bottom of the lake seeps into the phreactic aquifer, with the measured seepage rate in the southwestern and southern part of the basin in Nigeria being 7.1×10^{-3} m/d. Their findings indicate that recharge from the lake is about 10^{10} m³/yr., which represents an enormous amount of water available as groundwater resource in the Sahelian region of Africa. Also IWACO (1985) estimated that groundwater recharge along the Yobe River between Gashua in Nigeria and Lake Chad (286km.) in 1984 was 17 x 106 m³, further emphasizing the appreciable hydraulic link between surface water and groundwater in this area.

In Niger annual recharge is low and the sustainable yields from groundwater are thus much lower than what the abundant storage suggests. Though the aquifers of this country are generally known, their characteristics are not adequately defined.

3. ENVIRONMENTAL SETTING

The physical and the environmental settings in these two RBO areas are intertwined – natural events such as drought and high rainfall variability and socio-economic activities account for the poor nature of the environment. For example, the indiscriminate construction of dams in the upper reaches of the Komadugu-Yobe has had untold impact on the reduction in the area of the Nguru wetlands, while the virtual disappearance of Lake Chad and poor land use has caused environmental degradation that further accelerates the rate of desertification in the area.

4. SOCIO-ECONOMIC SETTING

Increased economic activities, which led to an increase in population and standard of living, have resulted in over-fishing, over-grazing, poor farming practices and deforestation in the Lake Chad Basin. In addition, increased economic activities in the future could further hasten the spiral of ecological degradation in this basin. Population is growing at the rate of 3 per cent per year in Niger, and this population is concentrated near the water sources in the south (World Bank Report No. 20705-NIR). The projected population of the people who depend on the resources of the lake and the drainage system of this basin could reach more than 45 million in 2020.

Lake Chad and its perennial tributaries, including the Logone, the Chari and the Komadugu-Yobe rivers are, with 1,305 species, rich in fish. The Lake before the onset of the 1973 drought was a lake rich in phytoplankton.

The Yaeres floodplains of the Logone River support flood-recession agriculture, pasture, fisheries, the Waza National Park, and drought security. Irrigation development in the Lake Basin has been practised in all the four riparian nations, although much of this is unco-ordinated and thus affects the flows into Lake Chad, as well as the wetlands in the lake basin. For example, the Maga Dam in Cameroon has reduced the flow of the Logone River and seasonal inundation of the floodplains in the Waza National Park; consequently, the wetland functions have diminished. Fisheries and livestock pasture have been seriously affected, and wildlife is infringing on cultivated land for forage and causing considerable damage to agricultural fields. Unregulated human migration and the resulting activities, as over-cutting of trees for fuel and wood or construction purposes, over-grazing and trampling by livestock, land clearing for agriculture, waterworks or human settlements, have intensified soil degradation and put significant pressure on the resources of the basin.

The post 1973 persistent drought has resulted in almost what can be regarded as catastrophic reduction in lake surface area. The lake shorelines even receded beyond the international boundaries of Nigeria and Niger in very dry years. Reduced surface supplies have resulted in intensified groundwater abstraction for urban and industrial water supply. JICA (1995) noted that in the Maiduguri urban area, there is a serious problem of lowering of the groundwater table because of the indiscriminate withdrawal for water supply and the construction of Alau Dam, which has resulted in the reduction of flooding over the Sambissa Wetland. Similar indiscriminate construction of dams in the upper reaches of the Komadugu-Yobe

River system has had adverse impacts on the Nguru Wetlands and the regime of the river.

5. POLITICAL SETTING

Frequent political instability in some countries of the LCBC poses a threat to the proper management of the Basin's water resources. For example, unrest in Chad forced the temporary move of the Commission from N'Djamena to Maroua, Cameroon, in the period 1981-82. During this period, very little was achieved, and the 1981 Action Plan remained dormant. Of the nineteen projects included in that Plan, of which ten were slated for early execution, only a handful of pilot projects survived in the programme with funding from the Commission's own resources. It is worthy to note that the instability is still much around as reported in the May 30, 2002 issue of a Nigerian newspaper (The Comet) –"Dozens 'dead' in Chad Fighting". The fighting was between government forces and a rebel group. There has also been news of army mutiny in the Republic of Niger during the first week of August 2002, and this current uprising is said to have broken two years of relative calm in one of the world's poorest countries where soldiers mutinied repeatedly in the late 1990s and the army seized power twice.

6. THE RIVER BASIN COMMISSIONS AND THE PROVISIONS OF THEIR AGREEMENTS

6.1. Nigeria - Niger Joint Commission (NNJC)

This is an agreement reached in 1998 between the governments of the Federal Republic of Nigeria and the Republic of Niger concerning the equitable sharing in the development, conservation and use of their common water resources in the following shared basins: the Maggia/Lamido River Basin, the Gada/Goulbi of Maradi River Basin, the Tagwa/El Fadama River Basin, and the lower section of the Komadougou-Yobe River Basin. Part I, Article 1.3 states that the agreement covers the ground waters contributing to the flow of surface waters. The two parties came together not to share the water resources of the basin, but to manage the resource sustainably. They agreed on three areas of co-operation that are essential to the long-term viability of the Commission at all times, even during periods of scarcity: development, conservation and use. The importance of this is that the Commission recognizes the significance of the the hydraulic link between surface and ground waters in this region. The rivers and the lake recharge the aquifers through seepage from their beds. Thus when dams are constructed, their impact on the flow regime is usually quickly felt with regard to recharge and reduction in wetlands.
The following articles of the agreement are relevant with respect to the proper management of water resources and protection of the environment in this fragile arid area vis-à-vis the sustainability/viability of the Commission - Part II, Article 2, Article 3 and Article 4; Part III, Article 5 to 9; and Part VI, Article 16 and Part VII, Article 17. Part II deals with the rights and duties of both countries. According to Article 2, each country is entitled to an equitable share in the development, conservation and use of the water resources in the shared basin. Article 3 focuses on water resources information and data gathering, archiving, sharing and monitoring, which are essential to long-term co-operation as well as integrated management of the resource. This Article stipulates that Nigeria and Niger undertake to collect, process and provide at regular intervals the NNJC with all the

data and information which, in the opinion of the Commission, are needed to arrive at equitable sharing determinations, and to monitor the continued viability thereof. Furthermore, at the request of the Commission, the two countries shall each – (a) install in his territory the required measuring equipment and protect such equipment from interference, and (b) permit and facilitate inspections by the commission of such equipment.

Article 4 calls for each contracting party to inform the other in advance of undertaking a project, programme or plan for the implementation of agreed upon equitable sharing determinations, or that is likely to have an appreciable impact on any such determination.

Part III deals with equitable sharing determinations, and Article 5, No. 1 of this Part seems to be very conscious of the high variability of rainfall and its unpredictability and their impact on water resources and the environment. This article lists twelve factors that should be considered in determining equitable share. These twelve factors are:
The climate of the region and its influence on and rainfall patterns;
Rainfall patterns, and their influence on surface hydrology and related hydrogeology Surface hydrology and related hydrogeology;
Existing uses of the waters;
Reasonable planned water development requirements;
The economic and social; development needs of the Contracting parties;
The dependence of local populations on water in question for their own livelihood and welfare;
The availability of alternative sources of water to satisfy competing water demands;
The practicability of compensating either in cash or in kind one or other Contracting Party as a means of adjusting competing water demands;
Maintaining an acceptable Environmental balance in and around a particular body of water;
The avoidance of unnecessary waste in the utilization of waters, with due regard to the technological and financial capabilities of each Contracting Party;
Article 5, No. 2 notes that each factor is to be given the weight warranted by the circumstances peculiar to each individual river basin, or group of basins, and all factors are to be considered together.

Article 6 – A water use existing at the time an equitable sharing determination is made shall take precedence over a future use, provided the existing use is beneficial to both contracting parties and reasonable under the circumstances.

Article 7- A water use existing at the time an equitable sharing determination is made shall take precedence over a competing … use which came into being later in time, provided that:
The use prior in time is beneficial to both Contracting Parties and reasonable under the circumstances; and
The weighting of the factors under article 5 does not warrant accommodation of the later use, in whole or in part.

Article 8 – A water use shall be deemed an existing use within the meaning and for the purposes of Article 6 and 7 by reference to, and within the limits of, the amount of water which has been put to a beneficial use from the date of inception of

construction or comparable acts of implementation to the date of entry into force of this agreement.

Article 9 – Groundwater resources shall not be accounted for the purpose of equitable sharing determination unless:
Such resources are part of shared river basins within the meaning of Article 1, paragraph (3); or
Such resources lie in whole or in part within the shared river basins and are bisected by the common frontier between the Contracting Parties.
It is not surprising that these factors are stipulated because the NNJC agreement came into being when all the harsh impacts of the persistent drought of post 1973 were evident which were exacerbated by the indiscriminate construction of dams in the upstream reaches of Komadugu-Yobe without due consultation with downstream users regard for downstream uses. The factors listed in the UN Convention on the Law of the Non-Navigational Uses of International Watercourses Part II Article 6 (Salman and Boisson de Chazournes, 1998) seem to have informed the drafting of the twelve factors that are proposed to govern how to determine equitable share in Part III, Article 5 of the Nigeria-Niger Joint Commission Agreement. It is interesting to note that NNJC Agreement was signed in October 1998, seventeen months (May 1997) after the UN Convention was opened for signature. It is therefore not coincidental the NNJC is more focused and explicit with respect to the proper management of water resources and the environment when compared to those (for example, the River Niger Basin Authority) that predate the UN Convention. Focused and explicit objectives of the RBOs are crucial to their success (Rangeley, R. et al., 1994.) and their viability in the long run.

Part IV, Article 16 deals with Special Provisions for the Komadougou-Yobe Rive Basin. This Article requires both countries to inform the NNJC of agreed- upon equitable sharing determinations concerning the lower section of the Komadougou-Yobe River Basin as defined in Article 1, including any subsequent adjustments thereof, and any plans, projects and programmes for the implementation of such determinations.

Article 16 probably needs to be amended in the light of the fact that what happens in the lower section of the Komadougou-Yobe River Basin is dictated by the impact of water schemes in the upper reaches of this drainage basin which are located in Nigeria. Furthermore, co-operation is not only necessary between Nigeria and Niger but also between the various states within Nigeria, namely Kano, Jigawa, Bauchi, Yobe and Borno. The downstream states, in particular Borno and Bauchi, as well as Niger complain that the construction of many dams upstream, with no regard to any integrated water management policy, has deprived the Komadougou-Yobe of regular water supplies and this, in addition to drought, has led to the situation in which this river is dry for half of the year; it used to flow for nine months. What has happened in the upstream portion of the Komadougou-Yobe River system is difficult to reconcile with Article 5 of NNJC and Article 6 of the UN Convention.

Part VII is on settlement of disputes. This provision is very important concerning the viability of the Commission because it creates a framework for conflict resolution and thus long-term co-operation.

6.2. Lake Chad Basin Commission (LCBC)

Four countries – Cameroon, Chad, Niger and Nigeria – sharing the lakeshore, formed the LCBC in 1964. It has very wide objectives which include regulation and control of the utilization of the water resources and other national resources as well as the initiation, promotion and co-ordination of projects and settlement of disputes. These objectives are captured by the following sections of the articles of the Commission's agreement: Chapter II, Article, V and VI, and Chapter III, Article IX a, b and g. Article V states that "The Member States undertake to abstain from taking, without prior consultation with the Commission, any measures likely to have an appreciable effect either on the extent of the loss of water or on the nature of the yearly hydrogramme and limnigramme and certain other features of the Basin, the conditions subject to which other riparian States may utilise the water in the Basin, the sanitary conditions of the waters or the biological characteristics of its fauna and flora.

In particular, the Member States undertake to abstain from carrying out on the portion of the Basin subject to their respective jurisdiction any hydraulic works or soil scheme likely to have an appreciable effect on the flow of surface and subterranean water in the Basin without adequate notice to and prior consultation with the Commission.

Provided, however, that the Member States shall be at liberty to continue to implement existing schemes and projects or those that are likely to be started within the period of three years after signing this Convention. Provided further that such schemes and projects will not have adverse effect on the regime of the Chad Basin.

The scope of this article is, to a very great extent, adequate with respect to the proper management of water resources in this basin if there is an appropriate management structure for this shared basin that will ensure compliance with its implied and real intentions. However, there is no legal instrument to ensure compliance. Even one would have fallen back on international law for the guaranteeing of proper management of the water resources of this region, but as observed by Salman, M.A.S., (2001) there is still no international legal instruments in force regulating the use and protection of international watercourses, and thus the rights and obligations of riparian states. The United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses (the UN Convention) that was adopted by the General Assembly of the United Nations on May 21, 1997 has not yet entered into force and effect.

Firstly, it is difficult to define what appreciable effect means. Secondly, appreciable effect may not be felt in the short run because by the time an appreciable effect is felt and determined, the damage done may not be readily reversible. In essence, it will be highly desirable for the Technical Committee of the LCBC to identify "sensitive environmental indicators" that could provide early warnings about any adverse impacts that the water resources and the environment of this basin may experience. (This may be one area where External Support Agencies could be further supportive of the SSA RBOs). Probably for the same reason the Lake Chad Basin Strategic Action Plan of 1998 recommends that vigilance is required to avoid over-exploitation of resources such as the excessive water diversions to supply water to large cities such as Kano in Nigeria. This recommendation seems a little

belated in that dams have been built in Kano State in Nigeria that have resulted in the disappearance of the Komadugu-Yobe before it enters Lake Chad and that have resulted in the reduction in the length of flooding for the flood-recession agriculture in the fadamas of downstream States such as Yobe State.

It is interesting to note that The Comet (a newspaper in Nigeria) wrote on July 20, 2002 "A few years ago, Tchad and Nigeria came into conflict over the lake. Today, the lakeside states deal with litigation *(possibly the paper intends to write conflict resolution instead of litigation)* within a four-party commission *(possibly the paper means LCBC).* A mixed police brigade patrols the lake. They sort out trafficking, illegal fishing and various minor conflicts amicably…"

Article VI stipulates that Member States, in order to achieve maximum co-operation in connection with the provisions of Article V, undertake to inform the Commission at the earliest stage of all studies and projects upon which they propose to embark. It is very interesting to note that this Article is very much in line with the provisions of Part III, Article 11 of the UN Convention on the Law of the Non-Navigational Uses of International Watercourses.

Chapter III, Article IX contains a list of the functions of the Commission. Three of these functions concerning the management of water and related resources in the basin are Article IX a, b and g. These are:
Article IX a - Prepare general regulations which will permit the full application of the principles set forth in the present Convention and its annexed Statute, and to ensure their effective application;
Article IX b- To collect, evaluate and disseminate information on proposals made by Member States and to recommend plans for common projects and joint research programmes in the Chad Basin;
Article IX g – To Examine complaints and to promote the settlement of disputes and the resolution of differences.

The LCBC came into being long before the Rio-Dublin Principles and the UN Convention and thus, it is not surprising that its Articles are not informed by both and are not as focused and explicit as those of the NNJC which started in 1998. Furthermore, at its inception there was no drought and the population as well as the economic activities around Lake Chad was about 50% of what it is now. Nigeria's population in 1972 was about 65 million and is now about 120 million. At that time, artesian boreholes that tap the Middle Zone aquifer of the Chad Formation had heads as high as 70ft (21.4m) above land surface. In short there was no threatening water crisis and no pressure on land and the region was relatively stable politically. It is therefore, understandable that the LCBC's objectives were not focused. On the other hand the NNJC was created as a way of combating the looming water crisis in a section of the Chad Basin.

7. CONCLUSION

Viability of the two Commissions will surely depend on co-operation – a co-operation that is built on focused objectives. The areas where co-operation is called for are the areas that could be sources of conflict. Most of the members of the two RBOs (Niger, Chad, Nigeria and Cameroon) have most or a sizable part of their landmass in the Sahelian region of Africa. Here everything (socio-economic activities) depends on water availability. Thus a sustainable and a dynamic

approach to the management of water resources is at the core of the viability of the Commissions. A critical review of the Articles of the NNJC captures the essence of such an approach. Thus all that is required is for Nigeria and Niger to comply with the clauses of the agreement reached. Furthermore, where there were projects that predated the establishment of these commissions and such projects fail to consider the interests of downstream users, they need to be considered, as suggested by Diyam Consultants, in the technical recommendations for improvement of the management in the Hadejia-Jama'are-Yobe River Basin (IUCN, 1999) with respect to regulated releases from several dams that were in existence before the inception of the NNJC.

Apparently one smart move made by the two riparians of the LCBC (Niger and Nigeria) in the light of the recommendations in the Strategic Action Plan for Lake Chad Basin (LCBC, 1998) was the creation of a bilateral institution (NNJC) for the management of Komadugu-Yobe drainage basin. This move is in line with the observation of Rangeley, R. et al., (1994) that RBOs that have only two members tend to be more successful than those with many members because co-operation in such an organization is easier. Such co-operation will require the riparians in these two Commissions to be fully committed to managing their water resources on an integrated basis, that is, managing the water resources of the two RBOs on a basin-wide scale. If this is done, dams will not be built as is done in the upper reaches of the Komadugu-Yobe river system for irrigation purposes without proper environmental impact assessment and without taking into consideration the effects on people and environment downstream. Furthermore, proper planning would be made such that the acreage under irrigation will not be far below the acreage that could be irrigated from constructed dams. For instance, in the Nigeria part of the Komadugu-Yobe drainage basin 20 dams were built or were under construction and 9 were contemplated as of 1998, whereas only 36,620 ha were irrigated out of intended 188,780 ha. Much water is therefore unused or lost through evaporation in the reservoirs or silted-up beds on the plateau. The total annual evaporation is about 80 inches (2,032mm) from free water surface in the Komadugu-Yobe Basin area.

The membership of the LCBC (only 5 riparians) is manageable, since its size has not been the key factor responsible for its limited achievement but its wide objectives are. Success or viability of this RBO at this period of persistent drought depends on a move away from wide objectives. It will need to make its objectives well focused and redone in such a way they capture the key clauses of the UN Convention. Rangeley, R. E., et al. (1994) noted that the LCBC is one of the three least successful RBOs of all those that they reviewed because of their wide objectives.

Viability of these RBOs will also require that they move away from a mindset that considers that the basis of co-operation is mainly to share the waters of international rivers, and embrace the fact that the issue of shared rivers centers on the need for co-operation between riparian states, not only for sharing waters but also the benefits derived from these rivers (Salman, M.A.S., 2001).

Managing the water resources of these two RBOs in a sustainable manner (which is the only sure way to guarantee their existence in the long run) will require consideration of the above suggestions and will also need to involve the following:

Harmonization of the water resources laws of the riparian countries;
Development of adequate and appropriate water resources database, state of the art data monitoring and evaluation system, data archival and dissemination system, etc.
Public awareness about water and natural resources conservation;
Public awareness about and adoption of proper land use and watershed management;

Finally, the countries covered by these two RBOs need to develop national drought policies that should also be harmonized into a regional policy. Drought is a continually occurring climatic phenomenon in this climate belt and Lake Chad, being a good regional integrator of local precipitation, has changed over the years in relation to periods of drought and abundant precipitation. Olivry et al. (1996) revealed that the Lake, being subject to serious natural fluctuations, recorded high levels in the Eleventh, Twelfth and Seventeenth centuries, while the lake has also dried out for 20 to 25 years in the latter half of the fifteenth century. Therefore, the policies should focus on droughts being accepted as part of the natural climate variability. The drought policies that need to be adopted should be those which can borrow ideas from those of the U.S.A. and Australia and will need to emphasize the protection of natural resource base (White, D.H., and et al. (2001). Furthermore, there should be awareness among riparians and communities that the solution to the problems of drought is acceptance by those living in climate-sensitive areas like the Sahelian region of Sub-Saharan Africa and that climate variability is an integral part of their environment and one that they must plan for, adapt to, and manage as responsible stewards of their land.

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WHAT INCENTIVES DOES WATER OFFER FOR CO-OPERATION?

WHAT INCENTIVES DOES WATER OFFER FOR CO-OPERATION?

ETHICAL AND CULTURAL INCENTIVES OF WATER FOR CO-OPERATION

Fekri A. Hassan[35]

"*…the real problem to be faced in this final assessment [of the human prospect] is not that of establishing a timetable for resource or environmental frictions. It is taking the measure to the institutional and attitudinal changes that will be required of future generations, and of weighing the various means by which society can enforce whatever adaptational or transformational changes will be necessary for survival*" (Heilbroner, 1980, p. 171)[36].

1. A SOCIOLOGY OF CONFLICT AND CO-OPERATION

Conflict and co-operation are **social processes** embedded in a deeper cultural matrix. As such, any attempt to transform situations of conflict or potential conflict must entail an understanding of social change.

In developing ethical and cultural incentives of water for co-operation we must indeed explore the means by which societies undergo transformational changes, and to understand the processes by which attitudes and institutions change.

As humans, we operate as **individuals in society**. We are all endowed with potentialities and dispositions shaped by our biological inheritance within the matrix of cultural traditions.

Our outlook on life, perceptions, cognitive styles and sensibilities are the result of the dynamics of **being in the world**; coping within the parameters of our cultural inheritance with ever changing life situations.

We are neither passive puppets, enacting traditional cultural programs, nor free agents who can create our world *ex nihilo*.

We acquire **cultural traditions** from parents, family members, educators, politicians, priests, professionals, and others in the process of becoming members of society. We are constantly socialized by others. But, we are also active in socializing others depending on our role and standing in society. Our influence and that of others can be negligible or extremely influential. But we rarely ever totally ape others, or faithfully reproduce cultural traditions. We are, in fact, **active agents of change**—developing new ideas from old ones, modifying our actions to suit novel situations, and exploring innovative means to ensure our survival and well-being within cognitive schemata of who we are and what we want from life.

Society is ultimately an arena of **bubbling innovations** advancing, bending, or clashing with traditions. Social change, in the long run, is a function of the differential adoption of novel ideas, modes of behaviour, belief systems, technical innovations, or social institutions. Such innovations may prove to be ephemeral or permanent. Their permanency depends on their compatibility with pre-existing

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cultural modalities and their perceived benefits weighed against their perceived ill-effects.
The continuity and sustainability of a society ultimately depends on how to secure social co-existence among members of society, minimizing disruptive inter-personal clashes while ensuring collective survival. For this reason, traditions are maintained to secure a sense of order and stability, but a blind or a dogmatic adherence to tradition can cripple societies in coping with new situations. Hence, societies cannot survive long without admitting change and innovations.

2. HOW DO SOCIETIES EMERGE AND HOW DO THEY CHANGE?

The human society is the product of a long evolutionary journey that was characterized and distinguished by two forcing mechanisms, (1) **social organization**, and (2) **intelligence**. Our ancestors succeeded in earning a place in the web of life because they shared food and information, and worked together to repel predators and protect each other. Our species also prevailed not because we obediently adapted to our environments, but because we developed an awareness of our surroundings, because we developed a sense of the past and the future, because we searched for information and stored it to retrieve it when needed, and because we could process information and make decisions rather than blindly following our instincts.

3. THE ETHICAL IMPERATIVE

One of the main developments that secured our success, so far, has been the ability to share raw information and ideas. Individuals reasoned together and eventually settled on certain codes of action and sets of belief. Generations passed their collective knowledge to their predecessors who guarded and enshrined the wisdom of the ancestors—a wisdom earned the hard way from trial and error. One of the most fundamental sets of beliefs in our intellectual inheritance was "Ethics". This set of beliefs provided directives for what a society deemed to be the right action. Because of the primacy of such directives and critical importance to society, ethical notions were enshrined in rituals and imbued with a sense of inviolability, and sacredness, sanctity. Such high-order beliefs about human conduct and action are bonded in our minds with deep emotions, feelings, and sentiments that verge at times on passion, zeal, and devotion. Ethics is not thus the dry subject of textbooks. It is the incendiary fuel of disputation and the pacifying ointment of social cohesion.

4. INCENTIVES BETWEEN TRADITIONAL CONSERVATISM AND OPPORTUNISTIC PAYOFFS

Incentives aimed at encouraging co-operation rather than conflict in international as well as regional and community management of water resources cannot be separated from existing modes of ethical and cultural beliefs and attitudes. The incentives cannot be considered without the **cognitive and emotive processes by which individuals accept or reject new ideas** transmitted as messages by messengers through specific channels of communication.
Efficacious incentives are those that either amplify an existing belief or those that promise a better payoff—personal, social, or economic. For this reason, the process

from conflict to co-operation is never purely a matter of economic calculus, ideological confrontations, or legal disputation. Every party to a conflict in a governmental delegation or a professional team is an individual, a human being, a social artifact and a social agent.

4.1. Incentives And Social Hierarchy

We must also recognize that modern complex societies are not homogeneous cultural entities. Differences exist between rural and urban populations, between people of different occupations, and between people who have been brought together from different ethnic backgrounds or religious beliefs in a single political body—the nation state. Thus, although disputes over water resources are arenas of transactions structured by governmental state organizations, financial and economic corporations, military establishments, educational institutions, science and technology foundations, and organized religious orders, incentives for co-operation in water resource management are a function of the ethical values and cultural background of the individuals who make and belong to various social institutions.

4.2. Incentives: The Human Dimension

There has been a tendency to regard water conflicts as a matter of inter-governmental concern that can be resolved or reversed through treaties. The role of individuals (either as members of government or the "Public") is rarely considered as the primary locus of social change. Harold Saunders, who has been involved in conflict resolution for more than two decades, has aptly concluded "*recognizing the human dimension of conflict opened the door to seeing peacemaking as a process not limited to the work of governments. Important as that work was…, it depended in fundamental ways on changes in human relationships—an arena well beyond the reach of governments alone. As that insight became more concrete, it enlarged the concept of the peace process*" (Saunders, 1999, p. xix)[37].

4.3. Incentives And Emotions

In conceptualizing an effective strategy to transform potential conflict to profitable co-operation and a peaceable coexistence among contenders, the process must also be regarded as much more than that involved in "negotiations" grounded in economic, legal, or political transactions. Incentives to genuine change to go beyond conflict to co-operation cannot be brought about without **a change of "heart**" among a significant majority or an influential minority in society. By "heart", I refer here to the unfathomable ethical and cultural normative views with the inevitable spectrum of emotions, passions, and feelings that often permeate perceptions of conflict and confrontation. Genuine change, we must recall, is a function of social messages that appeal to cardinal ethical and cultural lineaments of the self as a socialized entity (e.g., patriotism, religious beliefs, ethnic lore, or self worth). Equally important are perceived personal, social, and economic benefits or losses to individual parties.

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[37] SAUNDERS, H. H. 1999. *A Public Peace Process: Sustaining Dialogue to Transform Racial and Ethnic Conflicts*. New York, Palgrave.

Mistrust, grievances and enmities are obstacles to resolving water conflicts, which are often embedded in a historical context of emotional dimension. There is thus no ready-made, generic, off-the-shelf, objective formula to resolve conflicts or nudge people to co-operate. For each case, social scientists have to identify key, influential messengers and principal parties (organizations and groups), as well as the prevailing conceptualizations of the conflict, the stage of conflict, the current modes of conflict management, the potential for diffusing conflict, and the traditional modes of conflict resolution. Incentives for co-operation must involve reconciliatory mechanisms to sustain a positive milieu for dialogue.

5. THE TRANSCULTURAL ETHICAL IMPERATIVE

I will argue in setting the stage for the development of incentives aiming at a "water for peace" paradigm that such a great notion cannot be effectively persuasive unless it is founded on **a trans-cultural ethical foundation of the concept of justice and equity**. Co-operation is not simply a function of a cessation of conflict and hostilities. Co-operation is bound with notions of mutual recognition of rights and obligations, mutual respect and acceptance—which are grounded in the ethics of justice and equity. There is really thus no chance for sustainable co-operation without the promulgation of justice and equity among nations and within societies as the very foundation of co-operative ventures.

6. FROM IDEAS TO INSTITUTIONS

Ideas cannot be lodged in the human psyche without successive demonstrations of their efficacy, beneficial rewards and their role in mitigating danger and averting harm. Incentives must thus involve the **active pursuit of actions with tangible benefits** and the demonstration of the ills of conflict and confrontation.
Incentives for the resolution of water conflicts and the promotion of co-operation are far more likely to succeed if they are not solely focused on a disputation of water rights, legal obligations, or historical claims. Water as a sanctified substance with multifarious importance to human survival has the potential of mobilizing people in and outside governments to a higher order of dialogue between and within nations, involving broad economic and security arrangements.

The process of resolving conflicts and creating an environment supportive and inductive to co-operation engages deep ethical and cultural beliefs of many actors who may also have vested interests in the *status quo*, and who are interdependent and co-dependent on others operating with the same or other institutions. Incentives thus should not be restricted to a demonstration of the overall advantages of co-operation, but must be extended to incentives for tactical actions in the long term process entailed in institutionalizing co-operation. In this respect, a recognition of the sequential phases involved in the development of sustainable co-operation is important.
This long-term process entails:
1) inception,
2) incubation,
3) proliferation and diffusion,
4) amplification and reinforcement (racination).

These stages are not linear and may coexist. Certain stages may be skipped, but for social change within the span of decades (intra-generational) to become a cultural change it must survive from one generation to another and must spread from one community to many others. This cannot take place without a process of racination, in which an innovation takes root as a fundamental, axial notion in the minds of people—becoming a founder notion of deep significance in the making of self and its view of the world (e.g., notions of cars and mobility; of monotheism; of status and its material manifestations; of democracy and parliaments).

7. THE ROLE OF PROFESSIONALS

Water conflicts are too pervasive, too socially constructed, to be viewed as purely political issues left to diplomats, policy-makers, and legislators. I suggest that a partnership between professionals and the public is essential for promoting co-operation. As physicians save lives regardless of nationality, color or creed, water professionals must develop an ethical code of conduct that will serve as an incentive to act ethically for the promotion of water for peace and prosperity. Professionals will need incentives to encourage them to co-operate with other professionals to meet the demands of integrated management of international and national water resources. This will require also a change in university curricula and job descriptions.

8. WHY ARE INCENTIVES FOR THE PUBLIC IMPORTANT?

Clearly any change imposed from the top will be short-lived unless it entails a mechanism winning the support of the Public regardless of the political configuration of the state. Enforced co-operation based on intergovernmental treaties, e.g., as in the Middle East, does not succeed without public support. By contrast, people may adopt social innovations conducive either to co-operation or confrontation in violation of governmental edicts. We only need to recall the emergence of Christianity and Buddhism as popular social movements or the surge of militant ethnic and sectarian movements in different cultural settings from prosperous, industrial nations to impoverished, rural countries. Such movements grounded in passionately held beliefs (religious and ideological) often lead to a transcultural tidal wave that may force a gradual or revolutionary change in government.

Quite often, governments as well as interest groups or civic organizations may co-opt mass movements (e.g., Christianity or trade unions) to suit their political agendas. Ultimately, however, the manipulation of passionate beliefs without addressing issues of fundamental grievances can backfire.

Incentives for co-operation must thus realistically work both with governments and the "Public" as individuals in organized movements or groups, whose ideas and arguments are largely inseparable from an emotional ingredient. The incentives must be also elements of an integrated long-term vision based on the fruits of co-operation grounded in transcultural notions of justice and equity. The last century clearly demonstrated beyond doubt the force of this ethical imperative that forced imperial powers to release their grip on colonial possessions, and also forced governments to recognize human and civil rights for all.

9. INCENTIVES AND DISINCENTIVES FOR GLOBAL CO-OPERATION IN INTERNATIONAL WATER RESOURCES MANAGEMENT

The greatest threat to world peace and stability, as astutely predicted by Robert L. Heilbroner in the 1970s, is that the current tendencies in global consumption, pollution, population increase, and urbanization will create serious problems to industrial nations with massive urban complexes, and giant corporations. In this setting, certain governments will be tempted to create centralized hegemonic regimes blending "religious" orientation with "military" discipline (Heilbroner 1980).
The covert struggle between world economic blocks (led by powerful nations in alliance with transactional corporations) over resources including water is likely to focus their attention not on a global solution to world problems in poor countries, but to political means to guarantee or even monopolize control over resources. By controlling water through "market pricing", by eliminating subsidies to the poor and disadvantaged, and by holding property rights of patents for water purification, recycling, distribution and management using new information technologies and new materials, the new world power regimes will gain short-term profits but will sow the seeds of resistance, dissent, resentment, and violence.
Eventually, war and the threat of war will indeed be used as means to control and eliminate competitors, as well as a means to weaken and dominate poor countries. In the long run this strategy, which will be legitimated by ideological slogans, is doomed to fail for two reasons; 1) the cost of military confrontations and operations will mount disproportionately to a point where it will overtax the centralized regime, and 2) instability and poverty will diminish the productive potential to be exploited by the dominant power and poor industry and chaotic development will only worsen current rates of global pollution, slum urbanization, overpopulation and epidemics, not to mention resistance and hatred, thus requiring further costly endeavors to maintain control and prevent further deterioration in global conditions.

WATER AS A VEHICLE FOR INTER-STATE CO-OPERATION: A LEGAL PERSPECTIVE[38]

Kerstin Mechlem[39]

1. INTRODUCTION

Contrary to popular belief, co-operation and agreement and not open conflict, appear to be the norm in interstate water relations. This finding is buttressed by an impressive record, both historical and contemporary, of treaties and agreements between and among sovereign states with regard to development, management and protection of the water resources of rivers, lakes and, as of late, aquifers that straddle international borders.

Against this backdrop, the potential role of the core principles of international water law in reconciling conflicting interests of states sharing a watercourse will be discussed. The three core principles of international water law are the principle of equitable utilization, the obligation to not cause significant harm and the duty to co-operate. They are binding upon states in their general form as customary international law or in the concrete form they have received by being enshrined in watercourse agreements regarding specific watercourses.

In the first part of this paper the role of the core principles in three different scenarios will be discussed. The first is a setting where a shared watercourse, but no specific treaty exists; the second, where a treaty is in the process of being negotiated; and the third where an agreement over the shared resource is in force. The second part of the paper will look in detail at the normative content of each principle, its reflection in specific watercourse agreements and its implementation by joint bodies. Both parts will show that the contribution of the law is neither simply formal, adding a legal varnish to a negotiated deal, nor that it provides just "bindingness" at the end of an exclusively political process. On the contrary, the law imposes upon states material and procedural rights and duties that limit states' unfettered sovereignty to do as they alone wish with the part of an international watercourse that falls within their territory. International water law is designed in a way as to lead to mutually acceptable solutions in situations of conflicting interests and even to bring about co-operation in a number of ways.

2. THE ROLE OF THE CORE PRINCIPLES OF INTERNATIONAL WATER LAW IN DIFFERENT SCENARIOS

As mentioned, the core principles of international water law are the principle of equitable and reasonable utilization, the obligation not to cause significant harm and the duty to co-operate with co-riparian states in various forms, such as the duty to exchange information and data, and the duty to inform about planned measures. These principles play different roles in different scenarios such as when

[38] I thank Stefano Burchi for his inspiring this paper, his valuable contribution and his advice. I thank Ali Mekouar and Friedemann Kainer for their helpful comments.

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no specific treaty for a shared watercourse exists, when states are in a process of negotiating one or when a treaty regulates a specific resource.

2.1. A Shared Watercourse For Which No Specific Treaty Exists

In the first scenario, states share a watercourse but have not concluded any specific treaty regarding this resource. In some cases, shared and non-conflicting use has been a matter of fact for a long time and no party sees a need for change or formalisation. In that case, concluding a formalised agreement might even give rise to differences as it might disturb a carefully worked out *de facto* balance. In other cases, there have been differences regarding the use of a common watercourse, but a treaty does not seem to be feasible for political reasons.
Both types of cases fall under the regime of customary international law[40] to act in this way that is binding upon states. The core principles of international water law already mentioned are such principles of customary international law. A state that can claim to act in accordance with the law is, from a legal point of view, in a stronger negotiating position than a state that has to justify a deviation from the rule (*in dubio pro iure*). However, although states are bound by customary international law, its impact is often limited for two reasons. First, rules of customary international law are abstract and general. Although their abstractness and generality is an advantage in so far as it enables the principles to be applied in all cases, it is also a disadvantage as they are likely to be interpreted in very different ways by the various parties. Second, the implementation depends to a large extent on the political will of the parties concerned, as means of international enforcement are weak. Therefore, a tendency to conclude more and more comprehensive agreements for specific watercourses is noticeable.

2.2. A Shared Watercourse For Which A Treaty Is Being Negotiated

The negotiation of a new watercourse agreement is the second scenario in which the principles of international water law come into play. A number of motives can encourage states to seek to conclude a treaty. Among them is the desire to settle a potential conflict before it evolves into a real conflict, for the political and economic costs of conflicts are greater than the costs of a negotiated solution. Other reasons can be the need to regulate a change in the current situation, e.g., the construction of new works, or the wish to bring clarity to the rights and obligations of each riparian, or to advance co-operation by institutionalising it with the creation of a joint body or authority.
The general principles of law can influence the negotiation process in several ways. It can be the aim of the negotiations to concretise one or more of the general principles and to apply them to a specific situation.[41] The interpretation of the principles by international authorities such as the International Law Commission (ILC) or the International Court of Justice can give guidance to states searching for solutions. Calling upon international law, *ab initio,* strengthens the position of the state that can claim to be on the side of the law. By now, an acceptance of the rule of international law exists. States that want to breach this law or diverge from it will be questioned at the negotiating table to justify their position. Furthermore, in general, respect for these principles is a prerequisite for a working treaty, *i.e.*, a treaty that is respected and applied by all parties.

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[40] General practice (*consuetudo*) accepted as law (*opinio iuris*), Art. 38 para. 1 ICJ Statute.
[41] *Infra* part III.

2.3. A Shared Watercourse For Which A Treaty Exists

The third scenario is one in which a specific watercourse agreement is in place either regulating a certain shared resource in general or only dealing with a specific undertaking (as in the Gabcíkovo-Nagymaros case[42]).[43] While comprehensive international agreements such as the Convention on the Law of the Non-Navigational Uses of International Watercourses (UN WCC) of 1997 serve to set a general basic standard and a minimum common denominator, regional instruments such as UN/ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes[44] or the Revised Protocol on Shared Watercourse Systems in the Southern African Development Community (SADC)[45] can attain higher degrees of details as with fewer parties, fewer conflicting interests need to be reconciled. Watercourse treaties for particular watercourses can determine in detail provisions for rights and obligations, stipulate mechanisms to negotiate and to share information, provide for dispute resolution mechanisms and establish joint bodies and commission[46]. Furthermore, they constitute in themselves a first step of co-operation and can create mutual dependency. The importance of specific agreements is evidenced by the fact that those cases, where no comprehensive specific watercourse agreements involving all parties have been concluded, are often the most disputed ones.[47] The PCIJ in the *Lake Lanoux* case already stated in 1957:

> States today are well aware of the importance of the conflicting interest involved in the industrial use of international rivers and of the necessity of reconciling some of these interests with others through mutual concessions. *The only way to achieve these adjustments of interest is the conclusion of agreements on a more and more comprehensive basis.* International practice reflects the conviction that States should seek to conclude such agreements.[48] (emphasis added)

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[42] Gabcíkovo-Nagymaros Project (Hungary v. Slovakia), 1997 I.C.J. 7 (September 25).

[43] A valuable tool to find specific watercourse agreements is the International Freshwater Treaties Database at Oregon State University, http://www.transboundarywaters.orst.edu/projects/internationalDB.html (last accessed 15 February 2003). A number of treaties are also included in FAO's FAOLEX database, http://faolex.fao.org/faolex/index.htm (last accessed 15 February 2003).

[44] 18 March 1992, reprinted in: FAO, Sources of International Water Law, Legislative Study 65, p. 65.

[45] Revised Protocol on Shared Watercourse Systems in the Southern African Development Community (SADC), 7 August 2000, http://faolex.fao.org/faolex/index.htm (last accessed 18 February 2003).

[46] Although the establishment of dispute resolution mechanisms in a specific treaty is one of the great advantages of treaty law, dispute resolution will not be dealt with in this paper as the focus is on the potential of the law in accommodating conflicting interests and thereby preventing disputes.

[47] Tanzi, Attila, The UN Convention on International Watercourses as a Framework for the Avoidance and Settlement of Waterlaw Disputes, in: 11 Leiden Journal of International Law 441, 443 (1998), citing Postel, S. "Changing the Course of Transboundary Water Management", 21 Natural Resources Forum 85 (1997) and stating that none of today's most critical international water disputes is governed by a watercourse treaty in force for all the parties concerned.

[48] Lake Lanoux Arbitration (France v. Spain), Award of 16th November 1957, 53 American Journal of International Law 156 (1959).

A host of motives can alternatively or cumulatively determine the conclusions of a treaty. These motives can be economic interests, the continuation of friendly relations in other fields, the will to prevent open conflict (as in the majority of cases open conflict is the economically and politically more costly option), third-party pressure, advantages in gaining or minimising of potential disadvantages versus a stronger co-riparian, or a sense of true adherence to the law. Whatever the motives, if a satisfactory solution for all parties is found in a treaty, it serves the purpose of managing conflicting interests. A specific treaty is far more likely to be respected than the general principles of international law alone. Treaties can be useful tools even when they fall short of including all riparians of a watercourse such as China and Myanmar in the case of the Mekong River Basin Agreement[49]. Treaties can design meaningful co-operation even when states do not always fully comply with all of the treaty obligations, but still more or less operate within the treaty framework.[50]
The possibility of specific treaties to create joint commissions and bodies deserves to be highlighted as an especially important advantage of treaty law. Despite the conclusion of an agreement, conflict potential and conflicting interests will - evidently - not vanish overnight as though a magic wand had been waved. Therefore, more often than not, watercourse agreements include the creation of a permanent inter-state institution with a mandate to manage co-operation and to broker the reconciliation of the interests at stake on a continuing basis. These mechanisms have avoided or even resolved disputes[51]. The more formalised the co-operation between states, the greater the assurance that all partners are abiding by the rules[52]. Joint authorities also ensure an ongoing process of exchange on a technical level (versus a high-level political/diplomatic one) that helps to keep conflict potential low.

The more a treaty complies with and implements the general principles of international water law, the higher are, in general, its chances of being respected and implemented. For example, a treaty that is perceived to be inequitable by one party is not likely to be applied and hence meaningless. Therefore, treaties work best if they apply the general principles to the specific situation. Moreover, the general principles can be used to interpret treaty clauses. When differences occurred between the United States and Canada over Canada's right to divert Columbia River waters into the Fraser basin, the United States repudiated Canada's interpretation of Art. II of the 1909 Boundary Treaty[53] that appears to come very close to rights of unfettered sovereignty, on the grounds that "the reservation of

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[49] Agreement on the Co-operation for the Sustainable Development of the Mekong River Basin, 5 April 1995, Cambodia, Laos, Thailand, Vietnam, 34 International Legal Materials (ILM) 864 (1995), also at http://www.internationalwaterlaw.org/RegionalDocs/Mekong.htm (last accessed on 10 December 2002).
[50] For example, when an equitable and reasonable system of sharing a common resources was found, but one party falls short of exchanging data for a certain time.
[51] See McCaffrey, Stephen, The Law of International Watercourses, New York, 2001, p. 341 note 109, who mentions two examples from the work of the International Joint Commission between Canada and the United States established by the 1909 Boundary Treaty (Treaty relating to Boundary Waters and Questions arising along the Boundary between Canada and the United States, 11 January 1909, United Kingdom and United States, http://faolex.fao.org/faolex/index.htm, last accessed 12 February 2003): the High Ross Dam case and the Garrison Diversion case.
[52] *Id.* p. 400.
[53] *Supra* note 51.

sovereign rights in article II is based on the Harmon Doctrine, which is not part of international law".[54]
The fact that there is a tendency to develop legal regimes for a growing number of watercourses and a trend towards more comprehensive agreements bears evidence of the importance of treaty law. This is not to say that co-operation cannot exist without written agreement nor that there will not be conflict or that it will vanish the moment two or more states sign a water treaty. Treaties can, however, take the sting out of conflict situations and make states less prone to exacerbate conflict.
However, the conclusion of a treaty is only step one in a two-step process. Step two is the implementation of the treaty. If States fall short of this second step in part or altogether –as may happen – then the treaty will only be meaningless or meaningful to the extent that it is actually implemented.

3. THE GENERAL PRINCIPLES OF INTERNATIONAL WATERLAW IN DETAIL

One, two or all three principles have inspired and are embedded in most contemporary bi-lateral or multilateral treaties and agreements concluded with regard to the development utilization, protection and management of shared resources. As they are distinctively general and abstract they are flexible enough to accommodate the multitude of geographical, economic, technological, social and political factors of each case in specific agreements. In the following part each of the three principles shall be illustrated, and it will be looked at how each has been applied and concretised in specific agreements and the mandate of joint bodies and commissions.

The general principles of equitable utilization, no significant harm and the duty to co-operate have been embodied in a number of international instruments. For example, in 1966 the International Law Association (ILA) developed the pioneering Helsinki Rules on the Uses of the Waters of International Rivers.[55] The most recent, comprehensive and authoritative framework deriving weight from twenty years of drafting and research done by the International Law Commission[56] is the UN WCC[57] that still has to enter into force.[58] It applies to all surface waters and groundwaters

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[54] Quotation from McCaffrey, *supra* note 51, p. 295.
[55] Reprinted in FAO, Sources of International Water Law, Legislative Study No. 65, Rome 1998, p. 290.
[56] The ILC included the topic in its general program of work in 1971. In 1974 it established a sub-committee and appointed the first of five special rapporteurs. The draft articles elaborated between 1974 and 1994 were the basis of negotiations in the Sixth (Legal) Committee of the United Nations General Assembly, convening for this purpose as the "Working Group of the Whole".
For details on the ILC draft articles, see the 1994 commented proposal of the draft articles to the UN General Assembly, Report of the ILC to the General Assembly on its forty-sixth session, reprinted in: (1994) Y.B.Int'l L. Comm'n, vol. 2, pt. 2, pp. 66 – 135, U.N.Doc. A/CN.4/SER.A/1963/Add.1 (Part 2). See also, McCaffrey, The ILC adopts draft articles on international watercourses, in: 89 American Journal of International Law 395 (1995)
[57] The UN WCC is annexed to U.N. G.A. Res. 229, U.N. GAOR, 51st session, U.N. Doc. A/Res/51/229, 21 May 1997. It was adopted by a vote of 103 for and 3 against (Burundi, China, Turkey) with 27 abstentions. It is reprinted in 36 ILM 700 (1997).
[58] The literature on the UN Watercourse convention is vast. See generally, among others, McCaffrey, *supra* note 51; McCaffrey, Stephen and Mpazi Sinjela, The 1997 United Nations

except confined groundwater aquifers.[59] In the United Nations General Assembly, an overwhelming majority of 103 states voted in favour of the Convention. More and more treaties such as the Revised Protocol on Shared Watercourse Systems in the Southern African Development Community Region[60] were influenced by the provisions of the UN WCC and some, for example the Incomati and Maputo Treaty[61], refer explicitly to the principles and norms of international water law as reflected in the UN WCC. Other treaties were significantly influenced by the ILC's draft articles on which the UN WCC is based such as the 1995 Mekong River Basin Agreement[62].

3.1. The Principle Of Equitable Utilisation

The first principle to be discussed is the principle of equitable utilization which is at the heart of international water law. Whereas in earlier times it was disputed whether unfettered absolute sovereignty (which crystallised in the so-called Harmon doctrine) or riparian rights or prior appropriation were the rule of law[63], the principle of equitable utilization has been confirmed by the International Court of Justice as reflecting existing law in the Gabcikovo-Nagymaros case where the ICJ stated that

> [w]atercourse States shall participate in the use, development and protection of an international watercourse in an *equitable* and *reasonable* manner.[64] (emphasis added)

The principle of equitable utilization is ultimately based on the principle of sovereign equality of states. If states had the right to use their resources in an unrestricted and unilateral manner, the use of one state of its resources could seriously hamper another state's use. Hence the use by that state would *de facto* take precedence

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Convention on International Watercourses, 92 The American Journal of International Law 97 (1998); McCaffrey, Stephen, The Contribution of the UN Convention on the Law of the Non-Navigational Uses of International Watercourses, 1 International Journal of Global Environmental Issues 250 (2001); Tanzi, Attila, *supra* note 47.

[59] The law regarding confined groundwater aquifers is less clear. The ILC adopted a Resolution on Confined Transboundary Groundwater in which it commends states to be guided by the principles of the UN WCC where appropriate, Report of the ILC to the General Assembly on its forty-sixth session, reprinted in: (1994) Y.B.Int'l L. Comm'n, vol. 2, pt. 2, p. 135. At its 54th session the ILC decided to include on its programme of work the topic "Shared Natural Resources" and appointed Chusei Yamada as Special Rapporteur, Report of the ILC to the General Assembly on its fifty-forth session, http://www.un.org/law/ilc/reports/2002/2002report.htm (last accessed 15 February 2003).

[60] *Supra* note 45.

[61] Tripartite Interim Agreement between the Republic of Mozambique and the Republic of South Africa and the Kingdom of Swaziland for Co-operation on the Protection and Sustainable Utilisation of the Water Resources of the Incomati and Maputo Watercourses, 29 August 2002, South Africa, Mozambique, Swaziland, http://www.dwaf.gov.za/Docs/Other/IncoMaputo/INCOMAPUTO%20FINAL%20RESOLUTION%2029%20AUGUST%202002.doc (last accessed 15 February 2003).

[62] *Supra* note 49.

[63] See generally, amongst others, McCaffrey, *supra* note 51, pp. 76 – 174; Paisley, Richard, Adversaries into Partners: International Water Law and the Equitable Sharing of Downstream Benefits, 3 Melbourne Journal of International Law 280, 282 note 6 (2002); Tanzi, Attila, *supra* note 47, p. 453 note 45, all with further references.

[64] *Supra* note 42, para. 147, p. 201.

over the use of the other states, whereas states' rights of use are on a par. Therefore international law demands that a *modus* of sharing is found that allows all parties having shared resources to make use of the resource as limited by other states' legitimate rights. In the UN WCC this obligation reads as "Watercourse States shall ... utilize an international watercourse in an *equitable* and *reasonable* manner ... with a view to attaining optimal and sustainable utilization thereof and benefits therefrom, taking into account the interests of watercourse States concerned, consistent with adequate protection" (Art. 5 UN WCC, emphasis added). The entitlement to an equitable share is based on the notion of equality of *right* – not of *share*. Optimal use is not equivalent to maximum use. Rather it implies to attain maximum possible benefits for all watercourse states and to achieve the greatest possible satisfaction of all their needs, while minimising the detriment to, or unmet needs of, each.[65] The equitable sharing of an international watercourse is a complex, ongoing process that can require constant adaption to changing circumstances and uses.[66]

Art. 6 of the UN WCC gives guidance as to which factors a state has to consider when determining whether an actual or potential use is equitable, by assembling an indicative, non-weighted and non-comprehensive list. Comprised are natural or physical factors (lit. a)), social and economic needs (lit. b)), the population dependent on the watercourse (lit. c)), the effects of the use (lit. d)), existing and potential uses (lit. e)), conservation, protection, development and economy of use of the water resources and the costs of measures taken to that effect (lit. f)) as well as the availability of alternatives to a particular or planned use (lit. g)).[67] In order to ensure that its use is equitable and reasonable a state has to take these and other factors relevant in the specific case into account, not only with regard to its own territory, but also with regard to the whole of the shared watercourse.

In practice, equitable utilization can take different forms such as the equitable apportionment or allocation of water resources or the equitable sharing of downstream benefits.
Examples of allocation treaties are the 1906 Rio Grande treaty between the United States and Mexico[68] and the 1960 Indus Water Treaty[69]. In the dispute over the use of the Rio Grande the United States originally claimed to have absolute sovereignty over the Rio Grande waters, entitling the United States to use them as it saw fit without regard to the effects on Mexico,[70] whilst Mexico, on the other hand, based its argument on priority of use which would have prevented further development of the river by the United States. Ultimately, the States agreed upon a treaty to provide for the equitable distribution of the waters of the Rio Grande for irrigation

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[65] ILC Report, (1994) Y.B.Int'l L. Comm'n, vol. 2, pt. 2, p. 97, para. 3, U.N. Doc. A/CN.4/SER.A/1963/Add.1 (Part 2).
[66] A use that was equitable and reasonable can become inequitable and unreasonable through hydrological changes and a new use by one state can change the equitable utilisation calculus as among all other states.
[67] A similar list can be found in Art. V para. 2 of the ILA's Helsinki Rules, *supra* note 55.
[68] Treaty between the United States of America and Mexico relating to the waters of the Rio Grande, 21 May 1906, United States – Mexico, http://www.internationalwaterlaw.org/RegionalDocs/Rio_Grande.htm (last accessed 19 February 2003).
[69] Indus Water Treaty, 19 September 1960, India, Pakistan and International Bank for Reconstruction and Development, 419 UNTS 125.
[70] McCaffrey, Stephen, *supra* note 5151, p. 285.

purposes.[71] Agreed were the construction of a storage dam in the United States and the annual delivery of a fixed volume of water by the United States to downstream Mexico for irrigation use. Another example is the 1960 Indus Waters Treaty that reflects a complex and detailed equitable apportionment scheme of the regulated flow of the Indus river that in essence allocated the waters of the "Eastern rivers" of the Indus basin (the Sutlej, the Beas, and the Ravi) to India and those of the "Western Rivers" (the Indus, the Jhelum, and the Chenab) to Pakistan.

Equitable utilization can also be achieved by sharing downstream benefits as in the 1961 Columbia River Treaty between Canada and the United States[72]. While in that case the United States had originally taken the position of prior appropriation and Canada one of unfettered sovereignty, in the treaty Canada committed itself to the construction and operation of three large storage dams that would benefit the United States by increasing downstream power generation and protection against flood. In return the United States agreed to provide Canada with one-half the additional power resulting from the Canadian projects and to pay Canada a lump sum for the flood-control benefits.

Similarly, the Treaty concerning the Integrated Development of the Mahakali River of 12 February 1996[73] provides for the sharing of water and benefits gained from works – mainly from the Pancheshwar hydroelectric project.
In all these cases, states gave up extreme positions and settled in the end for solutions that benefited both parties in the respective agreement equitably and that reflected – explicitly or implicitly – the principle of equitable utilization.

The principle of equitable utilization also plays a role in various forms in the work of joint bodies. This can extend from merely administering apportionment terms without any latitude to change allocations, which is valid for the Permanent Indus Commission,[74] to playing a role in providing or fine-tuning the criteria which are to govern equitable utilization determinations. For example, the Mekong River Commission is mandated to prepare "Rules for Water Utilization and Inter-basin Diversion ..."[75] In some cases, it even goes so far as to prepare actual schemes for the equitable sharing of common water resources. This is the mandate of the Permanent Technical Committee of Water Experts established under an Agreement between Nigeria and Niger Concerning the Equitable Sharing in the Development, Conservation and Use of their Common Water Resources[76], which is a framework water resources sharing agreement. In preparing such schemes, the Committee is to be guided by the criteria laid down in the agreement, which closely mirror those found in the United Nations Convention and in the Helsinki Rules.

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[71] *Supra* note 68.
[72] Treaty Relating to Co-operative Development of the Water Resources of the Columbia River Basin, 17 January 1961, United States – Canada, and exchange of notes at Washington, 22 January 1964 and at Ottawa, 16 September 1964, 542 UNTS 244.
[73] Treaty between His Majesty's Government of Nepal and the Government of India Concerning the Integrated Development of the Mahakali River Including Sarada Barrage, Tanakpur Barrage and Pancheshwar Project, 12 February 1969, India – Nepal, 36 ILM 531 (1997).
[74] Indus Water Treaty, *supra* note 69.
[75] *Supra* note 49, Art. 5.
[76] Agreement between Nigeria and Niger Concerning the Equitable Sharing in the Development, Conservation and Use of their Common Water Resources, 18 July 1990, www.faolex.fao.org (last accessed 6 December 2002).

3.2. The Obligation Not To Cause Significant Harm

The second fundamental principle generally recognised as governing international watercourse law is the obligation to not cause significant harm (*sic utero tuo ut alienum non laedas* – so use your own as not to harm that of another).
Art. 7 UNWCC contains the specific obligation "to take all appropriate measures to prevent the causing of significant harm…"[77] The phrasing "to take all appropriate measures" shows that the obligation is one of conduct, not one of result. "Significant" means that the harm caused must be more than minor or trivial, but that it can be less than substantial or serious.[78] Harm occurs in different forms and types. Proscribed is not so much factual harm, but injury of a legally protected interest.[79]

The obligation not to cause significant harm does not stand on its own, but must be reconciled and brought into line with the principle of equitable utilization.[80]
The relationship between the two principles has been one of the most debated questions of international water law. Whereas some schools of thought argued that the equitable utilization principle took precedence over the no-harm rule, others saw the no-harm rule overriding the right to equitable utilization.[81] A complete prohibition of causing any harm would result in almost a veto power for new uses since any new use of a river, lake or groundwater resource is likely to cause some negative effect somewhere in the system. Were this to be prohibited, states that

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[77] Examples of the no-harm principle in other international instruments are Art. 3 of the Charter of Economic Rights and Duties of States that reads: "in the exploitation of natural resources shared by two or more countries, each State must co-operate … in order to achieve optimum use of such resources without causing damage to the legitimate interests of others", GA Res. 3281(XXIX), U.N. GAOR, 29th Sess., Supp. No. 31 (1974), 14 ILM 251 and Principle 21 of the Stockholm Declaration (Declaration of the United Nations Conference on the Human Environment, 16 June 1972, UN Doc. A/Conf.48/14/rev.1) as well as Principle 2 of the Rio Declaration on Environment and Development, UN Doc. A/CONF.151/5/Rev. 1, 31 ILM 874 (1992). The latter, being almost identical to the former, reads:

> States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and development policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction.

[78] McCaffrey, *supra* note 51, p. 329 *et seq*.
[79] *Id.* p. 347, 365.
[80] The problem of reconciling equitable utilization and the causing of harm occurs with respect to the shared use of all natural resources and different attempts have been made to find satisfactory solutions. See, for example, UNEP's Principles of Conduct in the Field of the Environment for the Guidance of States in the Conservation and Harmonious Utilization of Natural Resources Shared by Two or More States, 17 ILM 1097 (1978). Principle 1 reads:

> It is necessary for States to co-operate in the field of the environment concerning the conservation and harmonious utilization of natural resources shared by two or more States. Accordingly, it is necessary that *consistent with* the *principle of equitable utilization* of shared natural resources, States co-operate with a view to *controlling, preventing, reducing or eliminating adverse environmental effects* which may result from the utilization of such resources (emphasis added).

[81] The relationship of the two principles in the UN WCC continues to be debated. Brunnée/Toope, for example, argue that the UN WCC ties the two principles together in a circular relationship without resolving the priority issues and thereby neutralizing them, Brunnée, Jutta and Stephen J. Toope, The Changing Nile Basin Regime: Does Law Matter?, 43 Harvard International Law Journal, 105, 151 (2002).

develop their water resources later than others would be disadvantaged and new developments would be blocked leading to an inherently inequitable situation.
In the Gabcikovo-Nagymaros case, the ICJ relied explicitly on the principle of equitable utilization[82], but stated with regard to no-harm issues only that:

> The existence of the general obligations of States to ensure that activities within their jurisdiction and control respect the environment of other States or of areas beyond national control is now part of the corpus of international law relating to the environment.[83] (emphasis added)

The fact that the ICJ gave not more prominence to the no-harm rule despite Hungary relying heavily upon it in its arguments, can be seen as a rejection of the thesis that the duty not to cause significant harm takes prominence over other rules. Also the term no "*significant* harm" shows that when the two principles must be reconciled some harm can be accommodated.
Reconciling the two principles in many cases requires the accommodation of some harm. In fact in the UN WCC convention it is ultimately the principle of equitable utilization that dominates, which can be deduced from Art. 7 para. 2 UNWCC that states that "where significant harm is nevertheless caused to another watercourse State, the States whose use causes such harm shall, …, take all appropriate measures, having due regard for the provisions of articles 5 and 6," *i.e.*, the principle of equitable utilization,…, "to eliminate or mitigate such harm and, where appropriate, to discuss the question of compensation."
The no-harm principle is therefore limited by and only operates in conjunction with the principle of equitable utilization. It is the balancing of interests under the equitable utilization rule that has to solve the problem whether in a specific case a certain type of harm may be caused or not. The duty to consult with the affected state to eliminate or mitigate such harm, and to discuss compensation where appropriate (Art. 7 para. 2), alleviates the burden of this compromise for the state subject to harm.

The no-significant-harm obligation has inspired, and is embedded in, a number of watercourse agreements. Two examples for cases in which states settled disputes over activities that were causing harm to another state, are the Rhine salt case and the Colorado River case. In the Rhine salt case it was France's awareness of its obligation to not inflict significant harm by pollution via the salt wastes of its potash mining industry in the French Alsace region that led to the 1976 Convention on the Protection of the Rhine against Pollution by Chlorides.[84] It provided for a progressive reduction of chloride levels of the Rhine by injecting chloride ions into Alsatian subsoil. In the Colorado River example, Colorado River water was allocated to Mexico under a treaty concluded in 1944 between the United States and Mexico.[85] Due to increasing levels of salinity from intensive irrigation in the United

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[82] See quotation *supra* p. 199.
[83] See Gabcíkovo-Nagymaros Project, *supra* note 42, p. 241, para. 53.
[84] Convention on the Protection of the Rhine against Pollution by Chlorides, 3 December 1976, 16 ILM 265 (1977). The Convention only entered into force in 1985 when France ratified it after almost ten years and implementation of the agreement has not been fully achieved.
[85] Treaty between the United States of America and Mexico relating to the utilization of the Waters of the Colorado and Tijuana Rivers and of the Rio Grande, 3 February 1944; protocol signed at Washington

States, the quality of the allocated water deteriorated. This motivated Mexico and the United States to reach an agreement in 1973, known as Minute[86] 242[87], submitted by the International Boundary and Waters Commission of the two States that calls for the United States to deliver to Mexico water that does not exceed a certain salinity level. To implement its obligations the United States unilaterally constructed a desalination plant in Arizona.

States create joint commissions as mechanisms to fulfil their no-harm duty. Often they are given functions with regard to new works.
Some bodies like the Franco-Swiss Genevese Aquifer Management Commission (created by the 1977 Arrangement on the Protection, Utilisation and Recharge of the Franco-Swiss Genevese Aquifer) give only technical opinions on the construction of new water extraction works on the aquifer and on the modification of existing ones (Art. 2 para. 2 and Art. 5)[88] In other cases, commissions have the function of approving projects and measures, such as, notably, the Canada - United States International Joint Commission created under the 1909 Boundary Waters Treaty.[89] On occasion, inter-state commissions even have a direct licensing or permitting authority of proposed projects and measures of cross-border significance. This is the case of the Finnish-Swedish Frontier River Commission created under the 1971 Agreement between Finland and Sweden concerning Frontier Rivers.[90] The permission of this commission is, for example, required for any hydraulic construction works covered by the agreement and has to take into account various rules regarding the prevention or mitigation of harm or the payment of compensation for harm caused.[91] Joint Commissions can even be instrumental in developing new agreements as in the case of the IBWC illustrated by the Columbia case mentioned above.

3.3. The Duty To Co-Operate

In Art. 8 para. 1 the UN WCC contains the general principle that "watercourse states shall co-operate on the basis of sovereign equality, territorial integrity, mutual benefit and good faith in order to attain optimal utilization and adequate protection of an international watercourse".[92] This general duty is reflected and

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14 November 1944, Mexico - United States, http://www.internationalwaterlaw.org/RegionalDocs/Co_Tj_RioG.htm (last accessed 12 December 2002).

[86] A Minute is a decision of the International Boundary and Water Commission (IBWC) which is considered approved by the two governments if not objected to within thirty days, Art. 25 para. 2 Colorado, Tijuana Rivers and Rio Grande Treaty, *supra* 85.

[87] Agreement Approving Minute 242 of the IBWC Setting Forth a Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River, 30 August 1973, United States - Mexico, 12 ILM 1105 (1973).

[88] Arrangement relatif à la protection, à l'utilisation et à la réalimentation de la nappe souterraine franco-suisse du Genevois, 9 Juin 1977, Le Conseil d'Etat de la République et Canton de Genève – Préfet de Haute-Savoie, Art. 2.2, reprinted in: Teclaff, Ludwik A. and Albert E. Utton (eds.), International Groundwater Law, London, Rome, New York 1981, p. 464.

[89] *Supra* note 51.

[90] Agreement between Finland and Sweden Concerning Frontier Rivers, 16 September 1971, Finland – Sweden, 825 UNTS 191, English translation at 272.

[91] *Id.,* Art. 3, 13, 16 (*inter alia*).

[92] A duty to co-operate can be found in a number of international instruments. See, for example, Art. 4 of the ILA's Rules on Water Pollution in an International Drainage Basin

specified in the procedural duty to regularly exchange data and information (Art. 9), and in the obligations of notification, consultation and negotiation concerning planned measures. Only these latter duties will be discussed.

a) The Duty to Exchange Data and Information

Art. 9 para. 1 UN WCC imposes upon states a duty to exchange "on a regular basis ... readily available data and information on the condition of the watercourse, in particular of its hydrological, meteorological, hydrogeological and ecological nature and related to the water quality as well as related forecasts".[93]
Such information from all parties concerned needs to be taken into account if a state wants to determine whether a specific use is reasonable and equitable, since the state has to assess the situation of all relevant parts of the shared watercourse. It would, for example, be very difficult for a downstream state to optimise its uses of an international watercourse without information about such matters as rainfall and the quality and flow of water in the upper parts of the basin. This therefore calls for information that cannot be gathered by the assessing states unilaterally, but requires the provision and co-operative sharing of data and information between co-riparians. As the duty is limited to exchanging only "readily" available data, such as already collected data or easily accessible data,[94] it does not overburden states.[95] The regular and continuous exchange is furthermore a means of confidence building in itself.

The exchange of hydrological and hydro-geological data and information on a regular basis tends to be the lynchpin of many inter-state water-related treaties.

(Montreal Rules), reprinted in FAO, Sources of International Water Law, Legislative Study No. 65, Rome 1998, 314; Art. 3 of the Charter of Economic Rights and Duties of States Charter of Economic Rights and Duties of States, GA Res. 3281(xxix), UN GAOR, 29th Sess., Supp. No. 31 (1974), 14 ILM 251; or Principle 24 of the Stockholm Declaration, Declaration of the United Nations Conference on the Human Environment, 16 June 1972, UN. Doc. A/Conf.48/14/rev.1. A survey of international agreements, decisions of international courts and tribunals, declarations and resolutions adopted by intergovernmental organizations, conferences and meetings, and studies by intergovernmental and nongovernmental organizations relating to the principle of co-operation is contained in Third Report Special Rapp., (1987) Y.B.Int'l L. Comm'n, vol. 2, pt. 1, Doc. A/CN.4/406, paras. 43 – 58.

[93] The need for regular collection and exchange of a broad range of data has been recognised also in a large number of other international agreements. Art. XXIV para. 1 Helsinki Rules, *supra* note 54, states that "with a view to preventing disputes from arising ..., it is recommended that each basin State furnish relevant and reasonably available information to the other basin States concerning the waters of a drainage basin within its territory and its use of, and activities with respect to such waters." A survey of other agreements as well as of declarations and resolutions adopted by intergovernmental organizations, conferences and meetings as well as studies by intergovernmental and international non-governmental organisations can be found in
Spec. Rapp., Fourth Report, (1988) Y.B.Int'l L. Comm'n, vol. 2, pt. 1, pp. 2105 *et seq.*, Doc. A/CN.4/412 and Add. 1 and 2, paras. 15 - 26.

[94] An example of a treaty employing the term "available" in reference to information to be provided is Art. VII para. 2 of the Indus Water Treaty, *supra* note 69.

[95] Art. 9 para. 2 UN WCC regulates the collection and processing of data that is not readily available. It stipulates that states have to employ their best efforts when faced with a request for such data by another state and that they may condition their compliance with the request upon payment for the costs arising.

Examples range from the complex and multipurpose Indus Water Treaty,[96] to the two concise technical agreements concluded among Egypt, Libya, Chad and Sudan on Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System[97] and on Monitoring and Data Sharing[98]. Therein the States commit themselves to regularly update a hydro-geological database of the Nubian Sandstone Aquifer System (NSAS), and to regularly share additional data from agreed monitoring activities.

Data and information exchange and management constitute also the bulk of the mandate of many inter-state commissions. Building on this core mandate the Mekong River Commission detailed the principles of co-operation laid down in the Mekong watercourse agreement[99]. It developed (on the basis of Art. 24 para. C of the Agreement) Procedures for Data Exchange and Information Exchange and Sharing that were adopted by the Mekong River Commission Council in November 2001[100]. On the basis of those still fairly general Procedures, Guidelines on Custodianship and Management[101] were developed (Art. 5.1 Procedures) and further technical standards and guidelines will be developed in the future to ensure comparability of data. Hence, in this particular case the general principle of customary international law was first incorporated into a treaty and later detailed by a joint body created to administer the treaty.

b) Information, Notification and Consultation

Other obligations of co-operation concern planned measures. Part III of the UN WCC (Planned Measures) contains, among other duties, an obligation to inform and consult on the possible effects of planned measures (Art. 11) and, in case the planned measures could have significant adverse effects, a duty to notify (Art. 12). Whereas the duty to regularly exchange data and information (Art. 9) provides for an ongoing and systematic process, these provisions concern duties only arising in connection with planned measures - to be interpreted broadly as including new projects or programmes of a major or minor nature, as well as changes in existing uses of an international watercourse[102] - to enable co-riparians to realize the nature of the proposed undertaking and the possible effects. Thereby conflicts can be mitigated at an early stage. The obligation to provide prior notification of such planned measures was accepted by most delegations of the UN WCC except

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[96] Indus Water Treaty, *supra* note 69. More examples can be found in Report of the ILC to the General Assembly on its forty-sixth session, reprinted in: (1994) Y.B.Int'l L. Comm'n, vol. 2, pt. 2, p. 109, U.N.Doc. A/CN.4/SER.A/1963/Add.1 (Part 2).

[97] Agreement for the Monitoring and Exchange of Groundwater Information of the Nubian Sandstone Aquifer System, 5 October 2000, Chad, Egypt, Libya, Sudan, on file with author.

[98] Agreement on Monitoring and Data Sharing, Chad, Egypt, Libya, Sudan, 5 October 2000, on file with author.

[99] *Supra* note 49.

[100] Mekong River Commission, Procedures for Data and Information Exchange and Sharing, 1 November 2002, http://www.mrcmekong.org/pdf/Procedures.pdf (last accessed 10 December 2002).

[101] Mekong River Commission, Guidelines on Custodianship and Management of the Mekong River Commission Information System, 11 July 2002, http://www.mrcmekong.org/pdf/CustMgmtGuidelines.pdf (last accessed 11 December 2002).

[102] (1994) Y.B.Int'l L. Comm'n, vol. 2, pt. 1, p. 111, Art. 11, para. 4.

Ethiopia, Rwanda and Turkey,[103] providing evidence that states have no longer unfettered discretion to do as they alone wish with the portion of an international watercourse within their territory.[104]

The existence of such an obligation was disputed in 1979, when an agreement concluded by Argentina, Brazil and Paraguay[105] on the co-ordination of separate water development projects, planned on bilateral bases by these three countries on the Paraná River, ended a bitter dispute between Argentina and Brazil over prior notification. Argentina was of the opinion that Brazil had an obligation to provide prior notification and technical details regarding the bilateral Brazilian/Paraguayan Itaipú project. However, Argentinia's attitude was dictated by its concerns that the project could affect the plans to construct a dam with Paraguay further downstream on the Paraná. In the end, the 1979 agreement enshrined exactly these two obligations[106] Another example is the 1973 agreement between Mexico and the United States, addressing the issue of Colorado River water salinity and of unrestrained groundwater pumping on both sides of the Sonora-Arizona boundary, obliging both countries "to consult with each other prior to undertaking any new development of either the surface or groundwater resources, or prior to undertaking substantial modifications of present developments, in its own territory in the border area that might adversely affect the other country".[107] Although this agreement does not use the term "notify", theobligation to consult stems from the same *rationis materiae.*

The principle to receive prior notice of proposed projects and measures is likely to have a significant cross-border impact. It also falls within the remit of most inter-state commissions, which thereby serve a function as recipients of information and notice. Examples are the Lake Chad Basin Commission[108] and Mekong River Commission[109].

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[103] McCaffrey, The Contribution of the UN Convention on the Law of the Non-Navigational Uses of International Watercourses, 1 International Journal of Global Environmental Issues, 250, 256 (2001).

[104] *Id*.

In practice, states are always notified in cases where the World Bank helps to finance a water development project as the Bank's guidelines require notification, World Bank, Operational Manual, Bank Procedures 7.50, Projects on international waterways – Operational Policies, October 1994, paras. 2.

[105] Argentina-Brazil-Paraguay: Agreement on Paraná River Projects, 19 October 1979, English translation 19 ILM 615 (1980).

[106] *Id.* Art. 5 lit d).

[107] *Supra* note 87, Art. 6.

[108] Art. 5 para. 2 Convention and Statutes Relating to the Development of the Chad Basin, 22 May 1964, Cameroon, Chad, Niger, Nigeria, http://mgd.nacse.org/qml/watertreaty/textdocs/international/29.html (last accessed 10 December 2002).

[109] Mekong River Commission, Preliminary Procedures for Notification, Prior Consultation and Agreement, 12 November 2002, Cambodia, Laos, Thailand and Vietnam, http://www.mrcmekong.org/ (last accessed 10 December 2002).

4. CONCLUSION

Whether or not states have concluded agreements regarding a specific shared watercourse, the right of equitable and reasonable utilization, the duty not to cause significant cross-border harm, and the obligation to co-operate, determine and limit states' sovereignty and impose rights and duties upon states. Furthermore, these principles are designed to reconcile in a way that conflicting interests in a manner acceptable for each party.
As the core principles set material objectives to be achieved as well as procedural duties, they have the potential of guiding states' negotiations towards mutually satisfactory results. In numerous cases they have been built upon by States and have functioned as a yardstick guiding states' behaviour. They are therefore useful not only – or not so much as – to gauge, *ex post,* the legitimacy of actual behaviour, but also, and more importantly, to discourage antagonistic claims and counter-claims and to encourage accommodation of the interests at stake in the process of reaching an agreement.
The abstractness and generality of the core principles provide flexibility to accommodate in the framework of specific watercourse agreements the multitude of geographical, economic, technological, social and political factors, potentially leading to diverging interests of states sharing a common watercourse. There exists now a sense of adherence to these core norms which all sovereign States identify with and use as a basis, to eventually shape agreements on the specific rules which will govern the circumstances of each particular case. Specific conflict situations are best dealt with if the general principles are given concrete meaning in a specific agreement that gives justice to the particularities of each case. The technical work of joint bodies created by such agreements is often of key importance for implementation and adjustment of agreements as well as for the creation of stronger ties of co-operation.

This is not to say that conflict is or will not be there, or that it vanishes the moment two or more states sign a water treaty or agreement. Agreements can take the sting out of conflict situations, and make states less prone to open conflict. They are not a panacea, only a piece in the puzzle. The stronger the enmeshing and integrated management of a shared resource, created by treaty-based co-operation, the more the interests of one party become the interests of the other parties. Once a certain degree of interlacing and cross-linking is reached, a conflict carried out by force or even a break-off of co-operation is no longer an option as it would harm a state's own interests.

WATER REGIMES – A WAY TO INSTITUTIONALISE WATER CO-OPERATION IN SHARED RIVER BASINS[110]

Anders Jägerskog[111]

ABSTRACT

The paper analyses interstate water co-operation in shared river basins through the lens of regime theory. It is argued that regime theory is helpful for understanding why water seems to be a reason for co-operation rather than for war. Taking stock of the fact that international relations are increasingly characterised by interdependence it is argued that a development of new forms of rules, procedures and institutions that can manage these interdependencies have taken place. The transnational nature of water, which is particularly evident in international river basins, provides the riparians with a rationale for co-operation. It is argued that the development of co-operative water regimes was spurred as a result of an increased awareness of the potential benefits of co-operation, in some cases promoted by water experts and the interdependence of states. This chapter specifically focus on the regime features in the Jordan River Basin.

1. INTRODUCTION AND BACKGROUND

The aim of this paper is to analyse if and how regime theory can help us to better understand interstate water co-operation. In particular, specific emphasis is put on the analysis of the role of water experts in this promotion of co-operation. While the case study deals with the Jordan River Basin, it is believed that the lessons learned in the Middle East is also helpful in other river basins. Acknowledging the fact that any analysis needs to be situated in its specific political, historical and cultural circumstances it is still argued that the general knowledge on the creation and role of water regimes is applicable in any case of transboundary water course analysis.

A wide range of International Relation (IR) scholars showed by the mid-70s that the international system is increasingly characterised by interdependence. As interdependence affects politics and the behaviour of states new forms of rules, procedures and institutions for various activities have been created in order to manage and control transnational relations. These co-operative arrangements are usually referred to as international regimes. (Keohane & Nye, 1989)

The hydrological interdependence, i.e. the transnational nature, of international river basins (Elhance, 1999) provides a rationale for co-operation. Indeed, an awareness of the positive prospects of basinwide co-operation through the development of a water regime might spur an increased hydrosolidarity. Or, as a

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[110] A similar version of this paper has previously been published as: Jägerskog, Anders (2002) "Contributions of Regime Theory in Understanding Interstate Water Co-operation: Lessons learned in the Jordan River Basin" in Turton, Anthony and Henwood, Roland (eds.) *Hydropolitics in the Developing World – A Southern African Perspective*, African Water Issues Research Unit (AWIRU), Pretoria, pp. 73-78

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leading water professional put it "water may be a catalyst for peace" (Asmal, 2000). In a similar vein, the study, commissioned by the Swedish Ministry for Foreign Affairs, about how transboundary water management can be seen as an international public good, echoes this impression when it states that water is a common good that contributes to co-operation rather than conflict (Ministry for Foreign Affairs, 2001)

Water experts are an integral part of the establishments of co-operative water regimes as they tend to favour basinwide co-operation. They are referred to by political leaders who, under conditions of scientific uncertainty, "consult experts to help them identify their own interests and policies" (Haas, 1994).

2. WHAT IS A WATER REGIME?

Many IR scholars have devoted significant attention in trying to understand why international co-operation occurs in spite of the presumed anarchic international system. Some try to explain the co-operation through regime theory. The most commonly used definition of an international regime is that of Krasner (1983, p. 1). He defines regimes as:

"implicit principles, norms, rules, and decision-making procedures around which actors` expectations converge in a given area of international relations. Principles are beliefs of fact, causation, and rectitude. Norms are standards of behaviour defined in terms of rights and obligations. Rules are specific prescriptions or proscriptions for action. Decision-making procedures are prevailing practices for making and implementing collective choice".

The particular object that regime analysis is concerned with is the normative institution, dealing with a specified issue, which states create and subscribe to voluntarily as a means of self-regulation in the international arena (Mayer, Rittberger & Zürn, 1993, p. 393). Keohane (1984, p. 97) holds that:

"international regimes are useful to governments. Far from being threats to governments (in which case it would be hard to understand why they exist at all), they permit governments to attain objectives that would otherwise be unattainable. They do so in part by facilitating intergovernmental agreements. Regimes facilitate agreements by raising the anticipated costs of violating others' property rights, by altering transaction costs through the clustering of issues, and by providing reliable information to members. Regimes are relatively efficient institutions, compared with the alternative of having a myriad of unrelated agreements, since their principles, rules, and institutions create linkages among issues that give actors incentives to reach mutually beneficial agreements. They thrive in situations where states have common as well as conflicting interests"

These regimes are considered to exist in areas such as international trade, monetary policies, security and arms control, and concerning the use of natural resources. One might see the regimes as an intermediating factor between the power structures of the international system and the political bargaining, which takes place within it. In fact, regimes can become embedded in a sort of normative framework for action and thereby increase the political salience of certain issues. (Keohane, 1993, p. 29-30, and Keohane and Nye, 1989, p. 21). Furthermore, they may also function as a vehicle for international learning and the converging of

policies of states (Haas, 1994). This is iterated by Mayer, Rittberger & Zürn (1993, p. 394) who holds that the social interaction, which takes place in a regime fosters a convergence in value orientation and thereby create incentives for a further institutionalisation of co-operation. Wendt (1994) has usefully clarified the institutionalisation of co-operation in the international arena. He argues that:

"the process by which egoists learn to co-operate is at the same time a process of reconstructing their interests in terms of shared commitments to social norms. Over time, this will tend to transform a positive interdependence of outcomes into a positive interdependence of utilities or collective interest organised around the norm in question."

Wendt argues that this constructivist approach to institutionalisation of co-operation focuses on how the expectations that are produced by the behaviour affect interests and identities. This process of institutionalisation is one in which actors internalise new understandings of self and other and, furthermore, move towards increasingly shared commitments to the norms of the regime. Thus, there is a strong behavioural component in the international regime theory. Whereas an international treaty is a legal document stipulating rights and obligations, a regime is a social institution in which the behaviour of its actors constitute the regime (List and Rittberger, 1992). Thus, a regime is often based on an informal understanding and need not be in the form of a written document.

Thus, applied to the water relations within the international system, the regime theory appears to be a relevant tool in the analysis of how one might find compromising solutions, built on an acknowledgement of hydrological interdependence, through co-operation (Du Plessis, 2000, p. 21-22).

Water regimes has been identified by Haftendorn (2000) as:

"when the affected states to a conflict observe a set of rules designed to reduce conflict caused by use, pollution or division of a water resource or the reduction of the standing costs and the observance over time of these rules".

Haftendorn does, however, distinguish between general water regimes and those intended for a particular conflict. An example of a general one is the 1997 UN Convention on the Law of the Non-Navigational Uses of International Watercourses whose aim is to establish general principles for the use of transboundary water resources. An example of a regime dealing with a specific watercourse is the Rhine regime, which stemmed from an agreement on chemicals and chlorine. The regime has been beneficial in that it has managed to bring problematic issues to the fore and thereby facilitated settlements of disputes (Haftendorn, 2000, p. 65-67).

3. WHAT PROMOTES THE ESTABLISHMENT OF WATER REGIMES?

There exists a variety of explanations to why regimes come into existence. Realists tend to focus on the interests of hegemonic states. In their view, regimes are created by the powerful hegemons because they serve their interests. Consequently, when the power of a hegemon declines the regime also weakens. Neoliberals, on the contrary, focus on the *demand* for regimes. They view norms

not only as a reflection of sheer power but norms are likely to be demanded regardless of the existence of a hegemon as norms will enable states' to, more accurately, estimate the costs and benefits of action. When the regime is in place a state is able to interpret and value the actions of self and other and determine if it is in line with agreed upon principles (Mansfield, 1994). The regime might, furthermore, help states to co-ordinate their behaviour so that they can avoid collectively suboptimal outcomes (Hasenclever, Mayer and Rittberger 1997).

Another explanation to regime formation is the view that a crisis or shock might precipitate a formation of regimes (Young, 1994). This understanding has close connections to Hajer's (1996) *emblematic events*, which he sees as being necessary in order to raise the awareness on environmental degradation and vulnerability. Yet another explanation to the formation of regimes is the one offered by Haas (1994) and Adler and Haas (1992). They focus not so much on interests and dramatic events but argue that a regime can stem from communities of shared knowledge. Experts in a specific issue-area are termed *epistemic communities*. The emphasis is on how these experts play an important role in the articulation of complex problems, such as water management issues or pollution control.

The epistemic communities approach is the one that will be elaborated upon most as it emphasises the role of expert communities in the formation of policy innovation and the institutional processes leading up to the formation of a regime. Haas (1994) holds that "regimes may be transformative, leading to the empowerment of new groups of actors who can change state interests and practices". Members of an epistemic community might also have a decisive influence on the construction of policy in an area and, since the communities' nature is international, it might also lead to a general convergence of policies on the international level. Related to the epistemic communities approach are the ideas of Turton (2001). He argues that there is a strong need for social capital in the creation of regimes. Using Homer-Dixons (2000) theory on ingenuity[112], he argues that firstly a *technical ingenuity* is needed and secondly a *social ingenuity* is needed in order to establish water regimes. The technical ingenuity concerns the "hard" side of the issue and is data-intensive while the social ingenuity concerns issues such as the ability of actors to legitimise the hard data through negotiations. When these characteristics are present, the conflict potential in an international river basin can be institutionalised within a water regime.

The more general water conventions, whose aim it is to establish general principles for the use of transboundary water resources, have seen a high degree of involvement from the water expert community. Although the principles of these conventions are of a general nature, they may serve as a baseline for interstate water relations. In fact, the general international principles have led to the formation of more regional water regimes. This was brought about when riparians had mutually embodied norms, rules and principles and thereby incorporated a higher degree of co-operation among themselves (Haftendorn, 2000).

[112] A loose definition on ingenuity could be: "ideas that can be used to solve practical, technical and social problems, such as the water problems arising from water management. (Taken from Turton, 2001)

4. CONTRIBUTIONS OF WATER REGIMES – A CASE STUDY OF THE JORDAN RIVER BASIN

The water relations in the Jordan River Basin have often been used for showing that water might indeed lead to conflict and even war (Bulloch and Darwish, 1993, and Starr, 1991). However, for example Allan (1999 and 2001), Wolf and Hamner (2000) and Isaac (1995) brought the severe lack of solidity in this reasoning into the open. In particular, Allan (1999) points at the ameliorating factor of 'virtual water', which is the water embedded in water intensive foodstuff that is traded into the region. Furthermore, authors focusing on the potential for war have tended to neglect that something called a water regime has been in place regulating the water relations between Israel and Jordan since the early 50s. One might argue that the common understanding, reached in US-initiated talks, on the use of the disputed waters of Jordan River basin between Israel and Jordan, during a period when they, *de jure,* were in state of war, is a good example of a water regime that greatly reduced the tension between the adversaries. As such, the water regime could be seen as an example of a confidence- and security-building measure (CSBM).[113] Dinar (2000) argues that the US viewed co-operation on water issues in the Jordan Basin as a tool for the creation of peace in the region. This regime provided a means to build trust among the states and facilitated a development of friendly relations. Furthermore, the Johnston-plan for the water management in the Jordan River Basin, which was prepared by a U.S. team of experts, can be seen as a water regime despite the fact that it was not recognised by the states (Wolf, 1993). This is due to it being used as a baseline for water relations in the basin. One might also argue that the water agreement between Israel and Jordan, which is a part of the Peace Agreement signed 1994, enhanced and formalised the regime co-operation between the two states. The treaty, however, stipulates the rights and obligations of the two parties while the regime predominantly concerns the actual behaviour of the parties to the regime. Keohane (1984) holds that international regimes should be distinguished from specific interstate agreements and argues that a major function of regimes is to facilitate in the making of agreements. Young (1989), however, does not agree. He argues that if that view of regime analysis were adhered to it would merely resemble an analysis of explicit bargaining. In line with the argument of Young, I will, accordingly, view the Israeli-Jordanian water relations as a water regime even though a formal agreement is in place.

How can one assess the quality of the water regime presumed to exist between Israel and Jordan? Regime theory offers some tools. Hasenclever, Mayer and Rittberger (1997) maintain that one should analyze the *effectiveness*, *robustness* and *resilience* of regimes. The effectiveness of a regime is dependent on whether its members abide by its norms and rules, while the robustness refers to the "staying power" of a regime in the face of exogenous challenges. The resilience refers to the ability of the regime to adapt to changing circumstances.

It seems as though the regime between Israel and Jordan has been somewhat limited in its effectiveness as conflicts (not on water) between them forced them not to abide by the rules of the regime at all times. Having said that, it is apparent in the agreement from 1994 that many of the principles existing on the

[113] For a good discussion on CSBMs see Jones, Peter, (1998) *Towards a Regional Security Regime in the Middle East: Issues and Options,* SIPRI

international level, such as the provision not to cause 'significant harm', have been incorporated. Furthermore, a joint institution (The Joint Water Committee) has been established in order to implement and monitor the principles agreed upon. It is positive to see that emphasis has been put on co-operation in the maintenance of the common resource. As water experts were an integrated part of the negotiations leading up to these principles, one might argue, along the lines of Haas and others, that the scientific consensus saying that water management should be approached from a catchment perspective, clearly put its mark on the regime.
If one analyses the robustness and resilience of the regime, one may argue that it is a rather strong regime. The last time it was severely challenged was during the drought in 1998-2000, which produced a disagreement over allocation in periods of drought. This was partly due to the fact that no provisions were made for droughts in the 1994 agreement. The conflict was, however, solved and the norms, rules and principles that existed in the water regime contributed to this end. In this regard it is also interesting to view the Israeli-Palestinian water relations. Although still awaiting a final Peace agreement between Israel and the Palestine Authority, an interim agreement in which water is an integral part exists. As in the Israeli-Jordanian case, there also exists a Joint Water Committee (JWC). And even in the midst of the latest tensions during the second Intifada that started in the autumn of 2000, the work of the JWC continues. A joint statement from the Israeli and Palestinian heads of the JWC (31 January, 2001) reaffirmed their commitment, despite exogenous challenges, to continue their co-operation. This was significant and seems to confirm the functionalist regime analysis.

A further aspect relevant when discussing this regime is the asymmetry in power relations between Israel and Jordan. Keohane and Nye (1989) argue that an asymmetrical interdependence can be a source of power by which they mean the power to control resources or the potential to affect outcomes. A less dependent actor can have a political or economic resource at his disposal, which means that changes in the regime or relationship may prove less costly to him. While Israel has an economy that is both diversified and strong, Jordan is neither economically strong nor has a good negotiation position in terms of control over water (Allan, 2001). Hence, changes in the relationship may prove more costly to Jordan than to Israel.

As was stated above, water regimes do exist in many river basins. Another example of a general water regime is the SADC Protocol on Shared Rivers. Within the Southern African region there are also examples of more specific regimes. The Orange/Senqu River Basin Commission (ORACOM) is a regime that is fairly well established and functions despite border tensions between the two riparians, South Africa and Namibia. Another example of a regime is the arrangements between the riparians in the Okavango River Basin, Angola, Namibia and Botswana. They created in 1994 The Permanent Okavango River Basin Water Commission (OKACOM), which meets from time to time to discuss common issues of importance to their shared basin.

5. LIMITATIONS OF ANALYSIS

While regime theory contributes to our understanding of how water co-operation might come about, it has, as any other theory, limitations. The thinking of Asmal (2000) and others is functionalist in that it holds that co-operation over water could be a preliminary to co-operation in other, more contentious, areas. The argument in

this paper tends to lean in that direction. However, an obvious objection to functionalist regime theory is that it is somewhat blind to the fact that water may be subordinated to, for the states involved, much more important areas of dispute (Allan 2001). The hierarchy of issues is important to understand. A realist objection to the focus on water experts would be that the interests of the powerful make regimes come about. Hence, the co-operation between Jordan and Israel would rather be a result of U.S. interests than anything else. Furthermore, Kütting (2000) argues that regime theory concentrates too much on action and behaviour and thereby misses the wider social and historical process. Thus, agreeing with this regime theory is not seen as an all-encompassing theory but rather as one theory that offers insights into the institutional aspects of the water co-operation in the Jordan basin.

Considering the focus on experts and epistemic communities it is debatable whether the experts exert such vast influence as the theory claims. Furthermore, in a world where policy-makers increasingly tend to consult scientific expertise, there is also a growing scepticism about their expertise especially since complex issues often are characterised by both social and scientific controversy (Corell, 1999). While these and other objections to the analysis appears to be valid, I would still argue that the formation of co-operative water regimes, through the epistemic communities approach, tell us a great deal about the way co-operation might be achieved.

A further limitation to the involvement of experts in policy-making is the connection between science and politics. While there may be scientific agreement on an issue or a way to handle a problem, it might not be politically feasible. As Allan (1999) has pointed out, the logical way to achieve strategic water security would be to secure supplies of 'virtual water'. It shows, however, that the virtual water solution is not acceptable to the governments in the region since it is not part of the 'sanctioned discourse' on water.[114] Hence, some strategies that would be logical are not on the agenda because they are politically stressful.

It is also argued that many see water as a human right. The fact that people and governments involved in a water conflict tend to view water as an absolute necessity of life, means that there is a general reluctance to use water as a weapon. Thus, the view that water is a human right is a reason why governments do not withdraw water from their enemy (Soffer, 2001). However, others argue that there is strong historical evidence of water being used as a weapon of, or target, in periods of conflict and war (Turton, 2000). Thus, the explanatory power of using the concept of "water as a human right" as a reason for interstate water co-operation is weak.

6. CONCLUSIONS

International water regimes might be seen as a conflict-mitigating factor since they promote basin wide interstate co-operation and thereby increase water security. It is argued that an analysis of the water co-operation in the Jordan River Basin through the prism of regime theory is helpful in explaining why co-operation has

[114] Sanctioned discourse is a term coined by Charles Tripp at London School of Oriental and African Studies. It essentially refers to a normative paradigm within which certain hypothesis might be raised while others cannot.

occurred in spite of the strong political conflict. When a convergence of values has occurred within a regime and the co-operation has been institutionalised, it is harder than one might think to reverse or end this co-operation.

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CONFLICTS AND OPPORTUNITIES OF UNDERGROUND WATER SHARING: ETHICAL ASPECTS

Elmer Flor[115] and Ana Flor[116]

ABSTRACT

Southern South America bears an underground water source of continental extent called the Guarany Aquifer that contains enough freshwater to supply the 15 million inhabitants of the region for the foreseeable future. The present paper describes the tensions among the countries and communities that bear the aquifer, that result from the lack of specific rules and international agreements. It also proposes catalystic principles for regional peace and development through co-operation and participative management of this life-giving source of underground water. Ethical aspects of water sharing are brought to debate and a strong plea is made against the utilitarian tendency to privatise the management, treatment, and distribution of water to consumers. Finally, proposals are made for some concrete steps to implement co-operative mechanisms for underground water sharing.

1. GUARANY AQUIFER SYSTEM: THE MANANTIAL OF SOUTH AMERICA

Brazil is the proprietor of one of the main sources of drinking water in the world, both on surface and underground. In addition to the Amazon Basin, Brazil and its neighbour countries are on top of one of the biggest underground water reservoirs on the planet, the Guarany Aquifer System.

Underground water resources are fundamental to human life on earth, since they represent 95% of the available drinking water. Rivers, lakes, and dams count for only 5% of fresh water for human use. A sustainable approach to ecosystems characterises many leading, planning, and management concepts. Additional research is still needed to develop regional water strategies that ensure sustainable human use.

The Guarany Aquifer System with its 50,000 sq/km of fresh water located under the surface of the so-called Southern Cone in South America, is one of the largest of its kind in the world and underlies an area of about 1,195,500 sq/km. The important rivers Parana, Paraguay, Iguazu, and Uruguay, among others, flow above it. It covers an area of 840,000 sq/km in Brazil and the remaining area in Argentina (355,500 sq/km), Paraguay (58,500 sq/km) and Uruguay (58,500 sq/km). There is enough water in the Guarany Aquifer to provide the entire population of planet Earth with water for a decade.

This aquifer was at first called the Mercosur aquifer system because of its geographic location in the same zone of the economic trading zone of southern South America called by the same name. Subsequently, the name 'Guarany aquifer'

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was proposed in honour of the aborigines who lived originally in about the same area. The study of this aquifer used data from 228 water wells and 94 oil wells to define and regionally characterize this system and to draw maps of its structure, thickness, overburden, water temperature, and potentiometric surface. (Araújo 1999:319) Broader hydrologic and hydrochemical studies have been made of parts of the aquifer by various researchers, which will not be analysed in the present paper because of its specific purpose.

The climate of the Guarany Aquifer region varies from subtropical in its northern part to temperate and almost semi-arid in its far southern part, a variation resulting chiefly from the great length of the aquifer domain, which extends through 20° of latitude, or about 2,200km.

Basin-wide maps have been drawn, so that since recent times this study has been provided by a scientific basis for planning for long-term sustainable development of this important multinational reservoir. The most complete hydrogeological map of the Guarany Aquifer was edited by Campos (2000) after having been partially published at the 3rd Latin-American Congress of Underground Hydrology, San Luis Potosi, Mexico. This map helped to determine regional distributions of hydraulic head aquifers and to confine bed properties and groundwater flow.

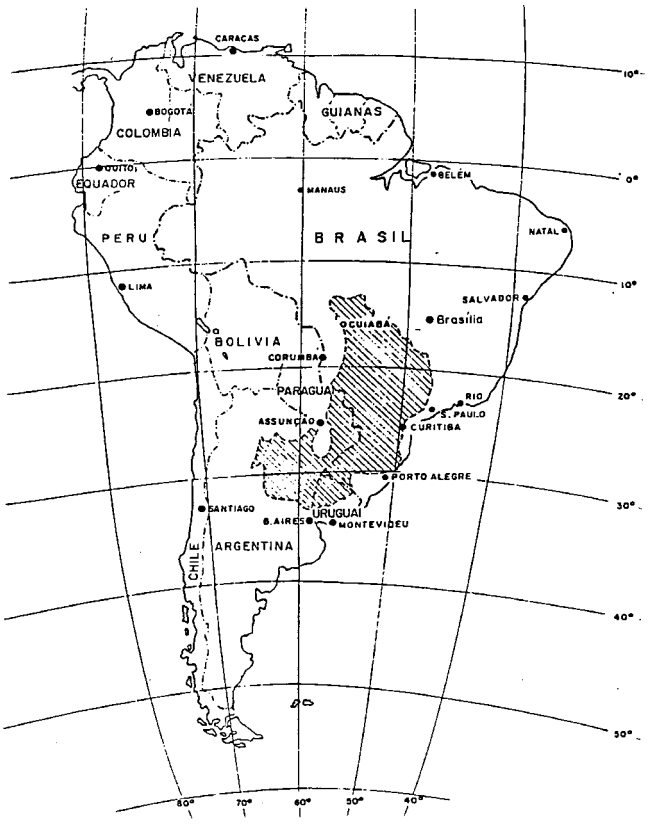

***Figure 1*: Map showing in the shadowed area the location of the Guarany Aquifer, as reproduced by Campos (2000:4). It is limited by longitudes 47°W and 56°W in the East-central part of South America.**

2. THE IMPORTANCE OF THE AQUIFER FOR SUSTAINABILITY

The existence of underground water resources in southern South America presents an enormous challenge to scientists and particularly to ecologists. One question is to know whether the planet can tolerate the present rhythm of exploitation of superficial and underground water resources. A further consideration is that of equity of access to these resources and to their supply. The preservation of these resources involves questions about their solubility since they suffer from various forms of pollution, even in the countries that have the aquifer, where there is still an abundant reserve.

Most of the Guarany Aquifer water is potable. It has also been thoroughly used for agriculture, industry, homes, and tourism (hydrohotels and spas). Its quality is locally enhanced by enrichment in fluoride. Groundwater with high fluoride contents (>1.2 mg/l F) has been found in several wells drilled in the aquifer area at various locations. Consequently, some of these wells cannot be used for public water supply. These hydrogeochemical anomalies suggest relationships with framework features of the Paraná Basin.

The discovery of this natural resource and its detailed study showed how immeasurably precious it is for human life as well as for all living creatures. The digital model requires that the studied area be divided into discrete sub-areas or blocks, and that a finite-difference approximation of the continuous differential equation be solved for each block for specified boundary conditions, aquifer hydraulic properties, and pumping stresses.

The real quest for sustainability is an ethical issue, which will be given further thought later in this paper. At this point it will suffice to say that the Guarany Aquifer must be included in the effort to sustain the biosphere on the planet and to advance ecological integrity, economic security, social justice, and human fulfilment among all the people in the area, without discrimination.

3. KEY ISSUES TO PREVENT TENSIONS

The Guarany Aquifer area involves lands belonging to four different countries, Brazil, Argentina, Paraguay, and Uruguay. In the past, at least one major conflict struck the area. The so-called Paraguayan War in the 1860s between Paraguay and the Triple Alliance of Brazil, Argentina and Uruguay, was basically a water conflict. The Paraguayan dictator Solano Lopez pleaded for an outlet for his products to the Atlantic Ocean by way of the Parana and La Plata Rivers, in which he was denied by the alliance. More recently, Argentina and Uruguay opposed the construction of the Itaipu Bi-National hydroelectric plant, in view of the ecological, political, and economical consequences which these countries reputed unfavourable for them. Even for the formation of the Itaipu dam, nature, ecologists and all people had to give away the beautiful and world-known Sete Quedas Falls, which was done under much tension.

The region is politically divided among various nationalities, although the languages they speak, the neo-Latin Portuguese and Spanish, are very closely related and commonly understood by both groups. There is a strong regional competition, for

instance, among cities that grew to unexpected size after the construction of Itaipu, like Foz do Iguaçu (Brazil), Puerto Iguazu (Argentina) and Ciudad del Este (Paraguay) on what was called the Three-border Complex. Differing policies to several problems by the various city councils and country laws make it a difficult task to co-ordinate efforts to propose solutions for the correct management of the water problem. Even in midst of the bounty of the natural resource, there are conflicts to be overcome.

This political and regional diversity requires the study of issues relating to management of underground water resources in a broader scope and in the international arena. To this end, there is a need to begin with promoting interaction between the populations involved, in view to environmental protection, for an optimal employment of a natural resource like water. Understanding the relation between subsurface hydrology and ethics - a task still to be addressed - will enhance and better sustainable life on earth.

Economically these areas have historically been agricultural. Sustenance farms grow cereals and other types of plantations. Cattle, pork, and chicken are major agro-pastoral undertakings. In the last decades, larger towns have developed to become industrial centres. The physical area includes some of the most developed parts of South America, presenting the largest and most industrial Latin-American parks and the place where major agricultural activities are carried out with modern techniques.

In addition, the area experiences an extraordinary socio-economic development due to MERCOSUR (South American Common Market) including Brazil, Argentina, Paraguay and Uruguay. Consequently, there is an increasing demand for groundwater as a human commodity for industries, agriculture, and housing.

4. SHARING RESOURCES: A CATALYST FOR HARMONY

The physical aspects of the Guarany Aquifer region are basically similar. It enjoys confluent groundwater streams - Parana, Paraguay, Iguazu, Uruguay rivers. The region is geographically identified by somewhat similar vegetation, climate, landscape. These characteristics make it feasible to let partners come together under one banner to discuss and approve principles that will foster regional harmony and development.

There is a need to spell out clearly principles of international environmental ethics and to refine them through repeated applications to concrete situations. In the case of the Guarany Aquifer, such an ethical system is an interlocking set of principles of proper conduct that, in a comprehensive manner, address the behaviour of individuals, groups and governing bodies. If the idea succeeds, it will endeavour to promote sustainable development of the whole region.

One of the issues under debate is about attitudes to nature, as environmental interests oppose to economic ethics, which is the expression that stands for the thrust toward sustainable development. On the one hand, there is an ecological diagnosis mentioned by Passmore: "The view that everything exists to serve man encouraged the development of a particular way of looking at nature, not something to respect, but rather as something to utilize." (Elliot 1995:131f) This is

a utilitarian view. Passmore was one of the first authors to advocate a strictly anthropocentric approach to environmental ethics.

On the other hand, Christian theology seems to have adopted the Greek cosmology, which defended that nature is in no sense sacred. Man was made in God's image, he was given the power to *radâ*, to rule over nature. This position has shifted in recent times to a more considerate attitude to nature, defending that humans are God's stewards over it and accountable for any abuses they incur. In this way the doctrine of creation has been put back on its pedestal on a level similar to redemption and sanctification. The Rio Declaration says in its very first statement that "human beings are at the centre of concerns for sustainable development". Nontheless, a common view is that human interests must give way when there might be conflicts. The valuable third article of the Rio Declartion states that "the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations."

A quite contentious issue on the quest for water is the privatisation of its management, treatment, and distribution to major urban conglomerates. The public (*res publica*) and the private (*res privata*) have been kept respectfully apart in political thought and practice all through the centuries in Western tradition. Environment as a whole and water in particular is intrinsically as well as instrumentally valuable. That means that water is valuable for its own sake as well as for all the benefits, tangible and untangible, that it provides equally to all human beings. Underground water should, therefore, belong to all members of a national society, and this right cannot be sold to individuals or companies by economical criteria. An established democratic government has been sworn in to defend its people, to preserve their right to propriety, and to invest the scarce resources in combating problems like the lack of safe drinking water, adequate sanitation facilities, and even secure food supplies. The government manages the *res publica*, which includes water resources and its management for public welfare. State representatives have no moral legitimacy to privatise public assets that are vital for human life and for the welfare of all citizens, like water.

The question to be asked is whether the decisions and laws aggregate happiness or efficiency to citizens. What has been consistently happening in developing countries is that, in unstable political and moral governance, public assets and gains are privatised and distributed among political peers, and all and every loss is socialised, which means that the taxpayer has to pay the account of inefficiency or malversation. This is to say that citizens don't get any profit from the results of privatised enterprises, and at the same time they are called to pay for every loss or deviation of money that occur through mismanagement or corruption on the part of elected or appointed authorities. In unstable economies it has been noted that people have to pay, for instance, for fuel and electricity in a strong currency, while they earn their living in the devaluated currency of the country. The explanation generally given by the government is that international prices grew higher, currency has become weaker, all fruit of maladministration of public assets.

Everytime water, a life-giving source, is transformed into an economical asset, its use presents numerous problems, whose solutions require ethical reflections. Through negotiation it must be so managed as not to become a source of conflict or imbalance between or within countries. Water is becoming rare, the world's population is increasing, the climatic environment is unfavorable and soils become

more and more fragile in a number of regions as a consequence of a pure utilitarian view and practice. Water is often wasted and its ill-controlled use exposes fragile land to barrenness; yet its availability is vital to the quality of life and hence the stability of societies.

5. ETHICAL PRINCIPLES FOR WATER SHARING

Environmental ethics is a relatively new branch of ethics concerned with "approaching as closely as possible a sense of what is essentially human in our nature". (Coicaud 2001:1) This perspective has been pursued in a recent United Nations publication on the extents and limits of ethics in international affairs. The authors admit that studies in this area are, at best, at an early stage in the development of international environmental ethics. This field is likely to evolve during the foreseeable future. According to the research proposals, the study should evolve (a) as a bio-centric ethics of environmental protection and/or (b) as an anthropocentric ethics of sustainable development (Coicaud 2001:190). Of course, the two visions may coexist and even reinforce one another for a period of time.

As for the Guarany Aquifer, the former is important for the survival of humankind, but the latter will prove stronger as definite steps are taken in that direction. The ethical contribution is to warn of adverse impacts on human well-being. The destruction of natural resources done particularly in the construction the Itaipu dam is one of these adversities. The economic need or greed has subdued legitimate scientific, medical, and aesthetic uses of the area under which the aquifer is formed. Instrumental values have so far been prevalent over the integrity of the natural environment. (Elliot 1995:1) Thus some have argued "that human nature is such that humans can genuinely and fully flourish only if there is frequent contact by humans with wild nature.." (Elliot 1995:1)

Following Coicaud's proposal of normative premises to what is ethical relevant for the Guarany Aquifer management, the present paper defends the principle of environmental equity, by which "the rich and powerful do not insulate themselves from environmental harm largely by displacing problems on to the poor and weak." (Coicaud 2001:167) There is a concrete danger in the region involving the use of hazardous chemicals or the production of toxic wastes, which will directly affect the underground aquifer system. There is an ethical need to preserve in the heart of the earth a vital resource that is being depleted or corrupted. A stronger voice must be lifted up opposing the exploitation of large industrial or agricultural undertakings for the disposal or reprocessing of hazardous wastes.

One of the basic principles of environmental ethics is "that it must illuminate, account for or ground appropriate respect for and duty towards the natural environment, and it must do this without placing primary importance on human interests." (Regan 1992:161) All are in the same boat, the rich and the poor, humans as well as other living creatures. To all applies the principle of caring for the earth and even for waters under the earth. There is a common but differentiated responsibility that includes the world´s richer countries and those that need assistance to participate in global environmental regimes.

An ethical system is an interlocking set of principles of proper conduct that address in a comprehensive manner the behaviour of actors in a recognized field of human endeavour. The principles of international environmental ethics, for the sake of the Guarany Aquifer, have not yet been spelled out clearly, nor been refined through repeated applications to concrete situations, nor have they been codified in a single authoritative text.

6. IMPLEMENTATION OF CO-OPERATIVE MECHANISMS

There is no universal declaration or charter of environmental ethics that all or virtually all the actors in an international society acknowledge as authoritative. This is true also for the Guarany Aquifer. The Helsinki Declaration was a rather good start. It is a victorious thesis in the field of peoples' citizenship and human rights. However, the voice of Third World countries is still weak and almost inaudible, but it has to be raised facing a growing process of economic massification. Issues having to do with the provision of assistance to poor countries to participate in global environmental regimes must be codified in a single authoritative text.

At governmental level, the countries of the Guarany Aquifer must foster the appointment of a Committee on which all involved are represented, in order to create laws and procedures which will be accepted and enforced by all of them at sub-continental level. The Commission for the Defence of the Consumer, Environment, and Minorities, constituted by the Brazilian National Congress, has already approved a motion to unify environment policies at the Mercosur level. The Legislative Decree PDC 1697/02 has issued a harmonising legislation for all four countries that form the Mercosur, stating equal conditions of competition to all by adding the environmental cost in the final price of the productive process. The decree represents in its details an advance to the discussions favouring the protection of the Guarany Aquifer. Mercosur is a regional body already in existence that should broaden its authority to managing transboundary water reservoirs. Measures taken like those at the time when the Itaipu reservoir and hydroelectric plant were planned, contain rich materials that proved successful in overcoming the tensions at that time, twenty-five years ago.

One could finally suggest the revision of groundwater policies affecting especially larger populational concentrations in the aquifer area and an interjurisdictional scan of groundwater protection program. Managing literature should be distributed freely to inform the population, so that people turn themselves witnesses to what positively distinguishes humans living on a treasure handed down to them by God and by nature: the quest for dignity.

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METHODOLOGIES FOR INTEGRATED WATER RESOURCES MANAGEMENT

USE OF COMPUTER MODELS IN MANAGEMENT AND NEGOTIATION OF INTERNATIONAL WATER RESOURCES

Gro D. Ofjord[117] and Richard Palmer[118]

ABSTRACT

This paper describes conflicts in three international river basins and discusses how computer models can facilitate negotiation of water resources, using the Rio Grande/Rio Bravo dispute as a case study. The paper begins with a brief description of the three river basins and summary of the types of conflicts encountered. Next, the role that computer models can play in facilitating negotiations is described. Shared Vision Modelling is proposed as a potentially useful approach in model development and application. In this approach highly interactive and user-friendly software is used by both stakeholders and water resource experts to develop models conjunctively. The advantages of such an approach are described and then an application to the Rio Bravo basin is presented. Two of the principle insights, the value of the "technification" program and need to decrease the annual water allocation to certain districts, provided quantification to the value and need of the programs that would not have otherwise been possible. Although the final agreement to this conflict has not occurred at the time this paper was completed, it is hoped that the model will find an appropriate role in the negotiation process.

1. INTRODUCTION

As the freshwater in our world become scarcer, conflicts over water increases. Some researchers and politicians forecast that water will cause future wars, while others argue that the shared desire to use transboundary waters efficiently will be an excuse for co-operation. Regardless, there is a growing need to resolve through peaceful negotiations the international water resource conflicts that currently exist. Conflicts occur in water resources planning and management for a variety of reasons. Stated most simply, conflicts occur when people disagree about how much water of a given quality and quantity should be used at a specific location for a specific purpose at a specific time. Negotiation is a process where two or more parties with conflicting objectives attempt to reach an agreement.

The guiding principle in the allocation of waters of an international watercourse is rooted in equity, i.e. there must be "perfect equality of all riparian States in the use of the whole course of the river and the exclusion of any preferential privilege of any one riparian State in relation to others." The United Nations General Assembly approved the "Convention on Non-navigational Uses of International Watercourses" in 1997 (UN 1997). The two key principles of the Convention are "equitable and reasonable use" and the obligation not to cause "significant harm" to a neighbour. The convention gives a number of criteria to consider (climate, geography, hydrology, population, among others) but does not offer a procedure for weighting them (Postel 1999). Most importantly, the convention makes it more difficult for an upstream country to ignore the needs of a downstream country. However, the

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challenge of how best to illustrate the trade-offs between the benefits that accrue to one nation relative to another in different patterns of water use and allocation remains.

Highly interactive computer models can contribute to the evaluation of the potential benefits of water use and allocation and to develop solutions to water resources conflicts. Such models can be used during the negotiation process by engaged parties or by a professional mediator. A computer model can simulate many of the complex negotiation problems encountered in a water resource conflict and provide a testing ground for potential solutions.

This paper reports the progress to date of a portion of a study of several international river basins. This paper focuses on three basins; the Nile River, the Columbia River and the Rio Grande/Río Bravo. The history of conflict and co-operation in the basins is investigated as well as the major international treaties between the riparian countries. The following questions are addressed;
How successful are the water treaties between nations?
Do the treaties address the important issues of today?
What are the possibilities for renegotiations of the treaties?
Was there any computer analysis in the negotiations of the treaties?
Are computer models currently being used in the management of the rivers?
Are the models used to implement the treaties?

The Rio Grande is used to illustrate the process of incorporating models into water resource negotiation. This model focuses on the current dispute between the US and Mexico concerning a 1944 treaty and the management of water during droughts.

This paper first provides a brief description of each basin and discusses the major conflicts, treaties and agreements, and the key riparians. The success of the treaties is evaluated. A general description of computer models used in negotiation and management of rivers follows. The last part describes a case where a computer model has been incorporated into a negotiation.

2. THE RIVER BASINS

2.1. The Nile River

The Nile is the longest river in the world, shared by ten countries; Ethiopia, Sudan, Egypt, Uganda, Kenya, Tanzania, Burundi, Rwanda, the Democratic Republic of Congo, and Eritrea. The White Nile originates in east central Africa and flows North through Uganda and into Sudan where it meets the Blue Nile, which rises in Ethiopia. The Main Nile flows from Khartoum through Egypt to the Mediterranean Sea. The total annual volume of freshwater reaching the Sea is only about 1.6 billion m^3, compared to 32 billion m^3, before Egypt built the Aswan High Dam. In addition to the lack of water in the Nile, the quality of the freshwater is also being degraded; i.e. deforestation in the Ethiopian highlands has caused severe topsoil erosion and silting of the river channels, farmlands in Sudan and Egypt are salinized, and water borne diseases are wide-spread (Elhance 1999).
There are 11 international agreements on the Nile, and all have given priority to Egypt's historical water rights. In 1959 Sudan and Egypt entered a bilateral agreement, known as the "full utilisation of the Nile." This treaty divides the flow of

the Nile between Sudan and Egypt, regardless of the water demands, or needs of the upper riparian states (Shiva 2002). The treaty did, however, anticipate future demand from the excluded riparians, but merely stipulated that Egypt and Sudan should deal with those demands jointly. The treaty gives Egypt the right to 55.5 km^3/year and Sudan 18.5 km^3/year. The rest (10 km^3/year) of the annual flow of 84 km^3 is lost due to evaporation. This treaty has not been approved or signed by any of the other 8 riparian states.

The key Nile riparians are Ethiopia, Sudan, Egypt and Uganda. Sudan and Egypt are currently the only countries that fully exploit the waters of the Nile. Egypt, the lowest riparian, depends entirely on the waters of the Nile. Ninety-six percent of the water it uses comes from the Nile. Egypt has consistently opposed any new Nile water treaties and wants to maintain its "acquired rights," and wants to expand its irrigation land (Dinar and Alemu 2000). Ethiopia on the other hand, the source of eighty-six percent of the water in the Nile, has a strong claim for Nile water entitlement. After years of civil war and social upheaval, Ethiopia now has the stability to begin tapping upper Nile waters for its own agricultural and economic advancement. Sudan also wants to maintain its prior "acquired rights", and claims to have fully utilised its 1959 allocated share. Sudan is reluctant to upstream claims, but does not oppose new Nile water agreement. Uganda contributes with 15 billion m^3 to the White Nile and is also interested in ensuring its entitlement.

International law and the guidelines of international financial bodies make it very difficult for an upstream riparian to develop its portion of the river without consent and co-operation of downstream riparians. In a sense, a downstream riparian can prevent third party financing of a development project in an upstream country. Ethiopia depends on third party financing to build large scale dams, however, it has a long tradition in small-scale agriculture and many farmers have the experience and skills to build small dams (micro-dams). The building of micro-dams does not necessarily require outside funding or technical expertise. Micro-dams are neither an obvious military target, nor will the impact of destroying one be severe. The building of these micro-dams may eventually have an impact on the water flowing to downstream riparians, and lead to conflicts with the downstream riparians.

In the past few years there have been a number of attempts to reach an effective water management agreement for the region. The Nile Basin Initiative was established between the 10 riparian states in 1999. This initiative is developing an agreed basin-wide framework and is guided by the countries' Shared Vision "to achieve sustainable socio-economic development through the equitable utilisation of, and benefit from, the common Nile Basin water resources." This work may be a precursor for negotiations for a new treaty between all the riparians.

2.2. Computer Models

Many computer simulation programs have been developed for the management of the Nile river e.g.: Nile River Forecasting System developed by the National Oceanic and Atmospheric Administration's Office of Hydrology's Technology Transfer Centre and the FAO. The prime objective of this project is to predict the inflow into the High Aswan Dam with as much lead time as possible. An additional goal is to regionalise forecast capability so that many of the ten riparians in the Nile basin could benefit from use of the forecasts. The Georgia Tech Nile Basin Management decision system, developed with the support of the FAO of the United Nations,

includes models for inflow forecasting, river and reservoir routing, and reservoir control. These models, unfortunately, appear to be extremely complex and not targeted appropriately for negotiated decision support.

2.3. The Columbia River

The Columbia River is the fourth largest river in North America. It flows through one province in Canada, (British Columbia), and seven US states; (Washington, Oregon, Idaho, Montana, Nevada, Wyoming and Utah). The river originates at the Columbia Lake on the west slope the Rocky Mountains in British Columbia, and runs to the Pacific Ocean, with its mouth on the border of Oregon and Washington. It is a snow-runoff dominated river with high seasonal variability. On average, 30 % of the river flow comes from Canada, however, 50% of the flow in summer originates in Canada. The Columbia River is one of the most developed rivers in the world. The river system consists of more than 250 dams, operated for a variety of purposes including power production, flood control, irrigation, navigation, and fish habitat enhancement. The possibility of further system expansion is limited. The hydropower production currently supplies about seventy-five percent of the electrical energy in the Pacific Northwest. The development of the basin for these purposes has resulted in pronounced changes in the natural flow regime in the river. This operation has compromised and degraded fish habitat and created other ecological impacts.

There is only one bilateral treaty, the Columbia River Treaty (CRT), initiated in 1961, and ratified in 1964, by the governments of the US and Canada. The treaty co-ordinates flood control and hydropower production in the Columbia River. According to the CRT, Canada will store 19 billion m^3 of water each summer in three dams to provide downstream flows. These dams are also drafted lower during the spring runoff to provide flood protection. In return for the building of the dams Canada is entitled to half of the additional hydropower benefits generated in the US part of the river. The US also is required by the CRT to utilise the flows from the Canadian storage in an efficient way to produce hydropower. The CRT was signed for a 60 year period. Neither of the countries can terminate the treaty during the 60 year period. If one of the countries wants to terminate the treaty at the end of the 60 year period, they will have to notify the other country 10 years in advance. There has been no serious talk regarding re-negotiation of the CRT. The Treaty projects were all completed by 1973, and the Treaty does not expire until 2024. There have been "supplemental agreements" under the Treaty (including the Non-Power Uses Agreement, the Libby Co-ordination Agreement, etc.). However, these agreements assume that the "default" operating conditions are set by the Treaty and that a supplemental agreement is only possible if both sides see mutual benefits.

There have been conflicts both within each country and between the two nations regarding the use and management of the Colombia's water resources. These conflicts have become more heated and costly as the variety and complexity of the uses and users of the Columbia River have grown (Cohen et al. 2000). The western water law of prior appropriation (first in time, first in right) has also made it difficult, especially for local managers, to manage and provide water to all users. The most significant conflict in the river is between hydropower production and the ability to meet the instream flow requirements for fish (Miles et al. 2000).

Transboundary issues between Canada and the United States are imbedded in some of the primary water resources challenges facing the Columbia River basin with regard to the maintenance of instream flow (for the fish) in the summer. The construction of the Grand Coulee Dam in the US prevented the natural migration of anadromous fish upstream; hence there is not much incentive for Canada to maintain the instream flow during the summer. In recent years, the nature of water use conflicts in the Columbia basin has changed appreciably. Environmental aesthetic, cultural, and recreational values that were given little attention during the period of dam development have become the central focus of policy debates (Cohen et al. 2000).

2.4. Computer Models

There were many engineering studies done in the late 1940's and 1950's with respect to the operation of potential Canadian storage projects in co-ordination with downstream U.S. power plants. However, these studies were done primarily without the aid of computers. Operating policies and principles were developed from these studies, the CRT negotiations made use of this information, and this resulted in a signed Treaty in 1961. The use of computers increased very rapidly in the 1960's and 1970's and have been used regularly since then to contribute to the standard CRT planning studies (Assured Operating Plan, Determination of Downstream Power Benefits, Detailed Operating Plan) every year. In addition, a computer model is used to "implement" these operating plans through the Treaty Storage Regulation (TSR) study, which is updated twice per month. The TSR study gives the official determination of U.S. and Canadian "rights and obligations" under the Treaty for the current hydrologic conditions. Both sides (U.S. and Canada) also use many other computer models to analyse potential operations and develop strategies for Columbia River operations.

Projected climate change scenarios shows that the climate in the US portion of the Columbia River basin will be warmer, with more rain than snow during winter and drier summers, which again will lead to less water in summer. The situation in Canada will, however, be less impacted, as most of the snowpack is at elevations where winter temperatures are sufficiently below freezing that a few degrees increase will not have a large impact. Some scientists therefore suggest that the US and Canada should renegotiate the treaty to include summer flows. Both parties may gain from such a re-negotiation, as the US will get more water during summer, and at the same time, Canada will gain from selling hydropower during summer.

2.5. The Rio Grande/Río Bravo

The Rio Grande (Río Bravo in Mexico) rises in the San Juan Range of the Rocky Mountains in southern Colorado in the US. It then flows through New Mexico to El Paso in Texas where it becomes the 1,920 km boundary between Mexico and the United States before it reaches the Gulf of Mexico. Both the quantity and the quality of the water in the Rio Grande are of primary concern to water users, and is a focus of cross-border management initiatives.

There are two bilateral treaties relating to the Rio Bravo between the US and Mexico. The treaties deal with the river upstream of El Paso (1906 Treaty) and downstream of El Paso (1944 Treaty). In the 1906 treaty, the US agreed to deliver 60,000 acre-feet (74 Mm^3) of water to Mexico. The 1944 treaty deals with both the

Colorado River and the Rio Grande. In this treaty the US must deliver water from the Colorado River to Mexico, while Mexico must deliver water from the Rio Grande to the US. In the 1944 treaty, an average of 350,000 acre-feet (432 Mm^3) of water per year must be supplied by Mexico from tributaries to the Rio Grande River. This treaty is discussed in more detail in the Rio Grande Case Study presented later in this paper.

The 1944 treaty has worked reasonably well and disputes between the U.S. and Mexico over division of the waters of the Rio Grande have been minimal—until the 1990s. Persistent drought in south-eastern Texas and north-eastern Mexico, coupled with rapid population growth and increased use of the region's water supplies, has led to significantly less water reaching the main stem of the Rio Grande - in particular from Chihuahua's Río Conchos, which in normal rainfall years is the source of most of the river's flows downstream of El Paso. During recent years, the Rio Grande has suffered one of the most severe and extended droughts in its recorded history. Thus far in 2002, conditions have only worsened. The natural runoff of the tributaries considered in the 1944 International Waters Agreement belonging to Mexico have been only 11% of the historical average during the period of January to July of 2001, representing the lowest flows during the dry period that began in 1993. During this drought, Mexico has not been able to deliver the water they are obliged to according to the treaty. The ranchers and farmers of the Lower Rio Grande Valley in Southern Texas who depend on the water have faced reduced resources, which negatively impact their operations. Tensions between the local Texan farmers and Mexico are growing.

The controversy between the US and Mexico has been more bitter and complicated than the one with Canada partly because both the Colorado River and Rio Grande for part of the length, form the international boundary. The conflict of use of the river is not only between the US and Mexico but has also been a source of conflict between the 8 US states in the basin, e.g. the sunbelt war, an 11 year "water war", between Texas and New Mexico (Earl and Czerniak 1996).

2.6. Summary River Basins

As can be seen from the above examples conflicts related to transboundary water occur regardless of whether the countries involved are developed or developing. The major conflicts are related to the allocation of water between not only the countries but also the different users of the waters. The less water there is the more acute is the situation.

All of the treaties currently reflect past water demands and allocations and do not reflect placing available water to its highest economic needs. Many of these basins are facing rapid population growth, increases in per capita water use, and increased water consumption by cities and industries. At the same time NGOs and citizens' groups has emerged as a powerful new force for conservation and ecosystem protection. The conflicts are thereby intensified. Renegotiations of the treaties may therefore be the next step in resolving the conflicts between the different riparians and users. The examples above indicate that there should be incentives and possibilities for all these treaties to be renegotiated in order to reflect both today and future situation. In such renegotiations of the treaties or other negotiations over the rivers, there will be many more stakeholders that will have or want to have a saying in the process. A computer model can be used in data-collection and

data sharing between the riparian countries, and in a decision making process for settling an agreement between the different parties. A computer model may also be a helpful tool to facilitate these negotiations.

3. COMPUTER MODELS

Computer models have been used in water resources planning for many decades (Yeh 1985, Loucks et al 1985, Simonovic and Bender 1996), and there is a trend towards increased use and accept of computer models both in simulations and optimisations of water resources. Computer assisted negotiation exercises are increasingly being used to help address the complex political and institutional issues that surround the allocation of scarce water during crisis (Sheer et al. 1989, Thiessen et al. 1998, Druckman et al. 2002). Computer simulations are currently used to evaluate the trade-offs between conservation storage, flood control, power production and water supply and to predict climate change scenarios. Computerised water resources simulation models implement physical, economic, political and biological features of a water system into a computer code. The models allow examination of the potential impacts of different system inputs, configuration or operations without incurring the costs and risks that would occur if such changes were made to a real system. They also allow water planners to simulate the effects of alternative approaches. In addition they are beginning to enable stakeholders to contribute to complex technical decisions (Simonovic and Bender 1996).

Can computer models help solve the conflicts over water in a peaceful way? Water resources disputes can be difficult to resolve because of the unquantifiable and conflicting objectives among the involved parties, the uncertainty of the hydrologic forecast, inexperience in managing extreme hydrologic events, and the legal and institutional systems that constrain the activities of the involved parties. To support negotiation and conflict resolution effectively, computer simulation models must possess a number of characteristics. These models must provide useful information that allows a common view of a resource that can be the focus of evaluating the range of outcomes that may be associated with a set of actions. In water resource conflicts, models must reflect the effected parties' perspective of their water resources system. Shared Vision Modelling refers to a process whereby all parties involved with managing water resources management in a watershed are brought together to construct a simulation model of the watershed (Keyes and Palmer 1993). Participants identify and agree on the scope of the model as well as the data incorporated into the model itself. Once developed, the model provides water resource managers the ability to interactively evaluate the effectiveness of alternative watershed management approaches before implementing any one approach. The Shared Vision process has been used in other regional watershed planning efforts, including a University of Washington study of the Alabama-Coosa-Tallapoosa and Apalachicola-Chattahoochee-Flint river basins in Georgia, Alabama, and northern Florida (Palmer 1998, Palmer 1999, Palmer et al. 2002).

Shared Vision modelling also enables clear organisation and evaluation of the relationships between physical and operational components of a water supply system. Each Shared Vision model can be constructed to specifically address physical and socio-economic factors influencing water use and availability within a specific watershed. Shared Vision models are easy to implement and available on multiple platforms. They also have a relatively short learning curve and can be

produced at relatively low cost, enabling local level watershed managers to use the model quickly.

4. RIO GRANDE CASE STUDY

As noted previously, the US and Mexico are engaged in a significant dispute related to the deliveries of water associated with the 1944 International Treaty signed between the two countries. The Rio Grande/Río Bravo is an extremely important river, serving as the international boundary between the US and Mexico and providing water for both municipal/industrial water supplies and for irrigation (Figure 1).

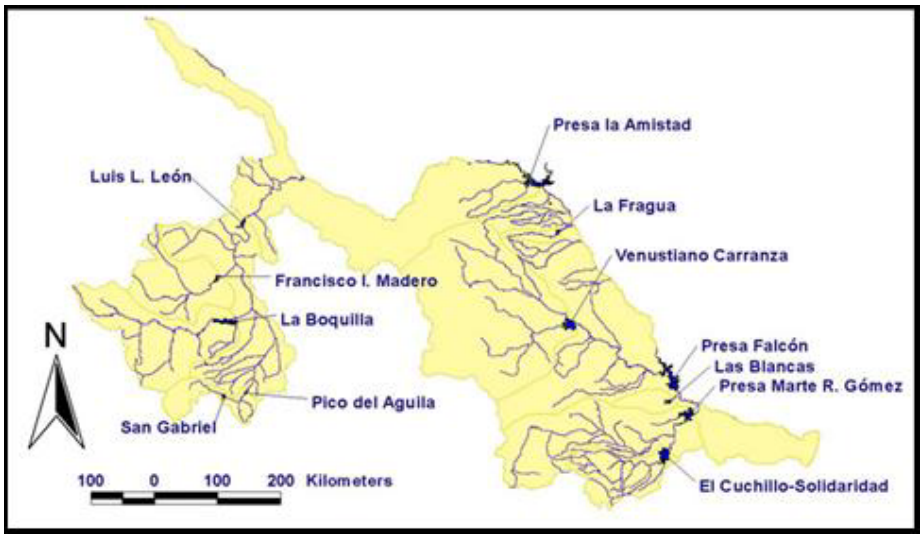

***Figure 1*: The Rio Bravo Basin (Falcon and Amistad are international reservoirs).**

When the region receives more than average annual flows, there is typically sufficient water to meet most needs. However, during drought events, the storage contained in reservoirs, on the mainstream of the Río Bravo and in the interior regions of Mexico that drain to the Río Bravo, must be used to augment natural flows.

The Río Bravo is experiencing one of the worst droughts on record and this has had a negative impact on the ability of Mexico to deliver treaty water, to provide irrigation water and to maintain is storage. The total storage in the Mexican portion of the two international dams on the Río Bravo during the past decade is presented in Figure 2, and current storage conditions in nine Mexican and two international reservoirs are given in Table 1

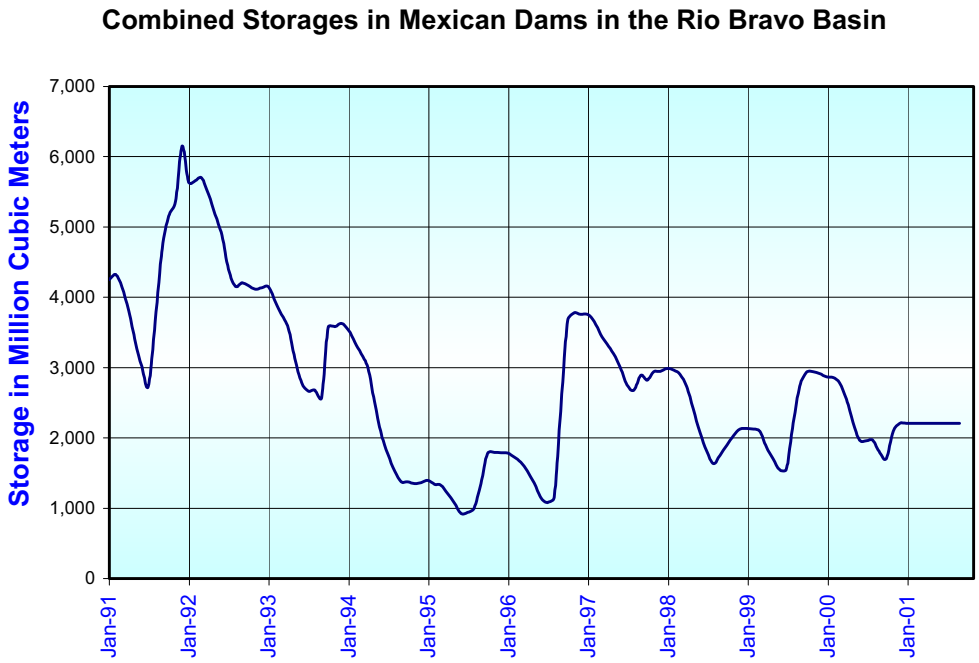

***Figure 2*: Combined storage in Mexican dams in the Rio Bravo basin**

Reservoir	Storage in (Million m^3)	Capacity in (Million m^3)	Percent of Storage
Francisco I. Madero	80	343	23.4%
La Boquilla	523	2774	18.9%
San Gabriel	19	248	7.7%
Pico del Águila	16	45	35.7%
Luis L. León	39	314	12.4%
Venustiano Carranza	75	1,374	5.5%
El Cuchillo	326	1,123	29.0%
Marte R. Gómez	230	999	23.0%
La Amistad	186	1,937	9.6%
Falcón	111	1,500	7.4%
Total Storage	**1,606**	**10,657**	**15.1%**

***Table 1*: Current Storage Conditions**

In response to this drought, the Mexican government has declared 19 northern states disaster areas. During 2001, Mexico has limited the amount of water provided to the irrigation districts in the basin in attempts to better manage the water that is available. Access to stored water has been limited, with some irrigation districts receiving no water, and others receiving considerably less than they have in the past. Deliveries to the Delicias, Río Florido, Bajo Río Chonchos, Don Martin, and Bajo Río Bravo districts have been reduced to 28% of typical water delivers prior to 1992, and to 40% of what they had been in the period of 1993-2000. This extended period of low flow has had significant impacts on the ability to provide water in the region.

4.1. The Treaty

The treaty between the two countries allocates water along the Mexico/US border. The allocation rule provides the US with, among other waters, one-third of the flow reaching the main channel of the Río Grande (Río Bravo) from the Conchos, San Diego, San Rodrigo, Escondido, and Salado Rivers and the Arroyo Las Vacas, provided that this third shall not be less, as an average amount in cycles of five consecutive years, than 431,721,000 cubic meters annually. If it is less, releases must be made from the reservoirs in Mexico during the five year period to augment the flows so that they do total 2.1586 billion cubic meters over the 5 year period. If Mexico is unable to meet this target during a five-year cycle due to extreme drought, they have another five year period during which to meet the original target and to meet the target of the new, current cycle. If the storage contained by the US in the international reservoirs reaches the US's storage allocation, then the cycle is completed and a new cycle is begun.

The length of cycles has varied greatly over the past 50 years. In the treaty's history, Mexico has not delivered the full amount required during three cycles: the cycles that began on October 1, 1953; June 2, 1982; and September 27, 1992. In the first two instances, the debt was either repaid during the following cycle or high flows created a new cycle by refilling the US storage portions of the reservoirs.

At the time of this writing,, Mexico owes approximately 1,600 million cubic meters (Mm^3) in payment to the treaty, which is due by September 30, 2002. During the past three years, Mexico has dramatically reduced the water provided to its irrigators, but continued low flows and low storage have prevented Mexico from repaying its debt to the US.

4.2. Negotiating Tool

Mexico currently has not arrived at an approach to solve this conflict. In an effort to better define the range of options available, the National Water Commission (NWC) of Mexico has developed, with the authors of this paper, a model to be used in the creation of an emergency drought plan. The purpose of the model is to simulate the system (storage, flows in the rivers) to various management strategies that provide differing amounts to water to the various needs of the basin. The model was developed in the STELLA® modelling environment.

The Rio Bravo Emergency Drought Management Model was constructed with the aid of the staff of the NWC and other regional experts. It simulates the operation of ten major reservoirs in the basin and identifies water uses by all of the major water irrigation districts and municipalities that use Rio Bravo water. A wide range of operating policies has been implemented into the mode. In addition, a variety of strategies has been included in balancing the needs of the irrigation districts, the treaty obligations, and the need to maintain storage in the system. Municipal water rights were given first priority in the model. The data used are supplied by the NWC and represent the most current streamflow and demand data available for the region. The model allows the NWC to explore a wide range of potential management strategies and to determine which best provides for the region's many needs. The model and its use are more fully described in Vigerstøl (2002).

4.3. Use Of The Model

As the September 30 deadline approached, the model was used to explore a wide variety of alternative operations. A primary concern was determining the quantity of water that could be provided to the US by Mexico to meet the treaty obligations to the extent possible. In using the model, a number of important insights were gained. The most important included:
Because of the continuing drought and current low reservoir storage levels, full delivery of the deficit would leave Mexico very vulnerable to municipal water shortages if the drought continues.
If the current drought streamflows continue, maintaining the current severe irrigation reductions is necessary.
The storage levels in the system are not likely to increase in the future until flows return to normal or above normal, and refill will require two to three years unless unusually high rainfalls occur.
The National Water Commission's current efforts to provide more efficient delivery of water to the irrigation projects and to decrease the amount of land being irrigated can decrease the likelihood of extremely low flows in the future.
Because of the extremely depleted reservoir storage in the basin, there is currently little operational flexibility. It is important that Mexico reserve sufficient water in its reservoirs to meet future municipal water demands, thus depleting the reservoirs further is not prudent.
Current annual weather forecasts project mild El Niño conditions, which should provide more than average rainfall to the region and will hopefully result in slightly improved storage during this year.
In the future, the implemented emergency drought plan will provide a series of triggers and drought responses that will decrease the probability that storage will reach such an extreme state. The drought plan will significantly modify system operation during low flows periods.

5. CONCLUSIONS

Conflicts related to transboundary water occur regardless of whether the countries involved are developed or developing. The major conflicts are related to the allocation of water between, not only the countries, but also the different users of the waters. The existing treaties currently reflect past water demands and allocations and do not reflect placing available water to its highest economic needs. The expected population growth and the increased focus on conservation and ecosystem protection are intensifying the conflicts and making them more complex, while at the same time introducing more stakeholders.

Shared Vision Modelling has several advantages for use in a multiple stakeholder watershed planning process. The primary advantage, referenced above, is the ability to use the model to evaluate management alternatives. A second advantage is the participatory nature of the process. Stakeholders can have increased confidence in the output of the model since they are involved in all stages of the modelling process. They must have agreements on data inputs and assumptions to be included into the model, encouraging resolution of technical issues prior to use in the model. Early agreement thus allows participants to focus on understanding the results of the model rather than debating the inputs after a result has been generated.

Without the use of the Rio Bravo Emergency Drought Management Model, many of the insights gained may not have occurred. Two of the principle insights, the value of the "technification" program and need to decrease the annual water allocation to certain districts, provided quantification to the value and need of the programs that would not have otherwise been possible. Although the final agreement to this conflict has not occurred at the time this paper was completed, it is hoped that the model will find an appropriate role in the negotiation process.

ACKNOWLEDGEMENTS

The authors would like to thank the National Water Commission of Mexico for their support and access to data, and the Valle Scholarship and Scandinavian Exchange Program for making this work possible.

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SOCIO-ECONOMIC ANALYSIS OF BILATERAL WATER TREATIES

Basman Towfique and Molly Espey[119]

ABSTRACT

Water resource issues are closely related to property rights issues, as the holders of property rights along a riverbank, watershed, lake, or river basin often take priority in terms of water usage. Rivers, aquifers and other bodies of water transgress national boundaries, giving rise to conflicts. Treaties, agreements, and conventions seek to allocate water rights among countries in a manner that benefits all participants. This study conducts an empirical analysis of macroeconomic, geographic, hydrological, and institutional variables in order to determine factors contributing to the existence of bilateral treaties and the structure of treaties.

1. INTRODUCTION

Water is one of the fundamental resources of nature. Water is a finite and renewable resource. Freshwater is required both biologically and economically, and is vital to industries such as agriculture, fisheries, mining, manufacturing, and others. There are approximately 261 watersheds and numerous trans-boundary aquifers affecting around 40% of the world population (Wolf, 1999). Rivers and streams supply 80% of the freshwater needs of human beings. There are more than two hundred river basins in the world that are currently shared by two or more countries, distributed across Africa, North America, South America, Asia, and Europe. These river basins cover approximately 47% of the earth's total landmass (Elhance, 1999).

Rivers do not respect national boundaries and give rise to major economic and environmental concerns. When a river flows through two or more countries it is defined as an international watercourse[120], and these trans-boundary waters or watercourses may serve more than one function. First, international watercourses may be used to draw international boundaries. Second, watercourses can be used as international highways, especially to countries without direct access to the sea. Third, these waterways may serve non-navigational purposes for irrigation, fishing and the production of hydroelectric energy. According to international law, any country situated on the bank of an international water body cannot perform any kind of activity in that river that might cause negative externalities in other countries. Improper management of these international water bodies has given rise to various socio-economic problems.

Physical geography plays a substantial role in defining the relative bargaining power of riparian states, which is primarily determined by international demarcations. Upper riparian rights-holding nations usually claim absolute territorial sovereignty, proclaiming the right to exploit the water source, regardless of the effects of this

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[120] Convention on the law of the Non-Navigational Uses of International Watercourses, Article 2(b)

water use on riparian countries. Lower riparian nations seek to preserve the absolute integrity of the water source, claiming that the upper riparian states should not adversely affect water quality or quantity.

Lack of secure, uninterrupted, and long-term availability of adequate amounts of freshwater is accelerating in many regions of the world. When essential, non-substitutable, shared resources are over exploited or degraded by one country at the expense of another, conflicts are inevitable. Shared basins can be substantially altered by intentional or unintentional human or economic activities. With the increase in world population, the consumption of and demand for common pool freshwater resources are intensifying. Dried-up rivers, shrinking lakes and wetlands, and falling water tables are signs of a natural decline in the water supply. This increase in the scarcity of water resources is giving rise to conflicts among countries that share international watersheds.

When resources are shared between two or more sovereign countries, there will be interdependence among them. Theoretical devices can explain the apportionment of these resources in collective settings; yet, in reality, it is a perplexing job. Co-operation between states that share international water basins is difficult to achieve, especially when sovereignty, territorial integrity, and security are at stake. Furthermore, negotiations and opportunities for the joint development of water resources are constrained by imbalances in economic, political or military power among the countries involved and due to the asymmetric availability of information. In such cases, effective water resource management solutions are usually reached politically through treaties or agreements to resolve uncertainty about the value and utilisation of shared resources between contracting parties. Nevertheless, the enforceability of these agreements depends on the economic and political powers of the countries involved. The cost of implementing international agreements and accords at times benefits some countries more than others. Differences in the costs and benefits of treaty formation give rise to conflicts among states, and often dictate whether accords are ultimately ineffective or problematic.

This research examines hydro-politics, the study of conflicts and co-operation of transboundary water resources, through an analysis of bilateral water treaties. While international river basin management involves social, political, economic, hydrological and ecological dimensions, this study concentrates on economic and socio-political factors rather than on ecology or hydrology.

Although, to the best of our knowledge, no quantitative studies of international water treaties have been conducted, there is a sizeable body of literature on water rights. For example Ditwiler (1975), Johnson, Gisser, and Werner (1981), Ostrom (1962), Burness and Quirk (1980), Brajer, Cummings, and Farah (1989), and Cummings and Nercissiantz (1992), and Dudley (1992) have made significant contributions to water rights literature.

There is also a sizeable body of literature on apportionment and river basin management. Notably, Wescoat (1995) presents an historical account of multilateral water agreements over the past three centuries. Becker and Easter (1998) consider water conflicts in the light of externalities and open access public goods using co-operative game theory. Just and Netanyahu (1998) discuss doctrines and guidelines for water apportionment among countries. Krutilla and Eckstein (1970) contribute the relative efficiency of river development projects at

any particular instance to national income and product redistribution, as compared to other projects. Biosson de Chazournes (1998) examines the management of the Aral Sea Basin, while Hirji and Grey (1998) examine transboundary water resources in Africa. Joseph Dellapenna (1994) demonstrates that international law plays a crucial role in fostering co-operation over shared water and prevents future conflicts.

This study is divided into two stages. The first stage involves estimation of the influences of economic resource constraints, geography, politics, and culture on the existence of bilateral water treaties in international river basins. The second stage analyses the structure of existing water treaties in an effort to understand why some treaties are more explicit (i.e. have more contractually explicit stipulations for monitoring, enforcement, information sharing, and conflict resolution) than others.

The next section of this paper discusses treaties as a means of assigning property rights and discusses related studies. In section three, the data used in this analysis is discussed. Section four entails the empirical model and results of an analysis of the existence of bilateral treaties. The fifth section presents the empirical model and results of an analysis of bilateral treaty structure. The final section presents the conclusions derived from the study.

2. BACKGROUND

Water resource issues are closely related to property rights issues, as the holders of property rights along a riverbank, watershed, lake, or river basin often take priority in terms of water usage. Therefore, no discussion of water resource economics can proceed without a discussion of property rights. A commonly used definition of property rights states that the right to a given resource implies the ability to control the use of that resource and to exclude others from using it. The rights to the use of the resource must be defined, enforceable and transferable. Surface water and groundwater sources are often common pool resources which are associated with the 'tragedy of the commons': users do not take into account the effect of their actions on other users of the pool, which in turn result in externalities.

Demsetz (1967) states that property rights are an instrument of society and are significant insofar as they help people form expectations in dealings with others. These expectations find expression in the laws, customs, and mores of a society. Demsetz argues that property rights arise when it becomes economic for those affected by externalities to internalise benefits and costs. According to Cheung (1970), externalities are attributable to either one or more of three specific reasons: the absence of the right to contract, the presence of a contract with incomplete stipulations, or the presence of stipulations that are inconsistent with marginal equalities.

Assignment of property rights through institutions and organisations in terms of contracts can be beneficial to the parties involved. Economics and politics play interactive roles in dispute resolution. States have developed a variety of terms to refer to international contracts (instruments) by which to establish rights and obligations among themselves. The Vienna Convention 1969 defines a treaty as "an international agreement concluded between States in written form and governed by international law, whether embodied in a single instrument or in two or more related instruments and whatever its particular designation." In a generic sense, a

treaty is a written document that must be binding, concluded by states or international organisations, and governed by international law. No international rules exist as to when an international instrument should be entitled a treaty. A bilateral treaty is a treaty between two parties, while a multilateral treaty includes more than two parties.

A more recent development in international water law is the concept of a "convention." On May 21, 1997, the General Assembly of the United Nations ratified a convention on international watercourse systems for non-navigable use. The articles of this convention deal with two major concepts. First, the articles address the principles of equitable and reasonable waterway usage, which govern shared water resources and have their roots in the judicial practices of federal states such as the United States. Second, the articles introduce the 'no harm' rule, which covers a whole range of neighbourly relations, including issues pertaining to the protection of the environment[121].

Treaties, agreements, and conventions seek to allocate water rights among countries in a manner that benefits participants. The work of Just and Netanyahu (1998) allows us to review standard approaches to the allocation of rights in water disputes. Just and Netanyahu discuss the doctrines and guidelines for water apportionment among countries. The six main apportionment theories are referred to as Prior Appropriation, the Harmon Doctrine, Riparian Rights, Mutual Development Theory, Linkage Principle, and the Helsinki Rules. The goals of formal contracts and apportionment theories include equitable and/or efficient allocation of water through river management. However, there are obstacles to the formation of sustainable treaties that assure proper allocation and are beneficial to all participants. These obstacles include asymmetric information, scientific gaps and technical uncertainties, enforcement limitation, national sovereignty, conflicting national and international interests, asymmetric country characteristics, and upstream and downstream considerations (Just and Netanyahu, 1998).

Hirji and Grey (1998) examine the management of the Nile basin and conclude that several points are of the utmost importance in the formulation of an effective treaty. According to the authors, national capacity must be built and strengthened, information asymmetry must be corrected, and dialogue must develop on diverse issues with the goal of seeking common ground. The countries in question must recognise that trust must be established, and that opportunities may lie in the use of the water resource in question, thus leading to a win-win situation for all of the countries involved. Dellapenna (1994) states that the ideal management of international water bodies requires not only formal legal order, but also co-operative management. This co-operative management should be capable of determining the facts of water usage in each country, resolving disputes, responding to temporary water shortages, designing and implementing solutions to permanent shortages of water, and enforcing decisions.

This research will add to this body of literature on international water treaties with a quantitative analysis of the influence of macroeconomic variables, economic and socio-political asymmetries, geographical characteristics, and water usage on the existence and structure of bilateral water treaties.

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[121] Convention in the Law of the Non-Navigational Uses of International Watercourses, Article 5, 6, and 7.

3. DATA

This study falls into the realm of environmental and natural resource economics, and applies contract theory and game theoretic approaches to arrive at theoretical assumptions and models of bilateral treaty formation and structure. These models are then used as the foundations for econometric models and tested empirically. The literature mentioned above links economic techniques with the study of conflict and dispute resolution.

For the purposes of this study, bilateral treaties, agreements, and conventions related to international rivers are considered and are referred to as treaties in this study. The Transboundary Freshwater Dispute Database (TFDD) contributes valuable information to the framework surrounding water treaties, the majority of which are bilateral. The treaties are mostly bilateral because the difficulty of negotiation increases with each increase in the number of parties involved. This database summarises general findings from comparative assessments of river basin treaties. The TFDD contains information regarding the basins involved in treaties; the principal management focus in these basins, the number of signatories to a given treaty; the non-water linkages (such as, money, land or other concessions) of a given treaty; the provisions for information sharing, monitoring, conflict resolution, and enforcement provided by a given treaty or agreement; and the method and amount of water diversion acceptable under the terms of each treaty.

The database[122] consists of 347 treaties dating from 1864 to 2001 of which approximately 82% (285) are bilateral and approximately 18% (62) are multilateral. For the purpose of this study, 118 bilateral treaties (236 observations), related to river basins and dated from 1944 to 1998, are examined. These treaties are compared and contrasted to one another, and also compared and contrasted to river basins for which no treaty currently exists. In this regard, 157 international rivers (314 observations) for which no treaty currently exists are examined. This data is supplemented by Gross Domestic Product (GDP), international trade, area of a country, population, annual water freshwater withdrawals, and river basin related data, as well by facts pertaining to national governments and languages, which are obtained from the Penn World Table 5.6 and 6.0, and the World Bank, the Historical International Statistics (B.R. Mitchell), the University of Groningen and The Conference Board, GGDC Total Economy Database 2002, the United Nations Population Division, the International Trade Statistics and the International River Basins of the World (Wolf, Natharius, Danielson, Ward, and Pender, 1999).

4. EMPIRICAL ANALYSIS OF TREATY EXISTENCE

The first model involves estimations of the influences of economic resource constraints, geography, politics, and culture on the existence of bilateral water treaties in international river basins. Given the following assumptions, countries are assumed to maximise the net benefits (national welfare) from co-operative river basin management subject to economic, socio-political, and geographic constraints.

[122] Product of the Transboundary Freshwater Dispute Database, Department of Geosciences, Oregon State University. Additional information about the TFDD can be found at: http://www.transboundarywaters.orst.edu. The TFDD originally included 145 international water treaties. Shira Yoffe of Oregon State University, provided an updated version of the database upon request.

- Assumption 1: Co-operation is preferable to non-co-operation.
- Assumption 2: Countries must be individually and collectively rational.
- Assumption 3: Co-operation or treaty formation is more sustainable if the group size is small.

Hypothesis I: Countries that are economically and socio-politically similar to one another are more likely to form treaties.

A logistic model is estimated to analyse variables contributing to the existence of bilateral water treaties between two countries sharing a river basin. Table I (see appendix) summarises the findings of an empirical analysis that aims to test hypothesis I. The model estimated in this study is as follows, and the results are described below:

Treaty = f(Difference in GDP, Percentage of international trade, Area of the country, Basin area of individual country, Percentage of the basin area within a country, Per-capita water withdrawals, Percentage of water withdrawals for agriculture, Percentage of water withdrawals for domestic use, Similarity in government, Similarity in language)

Treaty, the dependent variable, equals 1 if a treaty exists and 0 otherwise. The "non-existence" of a treaty or formal agreement may be attributable to standing disagreements or to the lack of need for formal contracts; that is, participating countries might refuse to contract due to existing disputes, or might view formal agreements as unnecessary due to generally strong relations with other riparian states.

'Difference in GDP' between participating countries is designed to measure the economic disparity between two countries sharing a river basin. The sign of the coefficient is negative, indicating that countries with greater disparities in GDP are less likely to form treaties. Hirji and Grey (1998) describe imbalances in economic power as constraints to the joint management of river basins. Therefore, countries with greater economic equality are more likely to engage in formal conflict resolution mechanisms than countries separated by economic inequality.

'Percentage of international trade' is the sum of a given country's exports and imports, measured as a percentage of that country's GDP. The sign of the coefficient is negative. A high percentage of international trade suggests that countries are likely to have broad and diversified trade bases, leading to a higher degree of economic independence from neighbouring countries. These countries are less likely to form bilateral water treaties.

The total surface area of a country is denoted by the geographic variable 'area of the country'. The sign on the coefficient for this variable is negative. This analysis suggests that comparatively large countries are less likely to seek treaties with smaller riparian neighbours, since larger countries are likely to be more economically powerful than smaller neighbours and are likely to control a sizeable portion of the relevant river basin. This prediction is in accordance with the conclusions of Just and Netanyahu (1998), who argue that 'asymmetric country characteristics' are impediments to the formation of formal agreements. It is expected that smaller countries generally have lesser economic or political power as compared to larger states. Therefore, these smaller countries are expected to rely

more heavily on neighbouring countries. This increases the probability that smaller nations will seek to form treaties.
'Basin area of individual country' is the area of a river basin that flows through a country. Theory suggests that conflicts over the use of common pool resources can be mitigated by contracts. The sign of the coefficient is positive, since a larger basin area could indicate a heavier reliance on the river basin itself and thus a higher probability of treaty formation. However, there is some ambiguity in this interpretation, since much depends upon the relative position of the country (i.e., upstream or downstream positioning).
'Percentage of basin area within a country' measures the percentage of a given river basin that is located within the borders of a particular country. The sign on the coefficient for this variable is negative, signifying that a country already controlling the majority of a river basin is less likely to profit from formal apportionment. Conversely, a country controlling a smaller percentage of a given basin is more likely to seek formal, international measures that would enhance their degree of control over the basin.

'Per-capita water withdrawals' shows the amount of freshwater withdrawn per person in a country. This measure does not imply water withdrawals for domestic use only, but averages per capita water withdrawals for all agricultural, domestic, and industrial purposes. The sign on the coefficient of this variable is positive. Freshwater is a biological necessity for all living things. Per capita withdrawal of water reveals the abundance or scarcity of the availability of water resources in a particular country. High per capita water withdrawals may signify several conditions, including an abundance of water resources in a country or a relatively small national population. These countries are probably interested in enhancing net benefits from river basin use through co-operative basin management. Again, low per capita withdrawal of water is generally associated with scarcity of water resources. Countries in which water is scarce may seek formal agreements to manage the scarce resource but may not possess the bargaining power necessary to facilitate treaty formation.

The variable 'percentage of water withdrawals for agriculture' is negative, since agricultural economies tend to be developing economies, and are therefore expected to have less bargaining power. These nations are therefore less likely to form treaties, although they might desire the formation of treaties. As Elhance (1999) argues, "The physical geography of a river basin also forms, to a large extent, the material basis for its economic geography, especially the resource-oriented, primary production economies of most developing countries."

The coefficient for the variable 'percentage of water withdrawals for domestic use' is also negative. Countries that are forced to use the majority of their withdrawals for domestic purposes are generally those countries in which water is relatively scarce. It can therefore be surmised that these countries will have a lesser degree of control over a given river basin and will be less likely to form treaties. Again, this is not to suggest that such countries will not seek the formation of treaties, but rather that they wield insufficient bargaining power to affect treaty formation.

'Similarity in government' shows the similarity in governmental systems, while 'similarity in language' captures the similarity in the language and culture of two participating countries. The coefficients of both of these institutional variables are negative, because similar governments are expected to have better understandings

or bilateral relations with one another, decreasing the probability of conflict and the need for formal conflict resolution mechanisms. Similarly, a shared common language is expected to bring participating countries closer and decrease the need for formal contracts. In other words, countries with institutional and cultural similarities are generally assumed to be on good terms and thus less in need of formal dispute resolution mechanisms.

5. EMPIRICAL ANALYSIS OF TREATY STRUCTURE

The second model analyses the structure of given bilateral water treaties in terms of explicit stipulations for monitoring, information sharing, enforcement, and conflict resolution. Monitoring provisions are often made to include data sharing and surveys. Information sharing builds goodwill and confidence between countries and enhances agreements. Enforcement mechanisms call for enforcing the provisions of the treaty, while conflict resolution resolves disputes through technical commissions, basin commissions, government officials, or third party intervention. The second model follows the assumption mentioned below:

Assumption 1: Explicitness in a treaty is preferred to non-explicitness in a treaty. That is, a higher number of provisions in a treaty constitutes a more explicit agreement and reduces resulting externalities.

Hypothesis II: Economic and socio-political similarities and the presence of other linkages are positively related to higher degrees of contractual explicitness.

For this analysis, the dependent variable, treaty structure, is the sum of the provisions stated in each treaty (monitoring, information sharing, enforcement, and conflict resolution), and hence ranges from 0 to 4. 'Treaty structure' equals zero if none of these provisions are stated in a particular treaty, and 4 if all of these provisions are stated in a particular treaty. A higher number of provisions in a particular treaty would be expected to enhance the structure and sustainability of the treaty. An ordered probit model is used to test the influence of the independent variables mentioned below on the contractual explicitness of existing bilateral water treaties. Table II (see appendix) summarises the results of the second model. The model used to estimate the factors that contribute to increased treaty structure is as follows, and the results are described below:

Treaty Structure = f(Difference in GDP, Major trade partners, Similarity in government, Non-water linkages, Difference in per capita withdrawals of water, Percentage of external flows, Hydropower, Water supply, Flood control)

The coefficient of 'Difference in GDP' of participating countries is positive, which would suggest that countries with greater similarities in economic power are less likely to agree to a higher degree of contractual stipulations. It may be argued that equally economically powerful countries already possess mutual social, economic or political understandings and may not need an explicit contract to ensure the dependability of the treaty. In the case of dissimilar economies, there will be higher stipulations so that the economically stronger country does not take advantage of the economically weaker nation. Economic factors play different roles at different stages of the negotiation process. In the stage in which countries are still assessing the need for a treaty, economic dissimilarity may negate the probability of formation of a treaty. Yet in the stage in which countries have already posited the

need for a treaty, but are negotiating the structure of that treaty, it is expected that economic dissimilarities enhance the level of contractual explicitness.

'Major trade partners' is a dummy variable that takes the value of 1 if the countries have major trading ties and 0 if otherwise. The sign of the coefficient is positive; countries are expected to form treaties in order to increase gains from trade. Since these countries are already engaged in economic activities they will ensure that disagreements do not arise in the case of shared water resources, because conflict over the river basin may start a trade war between the participating countries. Therefore, if two countries are major trading partners they are expected to demonstrate an increased probability of forming a treaty with a higher number of contractual stipulations.

The influence of 'similarity in government' of participating countries is negative, suggesting that the more dissimilar participating countries are in terms of governmental structure, the more likely they are to form a treaty with greater provisions. It may be argued that differences in governmental systems lead to a lack of trust or socio-political understanding between the two countries. Therefore, these countries need to have explicit contracts to ensure the reliability of the treaty. On the contrary, similar governments are less likely to have higher provisions in the treaty probably because of strong and established international relations between the countries.

'Non-water linkages' has a positive influence on the number of stipulations per treaty. That is, the existence of non-water linkages, whether monetary linkages, land linkages, trade or other concessions, increases the probability that a treaty with a higher number of provisions will be formed. According to Just and Netanyahu (2000), side payments or other linkages can lead to co-operation and has the potential for implementing a self-enforcing mechanism in some cases.

'Difference in per capita withdrawals of water' is the disparity in per capita withdrawal of fresh water for agricultural, industrial and domestic usage between the two participating countries. The sign on this coefficient is negative, suggesting that greater disparities in per capita water use lead to less explicit treaties. It is assumed that participating countries have difficulty reaching agreements regarding water allocation, because water is relatively scarce for one participating country than it is for the other.

'Percentage of external flows' is the percentage of the total annual flows accounted for by flows originating beyond the borders of a particular country. The greater the percentage of external flows, the higher the probability that a treaty with greater provisions will be formed. The sign on the coefficient of this variable is positive. Countries that depend highly on flows from other countries are, generally speaking, the lower riparian countries. There is a higher probability that these countries will seek formal agreements with higher provisions with other countries to ensure the proper amount of water flow.

'Hydropower', 'Flood control', and 'Water supply' are the principal focuses of different bilateral treaties. These are incorporated into this model as dummy variables that take the value of 1 or 0 in an effort to measure whether the existence of these specific, commonly found water management issues has a significant influence on the number of stipulations per treaty. The signs of these

coefficients are positive, which demonstrate that there is a higher probability of a greater number of stipulations if these variables are the principal focuses of treaties.

6. CONCLUSION

Externalities, which are often the results of non-explicit contracts, lead to conflicts over river basins. Formal contracts or agreements help to internalise these externalities. However, for full co-operation an explicit agreement with provisions for information sharing, monitoring, enforcement and conflict resolution mechanism is crucial.
The first hypothesis of this research states that economic and socio-political symmetries are conducive to the formation of treaty. The empirical results could not verify the statement in its entirety. The findings show that economic similarities in GDP increase the likelihood of treaty formation, but socio-political similarities decrease the likelihood of treaty formation.

The second hypothesis of this research states that economic and socio-political similarities, as well as the presence of other non-water linkages, lead to a higher degree of contractual stipulations. The empirical findings of this research partially dispute this hypothesis. The results show that economic and political similarities between countries lead to the likelihood of a less explicit treaty. However, the results also show that the presence of non-water linkages increases the likelihood of the formation of a formal treaty with a higher number of stipulations.

The uniqueness of each basin requires tailored solutions to each river basin problem rather than a single set of universal solutions to all problems. The policy implications drawn from this research are general in nature and have broad connotations. First, economics and politics play an interactive role in dispute resolution. Second, geographical characteristics of a country play an important role in defining the constraints and the possibilities of co-operation between nations in an international river basin. Third, a sustainable treaty requires that participating countries must have access to relevant data and information. Fourth, non-water issues can enhance the degree of co-operation between countries sharing an international river basin.

APPENDIX

***Table 1*: Treaty Vs. Non-treaty**

Dependent Variable:
Treaty = 1 Number of observations = 550
Non-treaty = 0

Independent Variable	Parameter Estimate	Standard Error
Intercept (76.204)***	5.5390	0.6345
Difference in GDP (17.641)***	-4.5E-7	1.071E-7
% of international trade (41.3998)***	-0.0274	0.00426
Area of the country (3.871)**	-0.00008	0.000041
Basin area of individual Country (42.237)***	8.703E-6	1.339E-6
Percent basin area within a country (31.4198)***	-0.0269	0.00480
Per capita water withdrawal (16.114)***	0.2436	0.0607
Percent of water withdrawal for agriculture (96.955)***	-0.0494	0.00502
Percent water withdrawal for domestic use (14.509)***	-0.0327	0.00859
Similarity in Government (Dummy) (8.419)***	-0.8465	0.2917
Similarity in language (Dummy) (2.330)	-0.4397	0.2880

* significant at 10% level
** significant at 5% level
***significant at 1% level

***Table 2*: Treaty Structure**

Dependent Variable:
Treaty Structure = 0, 1, 2, 3, 4 Number of observations = 236

Independent Variable	Parameter Estimate	Standard Error
(Intercept 1) (0.14)	-0.0763	0.2044
(Intercept 2) (22.16)***	-0.3072	0.0653
(Intercept 3) (111.23)***	-1.1066	0.1049
(Intercept 4) (226.21)***	-2.1066	0.1401
Difference in GDP of Participating Countries (5.33)**	0.0002	0.0001
Major Trade Partners (Dummy) (5.32)**	0.3809	0.1651
Similarity in Government (Dummy) (13.81)***	-0.6114	0.1645
Non-water Linkages (Dummy) (6.30)***	0.4040	0.1610
Difference in Per Capita Withdrawals of water (4.62)**	-0.0029	0.0013
Percent of External Flows (2.33)	0.0040	0.0026
Hydro-power (Dummy) (25.14)***	0.9705	0.1935
Flood Control (Dummy) (12.19)***	0.8786	0.2516
Water Supply (Dummy) (21.25)***	0.9339	0.2026

* significant at 10% level
** significant at 5% level
***significant at 1% level

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A CONFLICT RESOLUTION SUPPORT SYSTEM FOR USE IN WATER RESOURCES MANAGEMENT

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ABSTRACT

Water is an important factor in conflicts among stakeholders at the local, regional, and even international level. Water conflicts have taken many forms, but they almost always arise from the fact that the freshwater resources of the world are not partitioned to match the political borders, nor are they evenly distributed in space and time. Two or more countries share the watersheds of 261 major rivers and nearly half of the land area of the world is in international river basins. Water has been used as a military and political goal. Water has been a weapon of war. Water systems have been targets during the war. A systemic approach has been taken in this research to approach resolution of conflicts over water. By helping stakeholders to explore and resolve the underlying structural causes of conflict, our approach offers a significant opportunity for its resolution. We define the five main functional activities for assisting the conflict resolution process as: (i) communication; (ii) problem formulation; (iii) data gathering and information generation; (iv) information sharing; and (v) evaluation of consequences. A computerised technical support is developed in the form of the Conflict Resolution Support System (CRSS) for implementation of a systemic approach to water conflicts. Its principal components include an artificial intelligence-based communication system, a database management system, and a model base management system. At this stage of the development, the model base management system consists tools for multipurpose reservoir operation, river flow routing, multi-criteria decision-making, spatial data analysis, and other general utilities. A hypothetical river basin with potential conflict between stakeholders in respect to water sharing and flood control is used to demonstrate the utility of the new approach and the computer system developed for its implementation.

1. INTRODUCTION

Contemporary water resources management is a combined process of sharing water and resolving conflicts among stakeholders. Stakeholder in this context refers to an individual organisation or institution that has a stake in the outcome of decision related to water sharing, because it is either directly affected by the decision or has the power to influence or block the decision. Most environmental conflicts, including water related, spring from three sources (White, 1986). First source is an actual or prospective human intervention in the environment, which provokes changes in natural and societal systems. The conflict arises when one or more of the stakeholder groups see the activity as disturbing the complex interaction between physical, biological and social processes. The second source is disagreement over the management of water supply at one location as it affects the use of it elsewhere. The third source is where climatic variability and change, independent of any human activity, places new stresses on the water resources and generates fresh adaptations to available resources.

Use of water resources always involves an interaction between human users and the soil, water, air and organisms of the place. Each is modified to different degree

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so as to destroy the resource or the people. Two or more systems interact. This motivates the application of systemic approach to conflict resolution that is proposed here.

Our focus in this paper is on the first source of water conflict. In a river basin, which traverses across an international boarder, a political regional boundary or a general boundary of different jurisdiction, the basis of a conflict is the implementation of developments by a stakeholder concerned within its territory. Such implementation impacts at least one of its neighbours during water shortage conditions, and usually leads to a number of water conflicts. The key indicators or the water conflicts are related to a number of issues including water quantity, water quality, management of multiple use, political divisions, geopolitical setting, level of national development, hydro-political issue at stake and institutional control of water resources (Wolf, 1998).

2. APPROACHES TO CONFLICT RESOLUTION

Conflict resolution process has been approached by many disciplines such as law, economics, engineering, political economy, geography, and systems theory. An excellent source of selected disciplinary approaches is available in Wolf (2002).

We will confront in our discussion traditional versus systemic approaches to conflict. Traditional conflict resolution approaches such as the judicial systems, state legislatures, commissions and similar governmental systems provide resolutions in which one party gains at the expense of the other. This is referred to as the 'zero–sum' or 'distributive' solution. In water and environmental conflict resolution, a negotiation process referred to as the Alternative Dispute Resolution (ADR) is adopted. ADR refers to "a wide variety of consensual approaches in which parties in conflict voluntarily seek a mutually acceptable settlement". ADR generally seeks to move parties from 'zero-sum' solutions towards those in which all the parties gain, which are referred to as 'positive-sum' or 'integrative' solutions (Bingham et al, 1994). Negotiation, collaboration and consensus building are the key issues that facilitate ADR.

A systemic approach to conflict resolution is proposed as a new approach for water resources conflicts. It uses the disciplines of systems thinking and mental models to provide powerful alternatives to traditional approaches to conflict resolution, which often rely too much on outside mediation. By helping stakeholders explore and resolve the underlying structural causes of conflict, a systemic approach can transform problems into significant opportunities for all parties involved. A systemic approach to conflict resolution has been explored in the management science (Cobble and Huffman, 1999). Some elements of the systemic approach have been present in the work of Bender and Simonovic (1995) and Simonovic and Bender (1996) that proposes collaboration and collaborative process with active involvement of stakeholders that agree to work together to identify problems, share information and where possible, develop mutually acceptable solutions. Consensus building processes constitute a form of collaboration that explicitly includes the goal of reaching a consensus agreement on water conflicts. The indigenous approaches to water conflict reduction (Wolf, 2000) are also related to a systemic approach. Such methods include: (a) allocating time, not water; (b) prioritising different demand sectors; (c) protecting downstream and minority rights; (c) ADR; and (e) practising ritual ceremony of forgiveness.

3. THE ROLE OF COMPUTER-BASED SUPPORT IN CONFLICT RESOLUTION

At certain stage of conflict resolution, alternatives and proposals specific to stakeholders in conflict are analysed for their technical feasibility and economic viability. Such analyses in water-based conflicts include among other processing of vast amount of hydrological and geophysical data, describing system structure, identifying system states by routing of natural and scheduled flows, mapping and graphing system operational strategies, and optimisation and multi-criteria analyses of system components and operations. Therefore, a decision support tool that could assist the stakeholders with different technical aspects is vital for the success of a water conflict resolution process. Quite often, the stakeholders have limited or no technical knowledge relevant to water resources management. As a result, in a conflicting situation they generally stay firmly behind their positions irrespective of the technical difficulties associated with satisfying their criteria. It has been shown in the literature that in complex situations of this nature, the availability of computer-based support systems, that could convey the technical information to stakeholders in an understandable form, is one of the pre-conditions for finding mutually acceptable and sustainable resource management solutions (Simonovic, 1996).

Use of computer-based support systems is the recent development in water conflict resolution (Raiffa, 1982). It is often a challenge, for everyone involved, to handle the complex nature of water conflict on the regional or international scale. Such a complexity led the researchers around the world to develop computer-based decision support systems (DSS) that can provide considerable assistance in determining temporal and spatial distribution of water quantity and quality. Progress in computer software development and its implementation in water resources (Fraser and Hipel, 1986; Anson et al, 1987; Kersten, 1988; Anson and Jelassi, 1990; Meister and Fraser, 1992; Fang et al, 1993; Bender and Simonovic, 1995) provides a different kind of negotiation assistance medium. Such tools are also referred to as Negotiation Support Systems. The basis for all these systems is group decision-making process (Lewis, 1993), which assists in solving disagreements among various stakeholders. Other water resources related decision support systems (for example Fredericks et al, 1998; Andreau et al, 1996; Reitsma, 1996; Arumugam and Mohan, 1997; Ford and Killen, 1995; Ito et al, 2001) with one or more tools for the analyses of water quantity and quality distribution, flood and environmental management, are also helpful in water conflict resolution.

Simonovic (1996) defines a computerised decision support system as "a tool that allows decision-makers to combine personal judgement with computer output, in a user-machine interface, to produce meaningful information for support in a decision-making process". Such systems are capable of assisting in solution of all problems using information available on request. They use quantitative models and database elements for problem solving. They are an integral part of decision-maker's approach to problem identification and solution. A decision support system for application in water resources management has the following characteristics: accessibility, flexibility, facilitation, learning, interaction and ease of use. Water resources problems are generally ill structured, lack data, associated with uncertainties, and include non-quantifiable variables.

Next section of the paper introduces a systemic approach for conflict resolution. Discussion continues with the brief presentation of the conflict resolution support system and details of its architecture. Utility of a new approach and the computer-based tool are shown in the conclusions.

4. A SYSTEMIC APPROACH TO CONFLICT RESOLUTION

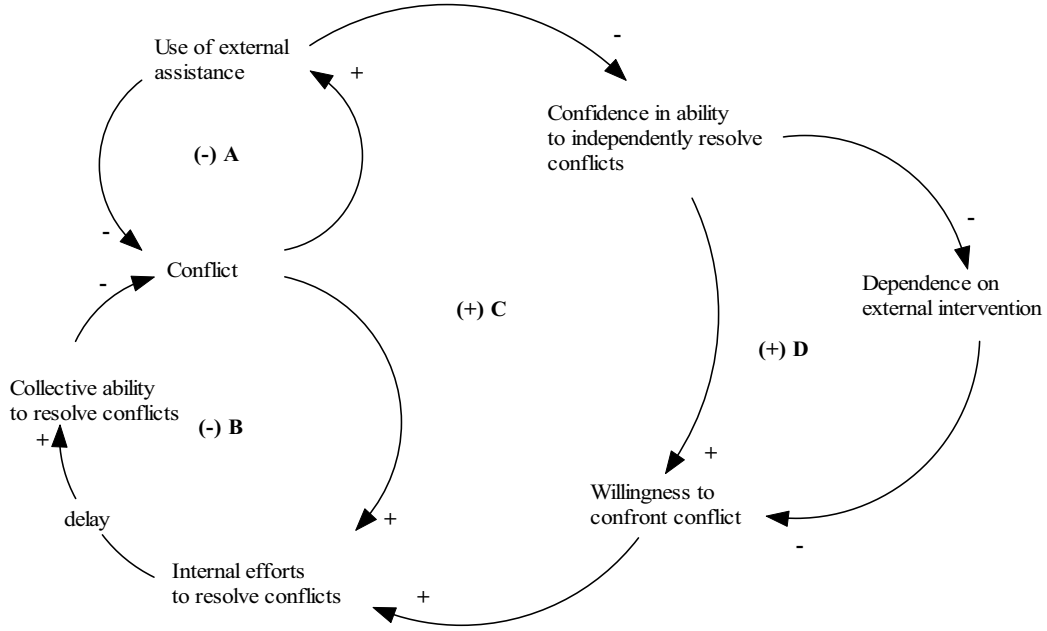
A systemic approach has at least three roles in illuminating grounds on which water conflict resolution may proceed. First, scientific investigation defines the systems that are affected, their structure (components), indicating where there is an established or assumed relationship among the various components. Definition of the system structure is fundamental because often conflicts arise where it has been assumed that the impacts were less-reaching than demonstrated in practice. Second, systemic approach helps describe the characteristics of the various components, including the physical systems, the ecosystems, affected social groups and organisations with their preferences and modes of action. To identify the components is to deal with their interactions as they are established. Third, systemic approach offers means of estimating the significance of impacts not only in terms of physical quantities but also in terms of the way in which they are perceived by the people and organisations affected.

The difference between traditional and proposed systemic approach to conflict resolution is shown in Table 1. A systemic approach is proposed as a powerful tool for deep inquiry and development of the dialogue among stakeholders. Active participation of stakeholders and development of their skills to deal with conflicting situations is the driving force of a systemic approach.

Systemic approach advantages are identified in Figure 1, using the systems language of causal diagrams. Negative (balancing) feedback loop A shows that relying on outside assistance, like hiring an outside mediator for example, to respond to conflict may serve parties involved in the short term. However, over the long term, it reduces stakeholder's confidence in their own ability to resolve problems and willingness to confront conflicting situation as shown by the positive feedback C. Another unintended consequence is a rise in the stakeholders dependence on external intervention, further decreasing their comfort with handling conflicting situations as indicated by the positive feedback D. Proposed approach offers a solution through building the stakeholders conflict resolution skills (negative feedback B).

	Traditional approach	Systemic approach
Intention	Conflict resolution	Conflict resolution skill building
Time horizon	Short term	Long term
Point of application	After conflict becomes extreme	Before conflict becomes extreme
Stakeholder response	Defend position	Become reflective and open
Focus	Individual adversaries	System
Processing of complexity	Polarisation	Powerful dialogue
Responsibility for conflict	Blaming of others	Own role in conflict

***Table 1*: Traditional versus systems approaches to conflict**



Legend: **(-)** negative (balancing) feedback; **(+)** positive (reinforcing) feedback; **+** a casual link between two variables where a change in one causes a change in the other in the same direction (one adds to another); **-** a casual link between two variables where a change in one causes a change in the other in the opposite direction (one subtracts from another).

***Figure 1*: Advantages of a systemic approach to conflict resolution (modified after Cobble and Huffman, 1999)**

5. CONFLICT RESOLUTION PROCESS

A systemic approach application requires four steps that can be implemented with or without the facilitator.

Step 1. The main purpose of the first step is to create the space and the intention between stakeholders to address a conflict. This can be achieved by encouraging participants to explore the source of conflict. Stakeholders should identify critical issues, actions and the thinking that led to conflicting situation. Exploration of what solutions are working and which aren't, will precede the development of a hypothesis about why. Work should occur in a meeting to increase stakeholder's capacity to learn and to work together. At the end of this step stakeholders should identify actions that might have caused problems for others.

Step 2. Objective of the step two is to build shared understanding of the conflict through inquiry and the creation of a systems map. Causal diagrams like one in Figure 1 may be of help. It is important to look for places of disagreement in diagram.

Step 3. At this stage building of dialogue skills should occur so the participants can directly address sources of conflict and understand their own role in it. During this process a shift should occur from a general problem structure to 'hot spots'.

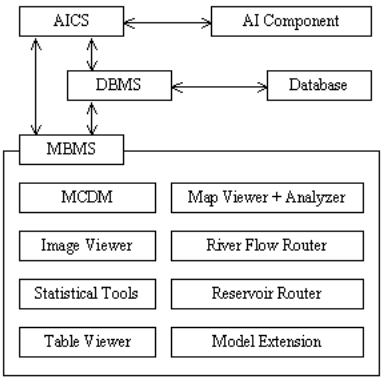
Step 4. The final step involves the creation of an action plan for developing and implementing alternative solutions, new ways to work and interact. Participants are expected to make agreements for applying new solutions and behaviours.

Generalised steps in each practical case will require major technical assistance. The following section presents a computer-based tool designed to support this process.

6. COMPUTER-BASED CONFLICT RESOLUTION SUPPORT SYSTEM (CRSS)

Conflict resolution is regarded as an iterative process, which converges to an acceptable resolution to the parties involved. Support for the four-step process presented in the previous section is provided in the form of five functional activities: (i) communication support; (ii) problem formulation; (iii) data gathering and information generation; (iv) information sharing; and (v) evaluation of consequences. These activities are repeated in sequence, until the parties involved accept a resolution that provides an acceptable compromise for all. These five functionalities are incorporated in a computer-based conflict resolution support system (CRSS) that facilitates the resolution process.

The present demo version of CRSS consists of an Artificial Intelligent Communication System (AICS), a Database Management System (DBMS) and a Model Base Management System (MBMS). Figure 2 shows the structure of CRSS.



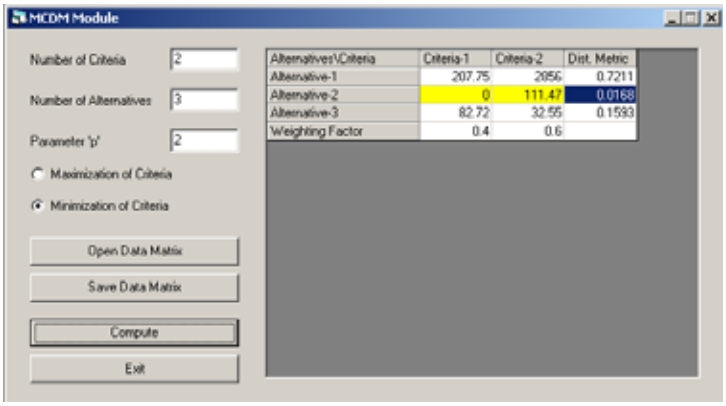


***Figure 2*: CRSS**
***Figure 3*: MCDM Module**

The entry point to CRSS is AICS, where a communication begins by opening access to other facilities of the system. Driven by an AI component, AICS connects the database through the DBMS and interacts with the MBMS modules appropriately. Moreover, data exchange between the MBMS modules and the database is carried out efficiently through the AICS. The MBMS modules incorporated in CRSS are, (a) Multi-Criteria Decision Making (MCDM), Figure 3; (b) Map Viewer and Analyser, Figure 4; (c) Statistical Tools; (d) Reservoir Router; (e) River Flow Router, Figure 5; (f) Image Viewer; and (g) Table Viewer. CRSS is flexible to accommodate additional specific modules that are required to analyse a realistic system. However, application of the present version of CRSS for a typical conflict resolution case where water allocation forms a reservoir and flood control in a river basin, is considered in this paper. Therefore modules such as Reservoir Router and River Flow Router are included in addition to the general utility modules. The MCDM module is considered to be the most required one to arrive at a compromise solution in any potential conflict resolution case. The modules have been developed in such a way that exchange of data in the forms of text, table and pictures

between them and the commercially available software is possible through simple operations of copy, cut and paste.

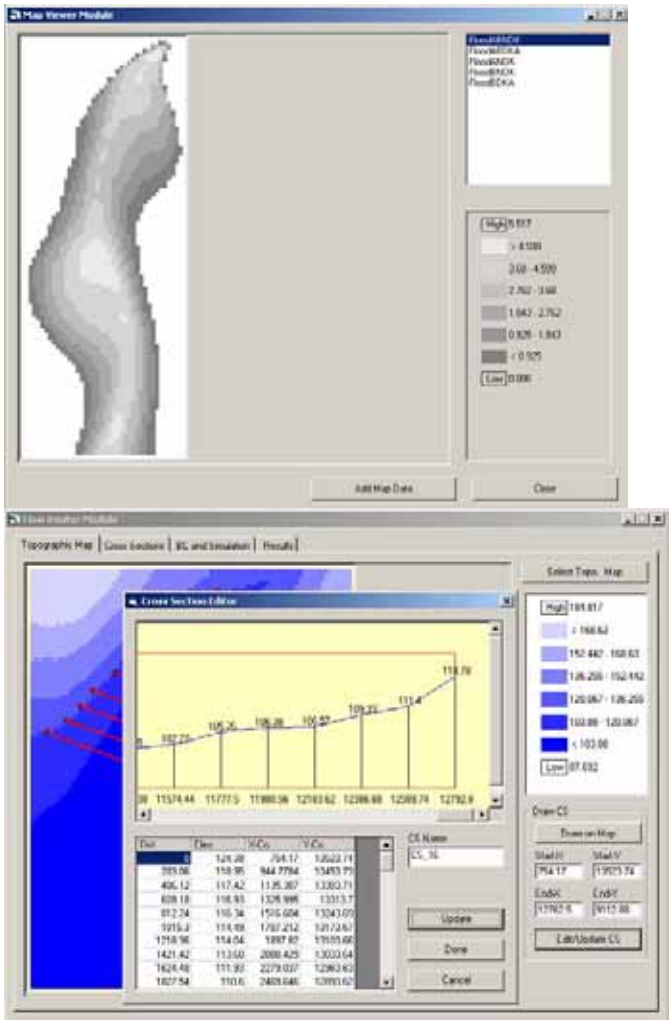


***Figure 4*: Map Viewer Module**
***Figure 5*: Flow Router Module**

7. CONCLUSIONS

The paper presents the systemic approach to resolution of conflicts over water. For implementation of this approach a computerised technical support system, CRSS, is developed that provides conflict resolutions support through five functional activities, namely, (i) communication; (ii) problem formulation; (iii) data gathering and information generation; (iv) information sharing; and (v) evaluation of consequences.

The CRSS consists of three main components, an artificial intelligence based communication system, a data base management system and a model base management system. The artificial intelligence based communication system facilitates communication among the stakeholders, and provides access to all the facilities available within the CRSS.

Computer-based implementation of the approach via CRSS helps in the process of generating agreements between parties in conflict that are more lasting and durable. Carefully selected functionalities of the CRSS and their scientific basis are providing the stakeholders with an environment for effective communication, maintenance of the dialogue, active learning, deep inquiry, assistance in evaluation of alternative options, and development of skills for creative resolution of a conflicting situation.

At this stage of the development, the model base management system consists of tools for multipurpose reservoir operation, river flow routing, multi-criteria decision-making, spatial data analysis, and other general utilities. Flexible system architecture provides for easy addition of other modules that may be necessary in resolution of different water related conflicts.

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NEGOTIATIONS IN THE CONTEXT OF INTERNATIONAL WATER-RELATED AGREEMENTS

Branko Bošnjaković[124]

ABSTRACT

The paper describes the results of a study to identify, analyse and discuss negotiation processes taking place in the context of international water-related agreements and conventions. An introduction is given to the role of legal arrangements in fostering co-operation in transboundary water basins, with emphasis on the economic, environmental and security dimensions of integrated water management. The paper introduces a life-cycle model of negotiating agreements and reviews in this context selected water-related agreements at the global, regional and water-basin level. The role of negotiations is highlighted for the initiation, adoption and implementation phases. Special attention is given to negotiations which led to the agreements established under the UN Economic Commission for Europe (Helsinki and Espoo Conventions and corresponding guidelines). Negotiations leading to basin agreements have also been analysed and compared. Some key factors and patterns in negotiating international water-related agreements have been identified and analysed. Conclusions and recommendations for practical negotiations and research are presented.

1. BACKGROUND AND SCOPE OF THE STUDY

After World War I, and even after World War II, security and economics were for the most part kept in separate boxes. However it was the Helsinki process, and especially the Helsinki Act of 1975, that revived the idea that security was not simply a matter of military balances and inter-state relations: social factors, human rights and economic performance were crucial as well. The degree of co-operation, especially in Europe, with respect to water-related issues is usually measured in terms of agreements concluded and (violent) conflicts avoided. If one looks at the degree of integrated management of transboundary waters then the picture is less impressive. Most treaties deal with one purpose only, or combine two or three aspects, but the management in an integrated manner is still an exception. It makes sense to classify the existing agreements on transboundary waters for which three groups have been proposed according to their purpose (HARTJE 2002):
Agreements allocating water
Agreements to develop joint projects and to provide a minimum flow for shipping
Agreements controlling pollution

Apart from agreements regarding specific water basins, framework agreements have also been developed. They might serve as "blueprints" for the elaboration of bilateral and multilateral agreements on specific transboundary waters.
Since the water-related international agreements play a crucial role for the fostering of both the integrated water resource management as well and the water-related security issues, it is important to study not only their structure but also the

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dynamic aspects such as the negotiation processes that lead to the adoption, implementation and further development of such agreements.
The objective of the study, which forms the basis of the present article, was to identify, analyse and discuss the patterns of negotiation processes taking place in the context of international water-related agreements and conventions, at global, regional and basin level. The study concentrated on the analysis of lessons learnt from a small number of test cases. The focus was on agreements addressing water allocation and pollution control, thus excluding the issue of navigation. A particular emphasis was put on regional water-relevant framework conventions in the UNECE region. The study addressed the various phases of negotiation according to a dynamic lifecycle model of international agreements. It addressed and generalised patterns of negotiation experiences, and identified aspects and factors that determine the prospects, progress and products of the negotiation process. The study made use of various sources of information, including where available and accessible the texts of agreements, reports of negotiation sessions, secondary literature and in some cases, oral reporting (interviews with actors and witnesses of negotiations). The study summarises the findings and formulates conclusions and recommendations on how to improve processes in future negotiations.

2. METHODOLOGY AND OVERVIEW OF THE TYPES OF MULTILATERAL WATER-RELATED AGREEMENTS

An international agreement is not a static instrument or monument but a dynamic process of negotiation and implementation with its own lifecycle[1]. Each agreement passes through a number of phases, each of which comprises some negotiation activities. One may distinguish the following:
Preparatory phase: orientation/initiation/triggering of the negotiation process
Main negotiation phase: addressing and defining the contents, and adoption/signature
Ratification phase and preparation of the work programme by the signatories
Coming into force and early implementation
Full implementation, and negotiation of amendments and protocols to the agreement
Major re-negotiation of the agreement.

In the present chapter, three categories of agreements will be reviewed in terms of a lifecycle model: global, regional and basin-related.

The International Water Convention (UN New York Convention): example of a global agreement. A recent overview of the main issues in the negotiation process leading to this Convention was given by SCHROEDER-WILDBERG (2002). The very long "gestation" period took place within the International Law Association (ILA), a non-governmental association of lawyers, as well as within the International Law Commission (ILC), a subsidiary body of the UN. The ILA started its work on the law governing the utilisation of international fresh water resources in 1954 (BOURNE 1999). The impetus for its doing so was its concern for a number of serious international river disputes that had arisen after 1945 (such as over the Indus, over the Nile, and over the Jordan). By 1966, in the Helsinki rules, the ILA had identified the basic rule of international water resources law – the principle of reasonable and

equitable utilisation sharing of the benefits of the waters of an international drainage basin. The ILC included the topic in its general programme in 1971 and began to study the topic in 1974 with the establishment of a sub-committee. The ILC worked on the project for some 20 years before the formal negotiation started in the Sixth (Legal) Committee of the General Assembly, on the basis of draft articles adopted by the ILC (ILC 1994; ILC 1996).

The Convention on the Law of the Non-Navigational uses of International Watercourses, adopted by the UN General Assembly on 21 May 1997 by a great majority of countries,[125] attempts to promote co-operation between riparian states by setting principles, norms and rules that give guidance for regulating conflicts. The Convention is a general, framework agreement that contains thirty-seven articles. The most critical and difficult part of the negotiation process concerned the articles 5 (Equitable and reasonable utilisation and participation), and 7 (Obligation not to cause significant harm), as they represent the key provisions that define and balance the rights of upstream and downstream states. The slow process of ratification reflects the tensions and the not fully resolved issues, which characterised the process of negotiations. Milestones on the lifecycle of the UN New York Convention are summarised in Table 2.1.

***Table 2.1*: Milestones in the lifecycle of the UN New York Convention**

Preparatory phase	Activities in the International Law Association since 1954 Work within the International Law Commission since 1971
Main negotiation phase and adoption	Negotiation within the Sixth Committee of the General Assembly of the UN starts in 1993 Adoption by the General Assembly, 21 May 1997
Ratification phase	12 ratifications by July 2002
Coming into force	Unpredictable

UNECE regional water-related conventions. Economic collaboration among all the countries of Europe was already seen by the founders of ECE in 1947 as "making an important contribution to the political unity of the major powers" (WEIGHTMAN 1956). Even in the early years of the cold war, all members of the Commission agreed on its importance as an instrument of consultation and "bridge" between East and West. Co-operation among governments in ECE has focused on a large number of narrowly defined technical problems on which the interested parties could negotiate without raising large questions about their economic and social systems. This technical work helped to create a framework in which the habits of co-operation overcame the differences. The search for common ground has become deeply entrenched over the course of nearly 50 years. The importance of such regional co-operation in the security context was recognised in the Final Act of the CSCE in 1975 and subsequently during Follow-up Meetings in 1983, 1986, and in particular in the Concluding Document of the Vienna Follow-up Meeting in 1989 (CSCE 1989a). In the latter, governments stated that they would "make further use of the existing framework, resources and experience of the ECE in areas of significance for the implementation of the recommendations of the CSCE".

[125] 103 nations voted in favour, 27 abstained and 3 voted against the Convention (Burundi, China and Turkey)

As regard to water-related agreements, the main breakthrough occurred during the Meeting on the Protection of the Environment of CSCE, held in Sofia, Bulgaria, 16 October - 3 November 1989. In accordance with the mandate of the Concluding Document of the 1989 Vienna Meeting of the CSCE, the participating States recommended (CSCE 1989b):
that the ECE elaborates an international convention, code of practice or other appropriate legal instruments on the prevention and control of the transboundary effects of industrial accidents;
that the ECE elaborates a framework convention on the protection and use of transboundary watercourses and international lakes;
that basin-related water agreements be elaborated where they did not yet exist, such as for the Danube and Elbe(Labe) rivers.

Whereas the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki I Convention) form the backbone of UNECE water-related legislation, two other UNECE conventions (the Espoo Convention on Environmental Impact Assessment in a Transboundary Context and the Helsinki II Convention on the Transboundary Effects of Industrial Accidents) are of key importance for transboundary water management, however, due to limited space they are not discussed in detail here.

The UN/ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes was signed in 1992 at Helsinki by 25 countries, and by January 2002 ratified by 32 countries including the EU. The Convention explicitly recognises the need to apply a number of basic principles, and contains a number of essential obligations of all Parties. However the main and core obligation (Article 9) to the Riparian Parties, i.e. the parties bordering the same transboundary waters, is to enter on the basis of equality and reciprocity into bilateral or multilateral agreements, in order to define their mutual relations and conduct regarding the prevention, control and reduction of transboundary environmental impacts. Such agreements shall provide for the establishment of joint bodies, covering well-defined catchment areas, and with a detailed catalogue of tasks. The work of the joint bodies specifically includes also the co-operation with coastal states, as well as with the joint bodies established by coastal states for the protection of the marine environment directly affected by transboundary impact. Whether or not in the framework of joint bodies, the riparian states have very detailed obligations with regard to consultations, joint monitoring and assessment, common research and development, exchange of information, warning and alarm systems, mutual assistance and public information (Articles 11-16). Under the Helsinki I Convention, several additional instruments –either binding or non-binding – have been negotiated, and others are still under negotiation (see Table 2.2).

***Table 2.2*.: Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki I)**

Preparatory phase and initiation of negotiations	- Working Party on Water Problems established in 1988 - Meeting on the Protection of the Environment of the Conference on Security and Co-operation in Europe (CSCE), Sofia, recommends in November 1989 to elaborate a framework convention
Negotiation phase and adoption	- Working Party on Water Problems negotiates the text of the convention in five special sessions between May 1990

	and October 1991 - Convention adopted and signed during the meeting of Senior Advisers to ECE Governments on Environmental and Water Problems (Helsinki March 1992)
Ratification phase and work of signatories	-Working Party on Water Problems prepares the future work programme under the Convention - Present number of ratifications (January 2002): 32 + EU
Coming into force and early implementation	- Convention enters into force on 6 October 1996 - First Meeting of The Parties: Helsinki, July 1997 - Second Meeting of the Parties: The Hague, March 2000 - Third Meeting of the Parties: Spain, autumn 2003
Full implementation and elaboration of protocols and amendments	- Development (together with WHO/EURO Regional Committee) of the Protocol on Water and Health, adopted in London on 18 June1999 - Guidelines on Monitoring and Assessment of Transboundary Rivers (1999); Transboundary Groundwaters (2000); International Lakes (2001) - Guidelines on Sustainable Flood Prevention (2000) - Intergovernmental Group on Civil Liability starts negotiation on a binding instrument on civil liability for transboundary damage caused by hazardous activities, within the scope of Helsinki I and Helsinki II - Established Working Groups: Legal and Administrative Aspects; Water Management; Monitoring and Assessment; Water and Health; Civil Liability and Water-related Accidents
End of lifecycle	Not predictable

The three UNECE water-related conventions form a coherent set, both from the substantive point of view and from the way they came into existence. The fact that ECE has offered a recognised neutral forum for negotiation of the conventions is, in itself, a source of coherence, which minimises the risk of fragmentation. All the conventions have a core constituency of the same signatories and parties

Basin agreements: Danube River Protection Convention as example. The present article is based on an analysis of water-basin agreements in 3 basins in the UNECE region: the Rhine River basin, characterised by a long history of institutional co-operation and considerable, tangible successes; the Danube River basin, where co-operation on the protection and corresponding institution-building started more recently; and the Aral Sea basin, where the water-related co-operation is in full development and transformation from the old Soviet patterns towards more modern approaches. As for the Danube River Basin, it is not only the geographical catchment area of the second largest river in Europe, but with its main 13 riparian states, it represents a diversity of languages, of ethnic and religious groups, a history of population movements, conflict and displacement of people, all of which are still root causes for lack of an environmentally sustainable management today (BENDOW, 2002a; 2002b). In response to the environmental challenges, the riparian countries recognized the need for regional co-operation. The Danube River Protection Convention (DRPC) was signed in 1994 and has been in force since 1998 (DRPC 1994; 1998). Table 2.3 gives some highlights from the history of the Danube River Protection Convention, based mainly on oral communications and written contributions from the former President and the present Executive Secretary of the DRPC (KITTINGER 2002; BENDOW 2202a; 2002b).

***Table 2.3.*: Highlights from the history of the Danube River Protection Convention**

1975	First initiative by Romania to start co-operation on water protection, water and flood management
1977	Initiation of bilateral agreement between Austria and Germany on water management co-operation in the Danube catchment (leading in the middle 1980s to the trilateral Regensburg Agreement, which included also the European Communities as third signatory)
1985	Bucharest Declaration for the Management and Protection of the Danube River
1989	Meeting on the Protection of the Environment of the Conference on Security and Co-operation in Europe (CSCE), Sofia, encourages a specific agreement on the Danube
1991	Danube Conference in Budapest decides to develop a binding instrument on the protection and sustainable use of the Danube River (Danube River Protection Convention, DRPC) and a separate instrument on nature conservation (Danube Basin Nature Conservation Convention, DBNCC)
1991	Danubian countries, donors, IFIs, G-24 countries and NGOs establish in Sofia the Environmental Programme for the Danube River Basin
1992	First round of negotiations on DRPC held in Vienna
1993 - 1994	Negotiation meetings on DRPC in Bratislava, Bucharest, Sofia, Prague
1994	DRPC signed by 11 Danubian countries and EC in Sofia on June 29, 1994; Declaration of the Signatories provides a preparatory period of interim implementation
1994 - 1998	Interim implementation period; ratification by 9 parties (Austria, Croatia, Czech Republic, Germany, Hungary, Romania, Slovakia, Slovenia, EU)
1998	DRPC entered into force on October 22, 1998
1999	Organisational framework established, consisting of: Conference of the parties, ICPDR, Secretariat, PMTF, 5 Expert Groups
1998	First meeting of the International Commission for the Protection of the Danube River (ICPDR)
2000	"Baia Mare accident"
2001	Memorandum of Understanding on Common Strategic Goals signed with the Black Sea Commission

3. KEY FACTORS AND PATTERNS IN NEGOTIATING INTERNATIONAL WATER-RELATED AGREEMENTS

Looking at what determines the prospects, progress and products (the 3 P's) of negotiating international water-related agreements, be it at the global, regional or basin level, one finds some recurring patterns and key factors. The study underlying the present paper identified the following components and analysed their role in the lifecycles of the agreements:

- Initiating development leading to formal negotiation
- Organisational setting, procedural rules and negotiation culture

- Balancing of interests (upstream-downstream, inter-sectorial) in the negotiation process
- Windows of opportunity that promote and accelerate negotiation
- Relationship with other, legally binding and non-binding, instruments as source of synergy in the negotiation process
- Role of technology, research and monitoring in the negotiation process
- Negotiation on implementation and compliance
- Role of human rights, transparency, and participation/role of the stakeholders/public in the negotiation process
- Role of management and financing issues in the negotiation process

In view of the limited space, only the first four factors are discussed in the present paper.

Initiating development leading to formal negotiation*.* Establishing objectives, issues and a negotiating agenda has far-reaching consequences for the success of the negotiations. They are essentially determined by the basic concerns of the negotiating players. One can argue that *the underlying concerns, which led to increased awareness of international water-related issues and eventually to a negotiated agreement, are essentially in all cases related to security as a broadly defined concept.*

In case of the *Rhine* river basin, the Netherlands as the main victim of the ongoing pollution, took the first initiatives. Elimination of the salmon in the whole catchment, high concentrations of phenol, damage to Dutch horticulture and the fear of progressively high salinity levels inspired the Dutch drinking water companies to establish contacts with upstream riparian states (DIEPERINK 2002). After informal consultations in 1950, a monitoring network was set up in 1953. The Berne Convention of 1963 provided the formal structure for the consultations and progressive development of the Rhine River regime.

In the *Danube river basin,* it was Romania in the 1970s that took the initiative to start co-operation on water protection, quantitative water management and flood control, whereas Austria and Germany embarked in negotiations in the 1970s, which in the 1980s resulted in concluding the so-called Regensburg Agreement. The process of contacts during a decade led to the Bucharest Declaration (1985). This process coincided with the first decade of the CSCE process. In accordance with the resolution of the 1989 Sofia Meeting, a Conference of Experts (Budapest 1991) mandated Austria to elaborate the Danube River Protection Convention (DRPC).

In the *Aral Sea basin*, the first interstate agreement (1992) became a necessity after the disintegration of the former Soviet Union. The newly established Interstate Commission for Water Co-ordination (ICWC) took over directly the responsibilities from the former Ministry of Water Resources of the USSR, with appropriate changes reflecting the sovereign status of the newly independent states in Central Asia. The next positive and necessary step was to subordinate the two BWOs for the Syr-Darya and Amu-Darya to ICWC by transforming them into the executive bodies of ICWC. However the mandate of the ICWC was rather broad, in practice the region was confronted with a number of highly sensitive water-related issues and developments, which went beyond the ability of ICWC to address and resolve them. As a consequence of this situation, the water sector in the Aral Sea region has been characterised by fragmentation, occasional confusion and frequent duplication of

transboundary co-operation efforts. There is seemingly no political will to establish a forum for comprehensive negotiation of water-related issues. A report by the Swiss Co-operation Office in Bishkek (GELY, 2000) concluded: "Recent dispute shows that inter-state bodies are not able to solve critical issues... As long as the region's leaders prevent the participation of local governments, the private sector, society organisations and institutions in the decision process and as long they insist on making unilateral decisions that affect their neighbours, water will remain a potential source of conflict in Central Asia".

In case of the *regional water-related agreements* in the ECE region, it was again the concerns about Pan-European security and the CSCE mechanism that triggered the final decision to add a new dimension to the technical co-operation, already existing within ECE.

In the case of the *global UN New York Convention*, the initiative and preparatory work leading to the opening of formal negotiation in the Sixth was based once again on security concerns, namely about a number of serious international river disputes that had arisen after 1945.

Organizational setting, procedural rules and negotiation culture. After the initiation phase, the preparation of the negotiation process is recognised as crucial for the outcome of the negotiation. An important part of the preparation is the choice of the organisational setting for negotiations. *The choice of the organisational setting determines the procedural rules and the general culture of negotiation, as well as the type of participants.*

Negotiations of the *UN New York Convention* follow the procedural rules of the UN General Assembly and its Sixth (Legal) Committee. This means that opposing opinions are reflected meticulously in the reports of the negotiation meetings, voting is possible and different positions are documented (SCHROEDER-WILDBERG 2002). The clarity of positions allows following the track of the process of negotiations and the positions of individual negotiating parties. However, from the point of implementation this might be a disadvantage, as it also means that countries voting against the text of an agreement are unlikely to ratify and comply with the agreement later. In short, the general culture of negotiations was predominantly legalistic.

Negotiations of the *UNECE conventions* followed the procedural rules used within UNECE. It is customary that decisions are taken unanimously, and the different positions taken by delegations during negotiations are not fully reflected in the reports of the negotiation sessions. Such a "harmony model" has its advantages and disadvantages. The advantage might be face-saving, i.e. a negotiating party is not prejudiced in its later behaviour (e.g. with respect to ratification) by its position adopted or expressed during the negotiation. A disadvantage might arise when a negotiating party uses the negotiation to dilute the results desired by the vast majority of participants, without in the end putting the own signature under the final document (ENDERLEIN 2002; SCHRAGE 2002). The general culture of negotiation was determined by a mixture of technical and legal experts.

The negotiations on water-related issues in the *Rhine River basin* did not form a straight line, but were based on a succession of challenges and legislative initiatives, some reaching back to before the World War II. The learning curve was

long, mainly because there were not many precedents to learn from. However, most of the negotiations took place after the World War II, during a period when a strong will emerged to build joint European economic and political institutions. The Netherlands were behind most of the initiatives, but besides them, politicians were also fully aware of the importance of the Rhine river, especially in Germany and Switzerland (DIEPERINK, 2002). The Berne Convention of 1963 determined the composition and the jurisdiction of the International Commission for the Protection of the Rhine (ICPR), and thus provided a formal structure for the consultations. Even when emotions were running high, and the positions seemed unreconcilable, the negotiations among the riparian partners in the Rhine River basin were characterised at all times by a similarity and even commonality of political institutions and traditions, a strong motivation to avoid any escalation of conflicts, and the ability to work towards win-win solutions.

The negotiations leading to the adoption of the *Danube River Protection Convention* took place in a climate based on the principle of consensus. The negotiation participants were professionally mixed, having both technical and legal background. The negotiation secretariat was located in Vienna, headed by an Austrian (KITTINGER, 2002). The experiences with procedural modalities of negotiation found their reflection in several provisions of the final text. Bilateral consultations and preparatory meetings of experts between the plenary negotiation rounds played an influential role. The fact that the European Community participated had its impact as well, since the negotiations took place immediately after the adoption of the Maastricht Treaty, which requires unanimity concerning decision-making in the policy area of water management.

The negotiations on water-related issues in the *Aral Sea basin* have been characterised by the legacies of the Soviet times, such as an inward-looking bureaucratic approach, lack of inter-sectorial communication and co-ordination, no participation of the local government or of non-governmental actors in the decision-process, limited knowledge of the modern international water law, and lack of skills and understanding how to reach win-win solutions. However, the countries involved acquired their sovereignty only recently, which may explain some negotiation deficiencies.

In comparing, one may conclude that the initiation phase and negotiation phases for the global UN New York convention were long. For the UNECE conventions, negotiation went rather fast after the political decision was taken. One reason might be the fact that negotiations are easier within a region than at the global level. Another factor might be the difference in the composition and negotiating tradition of the participants. Other factors, related to the "windows of opportunity", are discussed below. The negotiation processes at the basin level are strongly influenced by the cultural and political traditions of the participants. In case of the river basin agreements, the speed and character of initiation and negotiation was quite different for the Rhine and the Danube. The Rhine regime developed in a progressive way over a long period of time, going through a long learning curve, with riparian states having very similar political systems and economic strength. In the Danube basin, the negotiation process was much more straightforward as the participants could learn a lot from the experience in the Rhine river basin, especially since Germany is riparian to both basins. The other riparian states were in the initial process of a dramatic systemic transition, thus being probably more receptive and willing to achieve results and show co-operative spirit vis-à-vis the potential aid

donors. The negotiation process was taking place nearly in parallel with, or shortly after the negotiation of the ECE Helsinki I convention, the latter process serving as guiding paradigm.

Balancing of interests (upstream-downstream, inter-sectorial) in the negotiation process. Generally speaking, the interests of the downstream and upstream parties are fundamentally opposed (DIEPERINK 2002). This is true both for allocation and flood management (quantity aspect) as well as pollution and accident prevention (quality aspect). A state's geographical position along an international watercourse, i.e. being upstream, downstream or both (so-called mixed-motive countries[126]), is assumed to determine its positioning in negotiations (SCHROEDER-WILDBERG). Upstream states have a powerful position since they can control the water resources and pass on negative externalities to their downstream neighbours. The opposite may be true when downstream states used the waters of a transboundary river earlier and more intensely than their upstream neighbours. Thus, economic strength (often accompanied by political and military overweight) gives these countries an advantage that makes upstream development dependent on downstream agreement.[127] Today, typical conflicts are generated by upstream states that start to develop their water resource uses, which in most cases are strongly opposed by their downstream neighbour(s). While downstream states argue that they have the right to receive natural flow of the river (doctrine of absolute integrity), the upstream countries usually base their claims for water rights on hydrography, relying on where a river originates and how much of the catchment falls within their territory.

The relevance of the riparian status cannot be seen in isolation. The political and economic relationships originate from various sectorial interests, such as irrigation needs, or needs of producing electricity. The inter-sectorial balancing of interests can be a problem at the national level, and as such it can influence the transboundary negotiation processes. The domestic inter-sectorial tensions translate into transboundary issues when national economies of individual riparians are committed in a specific way to different economic sectors (BOSNJAKOVIC, 2001; TANZI, 2001).

Articles 5 and 7 were at the core of the negotiation process leading to the adoption of the *UN New York Convention*. Both articles are of high relevance for the process of balancing upstream-downstream interests. For a detailed and clear discussion of the negotiations regarding this issue see SCHROEDER-WILDBERG (2002).

During the negotiation of the *Helsinki I Convention*, there were a number of issues that could be traced to upstream-downstream conflict of interests, but the balancing of upstream-downstream interests was not so much in the centre of the discussions as was the case with the UN New York Convention negotiations. One may identify several reasons for that:

(a) The negotiations were initiated in the framework of the CSCE process in which the participating states already committed themselves to transboundary co-

[126]The term mixed-motive countries was introduced by SCHROEDER-WILDBERG (2002)

[127]Points in case are Egypt in the Nile river basin and Uzbekistan in the Syr-Darya river basin.

operation. Therefore the obligation to co-operate was a starting point which was not put in question during the negotiations.[128]
(b) The allocation of water is not a major issue in most parts of the ECE region due to the prevalent hydrographic conditions.
(c) The upstream-downstream conflicts of interest in the ECE region arise mainly from issues of pollution, with the Rhine and Danube as prime examples.
(d) The negotiation and adoption of the Helsinki I convention was facilitated by the simultaneous negotiation of the two other ECE conventions – Espoo and Helsinki II, thus allowing to include certain elements and cross-references to these conventions which guarantee a more balanced approach to contentious upstream-downstream and inter-sectorial issues (environmental impact assessment, information of the public etc.)

When negotiating the *Rhine river basin regime*, the clash of interests of upstream and downstream parties became apparent with regard to the dumping of salt from Alsatian potassium mines. The problem can be seen as an inter-sectorial conflict of interest, transformed into a transboundary issue: whereas France did not want to increase the costs of mining operation by stopping discharges of waste salts, the Netherlands tried to convince France that damage was inflicted by the increased dumping of salt on the Dutch horticulture. The conflict escalated in 1979 when the French government refused to submit the 1976 Chloride Convention for ratification. After the ratification of the Rhine Chloride Convention in 1985, France implemented the first reductions by temporarily storing the salts. However it took several more years and concessions on both sides to agree on operational modalities that eventually removed the salt problem from the agenda (DIEPERINK, 2002).

When negotiating the *Danube River Protection Convention*, the major issue in balancing upstream-downstream interests was the question whether the Convention should be applicable to the whole catchment area, or only to part(s) of it. This was a contentious issue in particular for Romania, which proposed partial applicability. The end result, achieved only after a special high-level encounter that took place between the Bucharest and the Sofia negotiation rounds in 1993 (KITTINGER 2002), was that the whole catchment area of the Danube was included. Interestingly enough, balancing upstream-downstream interests in the Danube basin was exactly one reason why the negotiations resulted in a multilateral agreement, and not a sum of bilateral agreements. One could assume that a multilateral framework would be better capable to cope with specific bilateral conflicts, such as between Hungary and Slovakia (with respect plans for joint hydro-electric water uses) and between Hungary and Romania (with regard to the Tisza river).

One of the most acute disagreements over resource sharing in the *Aral Sea region* concerns the "energy-agriculture" trade-off between upstream countries (Kyrgyzstan and Tajikistan) and downstream countries (Kazakhstan, Uzbekistan and Turkmenistan). The waters of the Amu-Darya and Syr-Darya rivers can be managed to maximise either hydroelectric generation from the dams of the upper watersheds with peak seasonal demand for water release in the winter months, or

[128] As pointed out in (TANZI, 2001, p. 80), the Helsinki I Convention not only provides for compulsory co-operation, but also for compulsory institutional co-operation. That is to say that, under Article 9, paragraphs 2, and 10, a clear-cut obligation is set out for co-riparians to enter into agreements establishing joint bodies.

for irrigation with peak seasonal demand in the summer months. While the agricultural regions of the downstream countries have grown dependent on continuous water supplies for crop production, the upstream countries are searching for ways to expand their economies through the use for hydropower and the expansion of their agricultural sector. The downstream countries fear that not enough water will be available for irrigation in the summer period if the water is used for hydropower generation in the winter period. Barter agreements by which the electricity needs of the upstream countries would be satisfied by energy imports from downstream countries, have not been successful so far. Here again it can be argued that unresolved inter-sectorial conflicts of interest become apparent as conflicts of interest between upstream and downstream states. The basic requirement for resolving upstream-downstream water-related conflicts of interest, is the political will and ability to negotiate win-win solutions. The present water resources management rules, based on the priority for irrigated agriculture, do not satisfy the priorities of States in the upper watershed (DUKHOVNY, 2000).

Windows of opportunity that promote and accelerate negotiation. The success of negotiations leading to the conclusion of a water-related agreement depends critically on the opening of so-called windows of opportunity. Conversely, if windows of opportunity do not open up, or are not used by actors, negotiations drag or even fail.

The launching of a negotiation process to adopt an agreement is often triggered or accelerated by an accidental event, a well-known fact from other policy areas. The fish mortality as a result of an accidental spill of the pesticide endosulfan in the Rhine in 1969 was one of the triggering events for changing the structure by introducing co-operation at the ministerial level in 1972. The ministers charged the International Commission for the Protection of the Rhine (ICPR) with the preparation of two treaties. A disastrous fire at the Sandoz factory near Basel in 1986 opened a new window of opportunity for the Dutch government to take the initiative to carry the negotiations further. The Dutch Minister of Transport and Public Works approached the other riparian states, and subsequently successfully converted dormant ideas on the improvement of the ecosystems in the Rhine catchment area into the Rhine Action Programme in 1987. Not long after that, the Netherlands formulated a new proposal, which eventually succeeded in removing the waste salt problem from the agenda.

There is little doubt that *the launch window for the ECE conventions was widely opened by the CSCE process on security and co-operation in Europe, and in particular when the process accelerated in the 1980s*. The Final Act of CSCE (1975) addressed a large number of environmental issues and the corresponding aims of co-operation. The political will expressed during the 1989 Sofia Meeting was a combination of three separate factors producing a considerable synergy within a very short period of time: (1) the ongoing CSCE process requiring enhancement of security and co-operation; (2) the recent emergence of a new, more transparent political thinking in Central and Eastern Europe, leading within less than a year to the crumbling of communist regimes, often under active involvement of environmental dissidents and activists; and (3) the impact on both the environment and the public opinion of several accidents with serious transboundary consequences (such as Chernobzl in April 1986). After that everything went very quickly. The negotiation of the Espoo Convention was done during six sessions between October 1988 and September 1990 of an Ad hoc Working Group. The

negotiation of the Helsinki I Convention took place during five special sessions between May 1990 and October 1991 of the Working Party on Water Problems. The negotiation of the Helsinki II Convention took place during five sessions between June 1990 and November 1991 of a Working Party. The 3 conventions were adopted within a period of 12 months between 1991 and 1992.

4. CONCLUSIONS AND RECOMMENDATIONS

The present study demonstrates the usefulness of a lifecycle model of water-related international agreements when studying the role of negotiations. A number of conclusions can be drawn with respect to the different life-cycle milestones and phases, as well as key factors and patterns regarding the negotiation of and within these agreements.

- The negotiation is strongly influenced by interplay of economic, social, environmental and security factors prevalent at a given time, be it at the global, regional or basin level. The influence of political culture and tradition is also of crucial importance.
- With regard to security, one can draw on the main conclusion of an important study of WOLF (2002), based on the Transboundary Freshwater Dispute Database project involving hundreds of watersheds and water-related treaties all over the world. He concludes: "The likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change". This corroborates the crucial importance of negotiating effective institutional water-related agreements.
- The process of initiating the negotiation is generally related to the wish for a broadly defined security, including lack of conflict, lack of health and environmental risks, and economic security. The political processes taking place in the European region after World War II- unification of Western Europe, the Helsinki process, emergence of newly independent states, profound changes in political culture, emergence of environmental awareness, transition to market economy, – were of decisive importance for initiating and concluding various water-related agreements.
- At the same time, the availability of the right organisational setting, procedural rules and negotiation culture contributed in a – publicly less visible –way to the progress and success of negotiations. In some cases these circumstances were readily available and contributed to a very efficient way of negotiation, as was the case with the ECE regional conventions. In other cases such circumstances did not exist from the very beginning, and had to be built in parallel as the negotiations progressed, which is the case in most water basins.
- One of the most frequently quoted factors influencing water-related relationships is the balancing of upstream-downstream interests. This study confirms that this is a major factor influencing negotiations. However, it also emphasises the totality of political and economic relationships among riparians. Reconciling and balancing of the inter-sectorial interests, both in the national and in the transboundary context, is of crucial importance. To achieve that goal, there exist general principles but there is no general recipe applicable to each water basin.
- Negotiating success is often determined by the opening of so-called windows of opportunity. In the cases studied, there were several types of such windows of opportunity. One of them pertains to general political developments, such as the CSCE process in Europe. Another refers, alas, to the occurrence of natural disasters or man-made accidents (Basel, Baia Mare) that accelerate the call for action.

- Waiting for, accidents, however, is not enough. Vision, and persistent and enduring efforts of dedicated men and women – be it scientists, technologists, environmental or social activists - are needed to achieve the right results. This explains the crucial role of transparency and the participation of the stakeholders and the public in bringing forward the negotiation process.
- Finally the success of negotiation depends also on a number of institutional and legal aspects, as well the frameworks for implementation, compliance, financing and management of agreements. The conclusion of an agreement is not the end of negotiation, as the follow-up activities require again a whole range of new negotiating activities.

One may wish to conclude that firstly, the present study could focus only on a small number of cases. Therefore it would be commendable to embark on a broader and more ambitious study in the future, which would involve a broader class of cases, especially outside the European region. Secondly, it would be useful to make use of the results of the present and the possible future studies in order to disseminate the knowledge and experience among those who may be interested in, or responsible for undertaking water-related international negotiations.

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WATER AND SECURITY IN INTERNATIONAL RELATIONS: A NON-CONFLICTUAL DISCOURSE

Anthi Dionissia Brouma[129]

ABSTRACT

This paper argues that water issues, when examined within the arena of International Relations, are more aptly conceptualised, understood and analysed through the lenses of Security Studies and the sub-discipline of Environmental Security in particular. This is because the complexity of water issues does not allow for a linear and simplistic analysis that considers solely one set of explanations, as there is a large number of diverse actors involved in various levels of interaction. Thus, an appropriate approach to water issues needs to be holistic, multi-level and multi-dimensional.
The paper is structured as follows: section one will explore the utility of theoretical approaches and show that water resource management and theories can co-exist, and in fact the latter is particularly fruitful for the former. Section two will elaborate on the three main theoretical approaches of International Relations in the context of water issues, in order to demonstrate the limited explanatory ability of those theories when it comes to the field of water. In section three, Security Studies will be analysed as a separate theoretical discipline, with particular emphasis on the current trends and the broadening of its context. Environmental Security will be the following subject of analysis, with reference to its context and historical development. The last section will conclude the paper.

1. IMPORTANCE OF THEORY

"*Theories are like lenses that one puts on to view, understand, structure or construct reality*".[130]

The world around us is full of events and facts that take place at various and random instances. The usual attempt is to put all these facts in a chronological order, so as to try and make sense of the world and then try to predict what will follow. However, facts on their own do not take this attempt very far[131]. We need to collect events, facts and evidence, which appear to be similar, and argue that similar sets of circumstances will lead to similar sorts of results. We categorise things together with the aim of making the world comprehensible, but we do not stop at merely categorising; we attempt predictions of what will happen and assume that there is some consistency to behaviour so we can go a bit further than talking of patterns and talk also of causes and consequences. However, this picture incorporates a parameter that cannot be captured, categorised and normalised easily: human nature and human behaviour[132].

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[130] Ayoob M., in Neuman G., 1998: 31
[131] Nicholson M., 1998: 106
[132] Because of this parameter the Social Sciences have been frequently accused of being unreliable and as providing highly contested and volatile predictions in the study of International Relations. This is more so if we put together a model from the Hard Sciences - lets say Chemistry - and a model coming from the Social Sciences - lets say IR. While in the first case you can go from point A to point Z with absolute certainty for an infinite number of times, in the second case this is not exactly what happens.

That is exactly where theory comes in. Theories and theoretical approaches have the gift of detecting patterns and consistencies in actors' behaviours. That by itself might not say much, but what it shows us is that the world we live in might be anarchic[133], but it is not chaotic. In this way pessimistic views of the world's future are dismissed and the task of finding co-operative models becomes worth undertaking. Consistencies and patterns are able to show that under similar circumstances actors may act in similar ways; thus, be potentially able to predict and find solutions to real problems or -if at all possible- avert conflict. Moreover, theories with their open-ended contextual and evocative borders can explain and occlude, include and exclude points; it is this process of inclusion and exclusion that is perceived as the positive aspect of theorising, because it simplifies complex realities and makes their comprehension an intellectually manageable exercise. That could be the first step towards reliable theoretical models that do not, though, claim that they can elucidate everything.

This is especially so when it comes to international theory. Dating back to 1966 and his article on *Why there is no international theory*, Martin Wright claims that "…international theory is marked…also by intellectual and moral poverty…"[134] that originates firstly in the intellectual prejudice imposed by the sovereign state[135] and secondly in the belief in progress[136]. Having this in mind, the analysis that follows attempts to present the weaknesses of International Theory regarding water issues, without at the same time disregarding their contribution to the overall discourse. As mentioned earlier theories are like lenses that we put on in order to view, understand and construct reality. Understanding the world means being in the position to analyse it. Analysing offers the potential for change and improvement. That is the contribution of theoretical frameworks.

2. WATER IN THEORIES OF INTERNATIONAL RELATIONS

2.1. Realism[137]

The realist school of thought, having its origins in the 5th century BC and the work of the historian Thucydides[138], claims to be the approach that best captures the nature of the modern world and offers a solid and reliable view of it. The main

[133] As the Realists would argue due to lack of highest authority implementing what we agree upon.
[134] Wright M., 1966: 19
[135] Issue that is focal and predominant to the realist school of thought.
[136] Subject that is extensively elaborated by the discourse on Modernity.
[137] The current trends of Realism include Neo-Realism and Structural Realism. Both acknowledge the significance of economic actors, which are no longer at the edge of the serious matters of power politics. The former stresses the Relational Concept of Power (that A is powerful only in relation to B) and that there is a one-way influence from the states to the economic actors; the latter stresses the important of the system in determining the behaviour of the individual states and giving them only a limited opportunity for freedom of choice.
[138] Thucidydes recorded the Peloponnesian War that occurred between Athens and Sparta, the two great powers in the ancient Greek world. The most representative sample of realist policy is the one included in "The Melian Dialogue", where Athens is using power politics to convince Melos to join her alliance. In Thucidydes (trans.), 1954: 360-365

question it tries to answer is how stability can be maintained in an anarchic world. Its theoretical core with regard to water issues includes the following points:

Statism is the centrepiece of Realism. The state is the main and principal actor, behaving in a *rational* and *unitary* way. In this theoretical approach other actors (whether individuals, local, national or international institutions and organisations) are disregarded by definition and their participation cannot be seen outside the main units. Moreover, no importance is being given to the structure both within and above the states, so there is a failure to understand the function of the international system, the subunits and the individuals[139].

Water is an issue that is conceived, understood and tackled on a local as well as on a national, regional and international level and requires the co-operation of different actors along with the state; thus, if water were to be included in the Realists' understanding, its focus would narrow down ominously and the ways to approach it would reduce to only a couple.

Power is a central concept within Realism. Power relations among states determine everything contained in the international arena[140]. States seek for a *balance of power*[141], which can be achieved with the appropriate manipulation of power relations, in order to control the *anarchic*[142] international system.
Power though, is intimately linked with the concept of sovereignty, which is bound up with the use of force. Consequently, power is predominantly conceived in competition terms and as a non-win-win game, with close reference to military understanding and arms capabilities. Thus, if water were to be incorporated in this interaction it would be treated as another power tool or weapon that aims to increase one state's power position over another's.

Survival is the overall goal of the states and national security figures on the top of the international issues' list. Survival is the outcome of a process of self-help, which emerges from the assumption that it would be far too dangerous to place a state's security in the hands of another. This situation can easily lead to intense militarisation, as one potential initiator of violence pushes everybody into a weapons contest. Following this logic, states find themselves trapped into what is called a *security dilemma*; this means that even if a state is arming only for

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[139] The levels of analysis that are most frequently used in the study of International Relations are five: international systems (the largest in dependent units), international subsystems (such as the European Union, the Organisation of African Unity, the Association of Southeast Asian Nations, etc.), units (states, nations, transnational firms), subunits (organised groups of individuals like bureaucracies and lobbies) and individuals. In Buzan B., Waever Ole and Wilde J., 1998: 5-6, Buzan B., in Booth K. & Smith S., 1995: 198-216 and especially the table on page 212

[140] Sometimes this interaction gives the impression of a billiard-ball game, where the winner is the one that eliminates all the others through the use of power/force.

[141] Through history, several models of balance of power have appeared, among whic h the basic are the bipolar (that characterised the world system during the Cold War Era) and the multi-polar (which is claimed to be the trend in the contemporary period).

[142] For Realists anarchy refers to the absence of any authority above states or hierarchy among states. States are sovereign, they claim to be independent and autonomous from other states and they claim a right to exercise complete authority over their own territories. Also "*international regimes and institutions of global management tend to lack the authoritative means to ensure compliance with their decisions*", McGrew A.G. in McGrew A.G. & Lewis P.G., 1992: 318

defence purposes it is rational in a self-help system to assume the worst in an adversary's intentions and keep pace in any arms build-up s17[143].
This nurtures a pessimistic view of the world in which a lack of trust and an inherent mutual suspicion are the principal characteristics. In such an environment talking about water co-operation is completely out of the question, while the intense militarisation can facilitate violent disputes over water.
In Realism there is a rigid distinction between *high* and *low politics* issues. Water can be conceived in both ways. If understood as a high politics issue, then it is considered as an issue of sovereignty and, thus is not negotiable and practically unapproachable. If, on the other hand, is considered as a low politics issue, then it is extracted from the security agenda as secondary to the military issues. Both ways result in periferisation of water issues and keep them in a cocoon that does not allow the grasping of the subject. Moreover, the global political process has experienced a domestication with low policy issues (economic welfare, drugs, the environment etc.) acquiring greater significance. . Thus, the distinction between high and low policy issues is not as rigid as it used to be, when traditional conceptions of state power and security are being redefined to embrace economic and environmental security.

States always act out of *self-interest* and focus their efforts on *absolute gains*. States join or leave alliances on the basis of the power structure of the system[145]. This means that a) agreements among states are only kept for as long as they serve the states' interest and b) that international interaction is a zero-sum game[146].
Both these points are incompatible with water issues and the search of a co-operative formula.

2.2. Idealism

The second school of thought is usually incorporated into the broader category of Pluralist Theory within International Relations. The question posed here is how can peaceful change be promoted in a world that is increasingly interdependent politically, militarily, socially and economically. The key points with regard to water issues are stated below:

The *non-state actors* are the key players, so there is room for interaction and participation for NGOs and other civil society representatives, as well as international institutions. A *co-web image of the world* is being put forward, where the individuals are the most important units of analysis. The state is to play a minimal role so as to ensure the necessary conditions for the individuals to interact[147]. The outcome is a mixed-actor system that is heterogeneous and

[143] Viotti P.R. and Kauppi M.V., 1993: 48
[144] McGrew A., in McGrew A. & Lewis P.G. et al., 1992: 314
[145] Nicholson M., 1998: 95
[146] This means that what one looses is gained by the other and v ice versa. There is no middle solution where all actors can gain something; only absolute gains are pursued. A worthy of note analysis is that of Prof. Gunder on the zero- and non-zero-sun game among Turkey, Syria and Iraq regarding the water of the Tigris and the Euphrates Rivers. For more see Gunder S.S., 1998
[147] The idea is drawn from Liberalism, where the individual is the focus. Also, we can trace the origins of this thinking in John Locke's work and especially his "Second Treatise on Government", published in England in 1689.

dynamic and where *"…the co-web of relationships between diverse actors, which reflects overlapping systems of action and exchange, produces a basis for a more legitimate global order"*[148].
This perception of international relations is useful for the examination of water issues, because the analysis is being carried out on many different levels simultaneously and also the individual-level approach (or actor-oriented, according to Development Theory[149]) has the advantage of providing tangible and viable solutions. However, such solutions are not always applicable on a higher level and sometimes distract the attention from the wider picture and examine matters in isolation.

The *agenda* of international politics is *extensive* in this school of thought. This means that even though national security is considered to be of vital importance, other issues, such as economic, social, political and environmental, are regarded as essential for the understanding of the world system[150]. Within this perception, security and security studies receive their wider concept (which will be discussed in Section III).
Within Idealism water issues find a proper place for discussion, as they can be easily incorporated within the agenda.

Followers of the Idealist school of thought support a *fragmented view of the state and the society within it* and claim that harmony grows out of competition and conflict among the different actors, in order for the democratic[151] ideal to be preserved.
However, water management needs a unitary approach, as too much fragmentation might exclude certain aspects of water issues. Moreover, it enhances the isolation of topics and the localisation of problems, which in the case of water does not promote co-operation and sustainability because water needs a multi-level and multi-actor approach.

Idealism includes words like *integration*[152] and *interdependency*[153] in its vocabulary. These concepts, when put into practice contribute in formulating a variable and

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[148] Smith M., 1992: 263
[149] For more on the actor-oriented approach see Long N., 'From Paradigm lost to paradigm regained? The case of an actor-oriented sociology of development' in Long A. and N., 1992: 16-44
[150] A fundamental realist like Henry Kissinger also stated this reality in 1975 as "progress in dealing with the traditional agenda is no longer enough. A new and unprecedented kind of issue has emerged. The problems of energy, resources, environment, pollution, the uses of space and the seas now rank with the question of military security, ideology and territorial rivalry, which have traditionally made up the diplomatic agenda". In H.A. Kissinger, 1975: 199 cited in Keohane R.O 7 Nye J.S., 1997: 3
[151] Around this concept revolved the Democratic Peace Theory, which emerged in the 1980s and argued that the spread of democracy would lead to greater international security. Its logic is based on Kantian thought and claims that wars between democracies are rare and are believed to settle mutual conflicts of interest without the threat or use of force more often than between non-democratic states. See Baylis J. & Smith S., 1999: 202
[152] It is argued that the proliferation of common problems requires collaborative response from the states. Successful collaboration in one particular technical field or functional area would lead to further collaboration in other related fields; in other words moving from low politics issues to high politics ones. The way in which the European experiment has evolved is supposed to be following the so-called functional theory and the logic of spill-over. For more on theories of European integration see Tsinisizelis & Maravegias, 1995

positive-sum game, where all the participating players can benefit. Building on this, Idealists cite *complex interdependency*, in which all actors affect and are affected by the behaviour and position of all other actors.
Such a framework even though includes useful concepts for co-operative water management, at the same time it transforms the overall attempt to a rather laborious task where a large number of parameters have to be taken into account; thus, solutions cannot be found with ease. In a similar context "*…if everything is so complex, and everything is connected to everything else, how can the analyst or the practitioner formulate a clear view of what is important?*"[154]

2.3. Structuralism / Globalism

The third main theory within International Relations is more of a way of approaching than a theory itself, as it encompasses many different theories within its spectrum. The main focus is on the dependency relations within the global political economy and its theorising draws its origins from the Marxist legacy and all the neo/post Marxist descendants. Some of its arguments regarding water issues are the following:

The focal point is the *structure* and not the actors. Structure is the most important determinant. The starting point of analysis is the *global context*[155], even though all other levels are included, and the process of globalisation[156]. This approach differs according to the grouping, which the analyst regards as crucial[157] (structural realists focus on the state, Marxists on the economic system, feminists on gender issues, and so on).
Such an analysis is rather limiting when it comes to water issues because water, as a subject, can easily fit into different categories and can be analysed under various frameworks. In the end, though, it requires a holistic approach in order to capture the essence of its main discourse, which is about competing actors struggling over a scarce and unevenly found resource, which is without a known substitute.

Structuralism places *scepticism on the influence*[158] of organisations and individuals within the international interaction. This means that there is limited scope for change, and even if change occurs it follows the needs of the system and not those of the actors.
Water analysis needs something more vibrant, where there is wide and meaningful participation for the actors.

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lpar[153] An analysis of the concept and the different aspects of interdependence is provided by Nye J.S., 2000: Ch. 7
[154] Smith M., 1992: 262
[155] An examination of the significance of global context with regard to political space and the world system is provided by McGrew A., 1995: 11-64
[156] In this process social transactions of all kinds increasingly take place without account for national or state boundaries with the result that the world has become "one relatively borderless social sphere". This also includes the growing interaction of national economies, a growing awareness of ecological interdependence, the proliferation of companies, social movements and inter-governmental agencies operating on a global scale and a revolution of communications that has aided at the development of a global consciousness. For more see Baylis J & Smith S. (eds.), 1999: 143
[157] Nicholson M., 1998: 102
[158] Ibid: 101

Another tenant of Structuralism focuses on the importance of *historical analysis* for the understanding of the world.
This is particularly important for water analysis, as frequently the solution to a given problem lies in the historical background of the debate. It may also assist in illuminating the reasons behind current problems by bringing into light parameters unknown up to that point. However, keeping historical memories alive has a flip side, for example by prolonging disputes, maintaining vendettas and keeping specific historical conflictual events as regular points of reference.

Structuralism makes frequent use of contrasts like North-South, East-West, Developed-Developing, Industrialised-Industrialising states. Economic factors are the main tools in explaining subordination and dependency relations[159] within the global context. So, the problem is to be found within the structure of the modern world system.
Water may benefit from such an approach, as the water paradigms approach follows a similar path. However, the obsession with the exploitative nature of the capitalist system might block any fruitful alternative thinking. Besides, water requires a multi-level analysis that does not attribute disproportionately more weight to economic factors.
This school of thought acknowledges the *wider agenda* of international politics, like the Idealists and, as stated before, water issues find an appropriate ground for expression.

The above three theoretical paradigms are different ways of looking at the world and the facts or events within it. Furthermore, they are complete world-views in themselves. However, they do not allow the blending together of different theories, nor do they offer the holistic multi-level and multi-actor approach that water issues demand.

3. SECURITY STUDIES AND ENVIRONMENTAL SECURITY

Security Studies, though initially conceived within the framework of national policy, evolved into a separate and independent discipline within International Relations. A concrete definition of what the concept entails does not exist[160] and the principal area of disagreement focuses on whether the relevant enquiry should be on the individual[161], national or international security. Even though security is assumed to

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[159] Such relations have been the centre-piece in the explanatory power of various development theories like Dependency Theory, elaborated by Celso Furtado in the early 1960s, or Wallersteins' theory on World Systems Approach in the early 1970s. For more information see Preston P.W., 1996: 179-195 & 213-233

[160] Certainly several attempts have been made during the years. According to Burry Buzan "…in the case of security, the discussion is about the pursuit of freedom from threats. When this discussion is in the context of the international system, security is about the ability of states and societies to maintain their independent identity and their functional integrity". Alternatively, Booth and Weeler proposed that "…stable security can only be achieved by people and groups if they do not deprive others of it; this can be achieved if security is conceived as a p rocess of emancipation". For more attempts in the search for a definition see Baylis J. & Smith S. (eds.), 1999: 195

[161] Individual security is certainly intimately related with state security, since the citizens expect their protection against all types of threat to be carried out by the state. At the same time individuals through the exercise of liberty (when it comes to human rights) seek for security from the state. "The most profound of all choices relating to national security is the

have roots in an objective referent, it entails both an objective dimension (the absence of threats to core values) and a subjective dimension (the absence of fear that such values will be attacked)[162]. Much of its intellectual history revolves around the debate between realists and idealists. While the former consider security as a derivative of power where an actor with enough power to reach a dominating position would acquire security as a result, idealists see security as a consequence of peace (a lasting peace would provide security for all). However, a fully developed concept of security can actually lie between the extremes of power and peace and may provide the bridge covering the political and intellectual gap that usually separates them. This quality of security led Barry Buzan to argue that "…the concept of security is, in itself, a more versatile, penetrating and useful way to approach the study of international relations than either power or peace"[163].

Furthermore, this attribute of security stresses the utility of Security Studies as a separate discipline. Other reasons that point towards the same direction may include: *a) the rising density of the international system* that creates a powerful interplay between anarchy and interdependence forcing the policy environment to change and adapt to new situations. While military threats might be fading away, there are a wide number of other kinds of threats coming into view and claiming an eminent place in the security agenda, with the most obvious example being the environmental issues. *b) The political qualities* of the concept that by definition create priority action. The word security itself is a powerful tool in claiming attention for priority when it comes to competition for government attention. *c) The intellectually attractive integrative qualities* of the word security. It provides a way of linking together many areas of theory and analysis within International Relations that are normally isolated from each other; thus, it overcomes the impasse the other three theoretical paradigms face. *d) It is a multi-level and multi-centred approach*, since it allows actors from different levels of analysis to interact and mingle together (individuals with states and international institutions). *e) It requires inter-disciplinarity*, since the issues it tackles do not originate exclusively from one discipline like political science, economics or sociology; on the contrary they usually lie somewhere on the borders of different disciplines and demand a multi-dimensional approach. *f) Its non-teleological scope;* it shows that dealing with security issues, does not necessarily mean dealing with or being led to conflictual situations.

In the post World War I era, idealism claimed widespread support through the activities of the League of Nations, preaching for world peace and collective security. During the Cold War period the dominant idea was that of national security, expressed in strictly military terms. After the transformations of the 1989-90 a new pattern of global security relations emerged with the following features[164]: a) the rise of a multi-polar power structure in place of the Cold War's bi-polar one, b) a much lower degree of ideological division and rivalry, c) the global dominance of a security community among the leading capitalist states and d) the strengthening of international (civil) society. The above assisted security to escape

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trade off with liberty, for at conflict are two quite distinct values, each essential to human development". Lynn-Jones S.M. & Miller S.E. (eds.), 1995: 17

[162] Litfin, 1999: 331

[163] Buzan B., 1991: 3

[164] For an analytical presentation of these points, please see Buzan B., 1994: 208

its monolithic military/political heritage and to acquire its wider approach[165], according to which "*…security is taken to be the pursuit of freedom from threat and the ability of states and societies to maintain their independent identity and their functional integrity against forces of change which they see as hostile*"[166]. This view asserts that the security of human collectivities is affected by factors in five major sectors[167]: military, political, economic, societal and environmental. The military concerns the two-level interplay of the armed offensive and defensive capabilities of states and states' perceptions of each other's intentions. The political involves the organisational stability of states, systems of government and the ideologies that give them legitimacy. The economic regards the access to resources, finance and markets necessary to sustain acceptable levels of welfare and state power, while the societal is about the sustainability within acceptable conditions for evolution of traditional patterns of language, culture, religion, national identity and custom. Finally the environmental involves the maintenance of the local and the planetary biosphere as the essential support system on which all other human enterprises depend. Each part defines a focal point within the security problematique and a way of ordering priorities, but all are woven together in a strong web of linkages. Wider Security Studies endorse an integrated viewpoint, which is exactly what water analysis needs. Security is conceived to be naturally integrative.

4. ENVIRONMENTAL SECURITY

The debate on the wider approach to security and security studies along with the new environmental politics of the late 1960s-early 1970s resulted in the formation and establishment of the sub-discipline of environmental security. The environment after becoming the hallmark of Modernity, due to the exploitation of nature on large scales and with advancing technologies and thus being completely displaced because of that, was brought securely back into the national and international agenda after the Stockholm UN Conference on the Human Environment in 1972[168] and the inception of the concept of sustainable development. The literature on the subject is vast[169] and covers all the known aspects the environment is currently viewed from. Environmental security does not refer solely to the threats towards nature. The main concern is whether the existing ecosystems that are essential to the maintenance of the present civilisations, are sustainable. So, environmental

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[165] For an analysis of the widening of security concept in its initial stages see Ullman, 1983: 133

[166] Ibid: 207

[167] The analysis and explanation of these five sectors within the wider security approach have been the focus of Barry Buzan's work. For a comprehensive analysis please see Buzan B., 1991, Buzan B., 1994, Buzan B. et al, 1998

[168] Even though Elliott L. claims that "…the major achievement of the Stockholm conference was that it brought together governments to debate international environmental issues and that it provided a basis for the slow development of international environmental law in the years to follow. *Its success, then, was primarily political rather than environmental*", 1998: 13

[169] From the environment and politics elaborated by Doyle & McEachern (1998) to analyses of environmental sociology that Barry covers (1999) and the connection of the environment with development by Norgaard (1994), further to the environment and its place within the project of Modernity that Spaargaren (2000) elucidates, to the environmental global politics with Elliott (1998) or the combination of the environment with discourses o knowledge that Fischer (2000) scrutinizes, the concept of environment both theoretically and in everyday matters has remained a stable point of focus.

security consists of the environment itself on the one hand, and, on the other, of the combination and interaction of the environment with civilisation, where the latter is considered to be responsible for the environmental constraints that it has imposed on nature[170]. The subjects that figure in the environmental security agenda may vary: disruption of the ecosystem, energy problems, population problems coupled with poverty and famine are some of them. Water scarcity and water resource management are also part of the agenda. "*Global development now suggests the need for another analogous, broadening definition of national security to include resource, environmental and demographic issues*"[171].

In 1997 Carsten F. Ronnfeldt presented the chronological trajectory of the research on environment and security in a concise and innovative way[172]. Even though he claims that it is only a review of the literature on the interface between environment and security, the distinction he uses is particularly useful. He refers to this analysis as the three generations of environment and security research. The following table[173] summarises this interface:

	1st Generation – early 1980s	2nd Generation – early 1990s	3rd Generation – mid 1990s
Scholarly approach	Conceptual debate	Process tracing	A broad range of social science methodologies
Field of analysis	Environment & Security	Renewable resources & conflict	Environment & Security
Level of analysis	Global/State/ Individual	State/Sub-state	Global/Regional/State/Sub-state

The first generation, covering the early 1980s, mainly criticises the conventional concept of security and calls for a wider approach that incorporates environmental issues into the security agenda. The second generation, starting in the early 1990s, includes primarily the work of Homer-Dixon[174] and the Toronto Group. Through the examination of 12 different case studies according to a key model where environmental scarcity (water scarcity being part of it) is the independent variable and conflict the dependent one, they reached the conclusion that scarcity of renewable resources is never the sole cause of conflict, but it can contribute to these disruptions when it interacts with economic, political and social factors[175]. Finally, the third generation constitutes a critique of the Toronto Group and focuses on the need to expand the independent variables so as to include other material and socio-political ones. It also stresses that environmental scarcity is a trans-boundary issue and thus, states are not the only actors involved in the interaction. Moreover, when cases of conflict are examined, the observer is likely to find confirmation of whatever is being sought out; thus, the case studies should include peaceful/non-conflictual examples as well in order to be reliable and scientific.

[170] It is possible to present environmental problems as a manifestation of the crisis of the so-called modernisation project and thus, link the two; Kakonen, 1992: 1
[171] Tuchman Mathews J., 1989: 162
[172] Ronnfeldt, 1997: 473-482
[173] Ibid: 474
[174] See Homer-Dixon, 1991
[175] In 1994 Homer-Dixon revised the original hypotheses to include more variables and asserted that scarcities of cropland, water, forests and fish are of immediate concern. See Homer-Dixon, 1994:39

Building on this line of thinking, it could be argued that it is misleading to focus on developing countries as the primary source of environmentally induced international instability. Besides ignoring the fact that the industrialised countries are the world's primary environmental offenders, this argument promotes the already existing fear of developing countries in what the relevant literature examines as "environmental imperialism or neo-colonialism"[176]. Moreover, in the case of water resources, the findings do not reflect an awareness of the developing world's ability to conclude agreements, like in the case of the agreements between India and Pakistan, Nepal and Bangladesh on sharing river waters. The usual reference involves cases where conflict is the predominant model of interaction. For example, when one refers to highly popularised and overwhelmingly examined cases like the waters of the Nile, the Tigris and Euphrates or the Jordan river, one usually points out primarily the tension among the riparian states and the different phases the dispute has been through, without acknowledging or publicising enough examples of co-operation and collaboration[177]. In such cases even though water issues are highly politicised and securitised, at the same time, they constitute an element of co-operation based on their indisputable value to humans and human welfare; and this is precisely the merit of environmental security.

5. CONCLUSION

Until recently International Relations have been suffering from a profound ecological blindness. For as long as nature appeared to be endlessly abundant and perpetually resilient, the study and practice of international relations could proceed its business as usual. This is no longer the case. With the realisation that there are, indeed, limits to growth and the finiteness and depletion of the world's resources not being an extremist's fiction story, a new approach was called for. The conventional theoretical paradigms of international relations, occupied with their inter-rivalries, seem unable to grasp the beat of the times. The complexity of the environmental crisis (and the water crisis, as part of it) demands more innovative and open perceptions, interdisciplinary approaches and a combination of different theoretical perceptions. There is a growing awareness that ecological health must be an essential ingredient in any recipe for international order.

Security studies experienced substantial conceptual and practical transformations in the last two decades of the 20th century. Security acquired a wider concept so as to include issues that would traditionally be exempted from its agenda, like social, environmental and economic. This attributed flexibility to its theoretical core and allowed for multi-disciplinarity, while at the same time ensured that a number of other actors along with the state would be involved into the overall interaction. Within Security Studies, the sub-discipline of Environmental Security seems to be the most appropriate arena for the environmental discourse to take place. It has the striking quality of politicising an issue and bringing it into the front of the international debate, while at the same time keeping tensions low and ensuring

[176] Litfin, 1999: 336

[177] An illustrating example of this sort, is the Joint Communique signed in August 2001 by the Administration of the Southeast Anatolia Project of Turkey (GAP-RDA) and the General Organisation for Land Development of the Syrian Ministry of Irrigation (GOLD), with the purpose of organising common training programmes, draft and carry out joint projects and realise exchange programmes and partnerships.

that co-operation is the ultimate goal through the spreading of common values for the tackling of shared problems. Environmental issues d o not recognise boundaries and do not respect borders. This last point can be said to promote the idea that environmental security is the antipode of sustainable development. Both involve the linkage of human development with the care for the environment, though comprising different conceptual connotations each.

Theoretical constructions are useful lenses in order to identify problems and suggest solutions. An identifiable problem lies with the amount of knowledge that is allowed to pass through those lenses. In 1989 Tuchman claimed that "…the current knowledge of planetary mechanisms is so scanty that the possibility of surprise, perhaps quite nasty surprise, must be rated rather high. The greater risk may well come from a completely unanticipated direction. We lack both crucial knowledge and early warning systems"[178]. Surely we have moved a little further from that point, however the sharing of vital environmental information at times seems to be as difficult as managing scarce water resources.

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THE INFLUENCE OF ASYMMETRIC INFORMATION IN THE DESIGN OF TRANSBOUNDARY WATER AGREEMENTS

Juan Patricio Castro Valdivia[179] and Miguel Ángel Tobarra Gonzalez[180]

ABSTRACT

The demand for water has increased continuously in the past hundred years because of its multiple uses in agriculture, industry, urban areas, households and tourism. At the same time, climate change produces uncertainty about the quantity and regularity of the natural supply of this resource.

In this situation, competition for water between countries can be a source of conflicts but at he same time, there are potential gains from co-operation since the gains of exploiting this resource in a co-operative way are bigger than the gains obtained exploiting it in an individualistic way.

In this working paper, we study the possibility of establishing agreements between two countries in order to regulate water transfers between them. The existence of asymmetric information and a conflict of interest between both countries can impede to reach an agreement. In this cases, economic theory proposes some mechanisms and variables to overcome those difficulties.

We conclude that, under asymmetric information, the payment for the water transfer must not be fixed but vary depending on the probability of an efficient use of the resource. The higher the probability of an efficient use is, the lower the payment should be. In this way, the parts will get a "second best" solution given the restrictions. A "first best" solution, a Pareto optimum, is only achievable under perfect information. In this situation, a punitive system would guarantee the fulfilment of all contractual conditions.

1. INTRODUCTION

The demand for water has increased continuously in the past hundred years because of its multiple uses in agriculture, industry, urban areas, households and tourism. At the same time, climate change produces uncertainty about the quantity and regularity of the natural supply of this resource.
In this situation, competition for water between countries can be a source of conflicts but at he same time, there are potential gains from co-operation since the gains of exploiting this resource in a co-operative way are bigger than the gains obtained exploiting it in an individualistic way.
In this working paper, we study the possibility of establishing agreements between two countries in order to regulate water transfers between them. This could be the case of two countries with markedly unequal resource endowment or simply one

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country that ceases water if it compensates him[181]. We assume that the destiny of the water is irrigation. This simplification of the reality is justified by the importance of the agrarian use of water. It is not possible to achieve an efficient use of water without an efficient agrarian use[182].

One of the impediments for the parts to reach an agreement is the existence of asymmetric information and a conflict of interests between them. Under these circumstances, economic theory points out that contracts are the suitable instrument to share risks and to make the objectives of both sides compatible.

We say that there is asymmetric information in a contractual relationship when one part knows something that the other does not. The contractor uses to be called "Principal" and the contractee uses to be called "Agent". In this context, Principal proposes a contract (or a set of contracts) to the Agent. The Agent accepts the contract if he so desires, that is, if the contract guarantees him greater expected utility than the other opportunities available to him. After having signed the contract, the Agent carries out an action or effort on behalf of the Principal.

Since carrying out an action or effort supposes disutility for the Agent, there exists a conflict of interests between both parts. Besides, the Agent's action or effort is not verifiable by the Principal and cannot be included in the terms of the contract. This is a *moral hazard* situation because Agent is tempted to cheat and save effort costs since his actions can not be controlled. But there are some observable and verifiable variables from which it can be deduced the effort of the Agent. These variables will be included in the terms of the contract.

In our point of view, water allocation studies (including the convenience or not of transfers between basins), can benefit from information economics. In the bibliography we have revised, there are implicit references to information economics. *Just and Netanyahu (2000)* use a strategic behaviour model applicable to water conflict between Israel and Arab States; *Zilberman (2000)* suggests new research avenues taking into account uncertainty and asymmetric information; Frisvold and Caswell (2000) use game theory to study water management in the case of shared resources between Mexico and the United States. Nevertheless, we miss a model that treats it directly.[183]

In this paper, we analyse the characteristics of a contract in which one country (Principal) transfers a certain quantity of water to other country (Agent) in return for a payment. The Principal wants to cease a small quantity of water to minimise the negative impacts in its economy and environment and wants the Agent to use the resource with a high effort. A high effort implies the adoption of saving water measurement as efficient irrigation systems, appropriate crops, water re-use, computerised and automatic irrigation and so on. This high effort implies a cost for the Agent and so a lower benefit. Some variables as crops, quantity of water used and weather should be taken into account to infer the level of effort if it is not observable.

Below, we study the design of cession water contracts between two countries in perfect and imperfect information situations. Finally, we present our conclusions.

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[181] There are some examples of situation like this as the Lesotho's Water Transfer Treaty with the Republic of South Africa or the possible transfer from Rhône River in France to Spain

[182] "Agriculture is the most voracious water consumer and also the biggest soil and water resources polluter " (Batie et al. 1985)

[183] Gallastegui et al. (1993) studies the influence of asymmetric information in fish contracts between two countries.

2. THE DESIGN OF CESSION WATER CONTRACT BETWEEN TWO COUNTRIES

We analyse bilateral contracts in which an assignor (Principal) and an assignee country (Agent) would participate. Our analysis focus on the following variables: the quantity of water used (x), the level of effort (e) and the payment for the water (T(x)).

Water is a flow variable that varies yearly depending on rainfall. A quantity of this annual flow can be transferred. This quantity is costless observed.

Respecting to the effort, the Principal takes into account the fact that a bad administered irrigation contributes to water scarcity and pollution. Inadequate irrigation and drainage systems imply leakage and evaporation. That is why he wants the Agent to make the highest possible effort. We suppose that there are two effort levels, high (e^h) and low(e^l). A high effort implies the adoption of saving water measurement as efficient irrigation systems, appropriate crops, water re-use, computerised and automatic irrigation and so on.

The Principal wants the Agent to make a high effort because his benefits/utility are greater in this way. The Agent will make the best effort for him given an incentive system. They both maximise their own objective function.

- The objective function of the Principal is: $E\{T(x(e)) - \beta(x(e))\}$ **[1]**

where T(x(e)) is the income that he would obtain by cessing water. The more water he transfers, the more income he earns. There is a negative relation between water used (x) and effort (e); the water necessary to attend a certain demand will be smaller as the effort is higher. We suppose that the Principal is risk-neutral.

$\beta(x(e))$ is a shadow price related to the use-value of the resource[184]. This variable shows the socio-ecological value of water. There are some negative externalities associated to water use as pollution or ecosystems harm that are not traded in a market but means a cost for the assignor country. Its inclusion let us consider water as a social asset and not only as a production factor.

- The objective function of the Agent is: $U\left[h\underline{y}(x) - T(x)\right] - w(e)$ **[2]**

where h is the product price (agrarian products)

$\underline{y}$ is the observed production of the Agent. This level of production can be obtained with a great amount of water, if it was not used efficiently, or with a smaller amount, if water was used efficiently. The set of possible amount of water used is $x_1, x_2, \ldots, x_n$.

T(x) is the payment for the water used

w(e) is the cost that the effort implies for the Agent

We suppose that the utility function of the Agent is a von Neuman-Morgensten type, separable in effort and income; we also suppose that the Agent is risk-averse; this risk aversion implies that $U' > 0$, $U'' < 0$.

It is necessary to guarantee the reservation utility so that the assignee country accepts the contract. There is a chance that the country did not accept the contract and got a determined utility in other activity. This is the participation condition.

$U\left[h\underline{y}(x) - T(x)\right] - w(e) \geq \underline{U}$ **[3]**

[184] In Castro (1993) is made a detailed analysis about shadow price determination that includes water value use.

Besides, we know that the Agent will choose a high effort if the expected utility associated to this high effort is bigger than the expected utility associated to a low effort. This is the incentive compatibility condition.

$$U\left[h\underline{y}(x)-T(x)\right]-w(e^h)\geq U\left[h\underline{y}(x)-T(x)\right]-w(e^l) \quad \textbf{[4]}$$

In the design of the contracts, it is necessary to take into account that there is not a direct relation between effort and water used because of the estate of nature. It is possible to have used a high level of water because of adverse weather conditions although the effort made is high. For instance, a farmer who has adopted the best irrigation technology needs 4000 m^3/Ha a rainy year and 7000 m^3/Ha a dry year. By observing the consumption of water in a dry year, it could be deduced that he uses a not efficient technology when he is using the best. So, weather changes the information of the result and this can not be ignored. That is why, we include conditional probability in our model. So, Prob (x_j / e) = P_j (e) means the probability of using the amount of water x_j if the level of effort "e" has been made.
In order to analyse the properties of the contracts in these circumstances, it is convenient to study the perfect information case (utility functions, cost functions and action are observable).

2.1. Contracts Design In A Perfect Information Situation - Observable Actions

The Principal wants a contract that maximises his objective function (his income) but limited by the level of effort (e^h) he desires to be made. As actions are observable, we do not have to include the incentive compatibility constraint because a big enough sanction can be established if contract is breached.
The Principal must solve the following problem:

$$\underset{T(x_j)}{Max}\sum_{j=1}^{n}p_j(e^h)\left[T(x_j)-\beta(x(e^h))\right] \quad \textbf{[5]}$$

$$\text{subject to } \sum_{j=1}^{n}p_j(e^h)U\left[h\underline{y}(x_j)-T(x_j)\right]-w(e^h)\geq \underline{U} \quad \textbf{[6]}$$

After its solving[185], we deduce that the optimal contract associated to e^h is

$$TO=h\underline{y}(x_j)-U^{-1}(\underline{U}+w(e^h)) \quad \textbf{[7]}$$

The assignee country pays to the assignor the difference between the production value $h\underline{y}(x_j)$ and the opportunity cost plus the cost of the effort w(e^h). In this way, the Agent is completely assured, obtains a certain utility (it is logical since the Agent is risk-averse and the Principal is risk neutral). As actions are observable, the Principal can sanction the Agent if a low effort is made. He can establish a fine in such a way that Agent's expected utility is smaller if he makes a low effort. The Agent, who is conscious that his effort is observable, knows that the most profitable is, given these circumstances, to make the high effort.

The payment system included in the contract would be:

$$\begin{cases} TO=h\underline{y}(x_j)-U^{-1}(\underline{U}+w(e^h)) & \text{if e = } e^h \\ TO=h\underline{y}(x_j)-U^{-1}(\underline{U}+w(e^h)-m) & \text{if e =} e^l \end{cases}$$

[185] See working paper "Gestión del recurso natural agua con información asimétrica", Tobarra (June 2001), for a complete mathematical development.

where "m" is a big enough fine[186].
In a perfect information situation, effort can be expressly included in the terms of the contract, and a high enough sanction can be established to dissuade the Agent from making a non-desired effort.
We see that in the complete information case, incentive compatibility constraint is not effective, so, a Pareto optimum result can be reached. One part will improve only if the other part worsens. In fact, what we have done in the last problem is to maximise the utility of one participant maintaining the other one's constant. It is interesting to stand out that the modification of $\underline{U}$ provides all the Pareto border. So, if effort is observable, it is possible to put a totally optimal incentive system in practice, although the level of water used is random.
Pareto optimum means an efficient situation in economic terms, another question is the profit sharing. It is the own benefit of both parts to pursue a fair deal that avoids opportunism and favour a relational structure and not a mere transactional one. This attitude will support the development of ongoing sustainable relationship at a minimum cost.

2.2. Contracts Design In An Imperfect Information Situation - Non-Observable Actions

The fact is that effort is not observable and the incentives system can only be based on the level of water used. This would be the variable that should be included in the contract. Now, the Agent could be tempted to make a low effort and save the costs associated to a high effort. In this case, the incentive compatibility condition is effective.
The maximisation problem is:

$$\underset{T(x_j)}{Max} \sum_{j=1}^{n} p_j(e^h)\left[T(x_j) - \beta(x(e^h))\right] \qquad \textbf{[8]}$$

Subject to

$$\sum_{j=1}^{n} p_j(e^h) U\left[h\underline{y}(x_j) - T(x_j)\right] - w(e^h) \geq \underline{U} \qquad \textbf{[9]}$$

$$\sum_{j=1}^{n} p_j(e^h) U\left[h\underline{y}(x_j) - T(x_j)\right] - w(e^h) \geq \sum_{j=1}^{n} p_j(e^l) U\left[h\underline{y}(x_j) - T(x_j)\right] - w(e^l) \qquad \textbf{[10]}$$

After solving it[187], we obtain the following expression for the payment in which conditional probability is included.

$$T(x_j) = h\underline{y}(x_j) - (U')^{-1}\left(\frac{1}{\lambda + \mu\left(1 - \frac{p_j(e^l)}{p_j(e^h)}\right)}\right)$$

[186] A punitive system based on periodic inspections and fines in breach of contract situations could be established. Fine would not be lower than the techniques cost difference and as high as possible to minimize vigilance costs.
[187] See Working paper "Gestión del recurso natural agua con información asimétrica", Tobarra (June 2001), for a step by step inference of this result.

The level of water used indicates the likelihood of having made a high effort or not. Payments are not going to depend on the volume of water but probability. The bigger P_j (e^l) is (and so, the lower P_j (e^h) is), the bigger the probability of having used x_j due to a low effort has made, the bigger is the payment required. If,after observing the level of water used (together with production and weather), it is inferred the high effort as the most probable, Agent's income will be bigger; if a low effort is inferred, the assignor basin will have to establish a penalisation, a bigger payment $T(x_j)$ so that the Agent's income was smaller and there was an incentive to make an efficient use of the resource.

We conclude that the payment depends on good water use probability and that the payment has to act as a disincentive to non-desired conduct, payment is designed in such a way that it is preferable adopting saving methods to not doing it.

We see how asymmetric information causes an economic efficiency loss. Pareto situation are only achievable when information is perfect or when there not exists a conflict of interests between Principal and Agent and so, incentive compatibility constraint does not exist. In other case, a first best solution is not possible and it is only achievable a second best solution. In order to reach this second best solution, the Principal has to design a contract that includes a set of retributive incentives that induce the Agent to adopt the actions desired by the Principal, that is, a high effort that allow an efficient use of the resource.

3. CONCLUSIONS

We conclude that, under asymmetric information, the payment for the water transfer must not be fixed but vary depending on the probability of an efficient use of the resource. The higher probability of an efficient use is, the lower the payment should be. In this way, the parts will get a "second best" solution, the best solution given the restrictions. A "first best" solution, a Pareto optimum, is only achievable under perfect information. In this situation, a punitive system would guarantee the fulfilment of all contractual conditions.

Water is a natural resource subject to multiple uses and an increasing pressure. That is why, although it is considered a non-biological natural resource, there are scarcity, distribution and environmental problems that worsen rapidly. In our point of view, taking into account the effects of asymmetric information in the design of contracts can help to solve some of the problems of water management.

In this paper we have tried to show the variables that should be taken into account in a contract that regulates a water transfer between two countries without forgetting environmental aspects. Obviously, the treaty will be easier to achieve if the income generated is the bigger and depends as well on the good will of the parties. A good example of a mutually beneficial contract is Lesotho's Water Transfer Treaty with the Republic of South Africa. Potential gains for both countries were obvious. South Africa could avoid the economic collapse of the Vaal Region due to water scarcity and Lesotho could develop hydropower, agro-industry growth, additional fisheries and expansion of tourism. South Africa did not have a cheaper transfer alternative and Lesotho had low impact cost because the zone in which infrastructure was built was sparsely populated. The parties gained economies of scale by using flexible language to resolve controversial issues, establishing various neutral institutions to police the treaty, and integrating benefits under the treaty with existing arrangements between them.

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NOTIFICATION, CONSULTATION, AND NEGOTIATION IN INTERNATIONAL WATER RESOURCES LAW

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ABSTRACT

Sharing international water resources is inevitable. States have their sovereignty limited by the principle of equitable and reasonable utilisation and by the obligation not to cause significant transboundary harm, which demand some form of co-operation between them. The greater the extent of co-operation established between States, the more likely it is that States maximise the utilisation of their water resources while protecting the environment. International water resources law evolved in order to settle water disputes peacefully and to set the framework for co-operative alternative solutions. International law does impose on States a general obligation to co-operate with other States regarding shared water resources. But this principle, for lack of specification, is manifested through procedural obligations. These procedural rules help to ensure that in the decision-making process concerning existing and planned uses of the waters resources, the interests of other States potentially affected, are taken into account. These rules are designed to be applied before any harm has occurred and planned measures have been implemented.

The 'Procedural Law of Co-operation' has evolved significantly in the past decades. Most procedural obligations developed from recommendations and rules of scholarly associations, and gained consistency with treaty practice. But even though these obligations have been repeatedly affirmed in treaties and other international legal instruments, the status of some of these rules as general customary international law is still subject to debate. State practice indicates an increasing willingness of States to have recourse to these procedural rules in order to avoid conflict.

This paper examines some of the procedural rules relevant to international water resources and their evolution, primarily in conventional state practice, through a comparative approach. The procedural rules under scrutiny include the obligation to notify planned measures and environmental impact assessments, the provision of emergency information, the obligation to enter into consultations, and the obligation to negotiate in good faith. The relevance of the 1997 UN Watercourses Convention and some regional conventions, and the influence of the work of the World Bank, are also analysed in this paper in order to identify the main strengths and central difficulties of the procedural rules under review, as well as their significance outside the treaty regimes. Thus, the paper assesses the evolution of the obligations of notification, consultation, and negotiation in the context of transboundary water resources towards higher degrees of co-operation, notably through an integrated management approach and the establishment of joint institutional mechanisms.

1. INTRODUCTION

Sharing the waters of international water resources is inevitable. States have their sovereignty limited by the principle of equitable and reasonable utilisation and by the obligation not to cause significant transboundary harm, which demand some form of co-operation between them. These principles require the States to take into account the interests of the neighbouring riparian States, thus requiring 'some compromise of interest by all' (Lipper, 1967, p. 33). Nevertheless, States may

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develop the river basin in their territory independently. This doctrine of limited territorial sovereignty or integrity has acquired the largest support in state practice, bilateral treaties, multilateral conventions, and decisions of both domestic and international courts and tribunals. But the doctrine of 'community of interests', also known as the doctrine of common management, seems to be gaining support at the international level. This theory aims at obtaining an optimum utilisation of the waters by an integrated and joint management of the river basin in its entirety, with little regard to the political frontier demarcations (Lipper, 1967, p. 38). This is a very ambitious theory, given that it implies a high level of co-operation, mainly by requiring an institutional framework further to the procedural obligations indispensable for the implementation of the substantive principles of equitable and reasonable utilisation and of diligent prevention of significant transboundary harm.

The procedural obligations, also named as 'Procedural Law of Co-operation' (Higgins, 1993, p. 136) play a critical rôle in the implementation of the substantive principles, and in the protection of the environment of international water resources. They aim at ensuring participation of all interested States in the decision-making process concerning planned measures or new uses of the water resource, thus enabling the potentially affected States to express their concerns, to assess the effects of the proposed activities on the environment and on the territory of the other States, and to take adequate measures (Okowa, 1997, p. 277). Hence, the substantive decisions reached by each riparian State take into consideration potential transboundary harm from planned works or uses of the waters, and the interests of the States that are likely to be affected. This follows the modern approach to water resource management that requires planning for the whole water resource instead of subsequent accommodating of conflicting interests.

This paper examines some essential procedural rules relevant to the law applicable to international water resources and their evolution, primarily in conventional state practice, through a comparative approach. The procedural rules under scrutiny include the obligation to notify planned measures and environmental impact assessments, the provision of emergency information, the obligation to enter into consultations and to negotiate in good faith concerning planned measures. The general obligation to exchange data and information will not be discussed in this paper.

The relevance of the 1997 UN Convention on the Non-Navigational Uses of International Watercourses ("the 1997 UN Watercourses Convention)[189] and some regional conventions, and the influence of the work of the World Bank, are also analysed in order to identify the main strengths and central difficulties of the procedural rules under review, as well as their importance outside the treaty régimes.

[189] This Convention of universal character was adopted by General Assembly Resolution 51/229 of 21st May 1997. The Convention was opened to all States and regional economic integration organizations for signature from 21st May 1997 until 21st May 2000 at the Headquarters of the United Nations in New York. Although the Convention has 16 signatories, as of January 2003 only 12 States are Parties to the Convention (Finland, Hungary, Iraq, Jordan, Lebanon, Namibia, Netherlands, Norway, Qatar, South Africa, Sweden, and the Syrian Arab Republic). Article 36 of the Convention requires 35 States to ratify, accept, approve or accede the Convention for its entry into force. U.N. Doc. L.3/L.4ADD.1/CRP.94; 36 *ILM* (1997), 703-20.

2. THE OBLIGATION OF NOTIFICATION

The obligation to notify planned measures arises when a riparian State intends to carry out new activities on its territory on an international river or aquifer and these entail a risk of affecting other riparian States. These activities might concern the construction of a dam and a hydro-electric power plant, or a reservoir for irrigation purposes or flood control. The planning State must notify these States of the project before the proposed new works or change of previously existing use are implemented, and provide relevant technical data and information, including the results of any environmental impact assessment, relating to the activity and risks involved, as well as the potential harm to the States likely to be affected. The purpose of the notification is to allow the potentially affected States to make their own evaluation of the situation and, if need be, to initiate a period of consultations in order for the planning State to take into account the interests of the potentially affected States. This obligation also arises in emergencies, so that the potential victim States may take some measures to mitigate the harmful effects.

Both the Institute of International Law and the International Law Association contributed to the development of the rules on the notification procedure. [190] However, it was the work of the International Law Commission (ILC) for more than 20 years on the topic of the law of the non-navigational uses of international watercourses that made the most significant contribution to the codification and progressive development of international law on the notification procedure.

In this matter, the landmark case that unquestionably contributed to the development of the law is the *Lake Lanoux* arbitration[191] between France and Spain. It concerned the diversion of the waters of the Lake Lanoux to the Ariège River with full restitution still on French territory to the international River Carol. In the award of 1957, the arbitral tribunal considered the existence of procedural obligations, namely the obligations to notify, to consult and to negotiate with the potentially affected States.

The tribunal had to decide, *inter alia*, whether France had complied with the procedure laid down in Article XI of the Additional Act to the Treaties of Bayonne, of 26th May 1866, before proceeding with its project of diverting the waters of Lake Lanoux. According to this Article, France had to give prior notice of works that could change the course or the volume of a watercourse flowing into Spain, so that the interests that could be involved on both sides would be safeguarded. The tribunal held that France had complied with its obligations under Article XI by notifying Spain of its planned works, including the diversion project, by consulting with Spain prior to initiating the project, and by subsequently altering its original plan, so that the waters would reach Spain from the same point on the frontier, in order to accommodate Spanish interests. The tribunal also held that international law does not require prior consent by the notified State for the implementation of the proposed measures by the planning State.

This award was based on the terms of a treaty, but the examination of the procedural rules by the arbitral tribunal went beyond the interpretation of those

[190] For the contribution of the ILA to international water resources law, see generally Bourne, 1996; and Bogdanović, 2001.
[191] 53 *AJIL* (1959), 156; 24 ILR (1957), 101.

treaty provisions. Among other statements, the tribunal seems to suggest that there is a principle of general application according to which '[a] State wishing to do that which will affect an international watercourse cannot decide whether another State's interest will be affected; the other State is the sole judge of that and has the right to information on the proposals' (*Lake Lanoux* Arbitration, p.119). This assertion clearly points to the obligation to notify planned works, to consult and to negotiate in the context of an international water resource.

2.1. Notification Procedure In State Practice

The ILC carried out surveys of the authorities supporting the principles of prior notification and consultation.[192] The large number of treaties containing these principles illustrates the widespread practice of States willing to notify and consult other States in the case their planned conservation or new engineering works could affect other States' interest or uses of an international river. State practice is consistent and not only based on a treaty. In most instances, the duty of notification of planned measures is provided in the framework of an institutional mechanism.

The 1997 UN Watercourses Convention provides a detailed notification procedure from Articles 11 to 19[193] based on the experience of the World Bank, and to a great extent on existing conventional practice. Since this is a framework convention, some delegations at the Sixth Committee considered the notification procedure to be too detailed.[194] Yet, there was not much debate about it within the Working Group of the Sixth Committee. This notification procedure includes notification upon request (Article 18 (1), following the terms of Article 3 (7) of the 1991 Convention on Environmental Impact Assessment in a Transboundary Context; the request for the suspension of the works for a period of six months, 'unless otherwise agreed' (Article 18 (3)); and the requirement of 'timely notification' (Article 12). This term, although not precise, is intended to require notification at an early stage in the project, thus permitting meaningful consultations and, if necessary, negotiation. Some bilateral and multilateral treaties set forth specific but varied time frames for the provision of notification for different reasons. For instance, in 1926, South Africa and Portugal agreed that a written notification of planned works should be provided two years prior to the implementation of any project for the use of the waters of the Kunene River in order to allow the other State to express its intention to join the project.[195]

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[192] See McCaffrey, Third Report, *Yrbk ILC 1987*, Vol. II (Part One), 23, 28-35, paras. 60-87, and Second Report, *Yrbk ILC 1986*, vol. II (Part One), Ch. II; and Schwebel's Third Report, *Yrbk ILC 1982*, vol. II (Part One), 105-110, paras. 170-186. See also Bourne, 1972a; Bourne, 1972b; and Kirgis, 1983.

[193] For an in-depth analysis of the 1997 UN Watercourses Convention, see Tanzi and Arcari, 2001.

[194] This criticism was made mainly by upstream States, such as Turkey, Ethiopia, Czech Republic, Slovakia, Romania, and France. See UN Doc. A/C.6/51/SR.20 (1996).

[195] Article 2 of the 1926 Agreement Concerning the Use of the Waters of the Kunene River For the Purposes of Production of Water Power, Flood Control and Irrigation in the Territory Under Mandate of South West Africa.

The obligation of notification has been considered by several authors as a rule of general customary international law.[196] This means that if the rule exists in general customary international law it applies to all States irrespective of whether they are bound by a treaty.[197] General rules of procedure, as opposed to detailed rules such as the six-month period to reply to notification, may become rules of customary international law. Authors who support this contention rely heavily on treaty practice, but this seems to be inconclusive. There is in fact an extensive number of States that have been participating in this practice in a consistent manner. Yet, the assessment of the value of the large number of treaties containing procedural obligations in the process of formation of customary international law requires considerable caution.

Several arguments may be put forward. First, because of the diversity of factual situations to which customary rules would apply, it may be argued that they exist, if at all, only with regard to some regions (Berber, 1959, p. 114). However, procedural rules, by their very nature, have clear common denominator characteristics which allow them to be applied independently of a specific region. Secondly, it may be argued that the fact that this area of the law has a preponderantly conventional character is *ipso facto* contradictory to the existence of rules of customary international law (Bruhács, 1993, p. 72). This argument, however, does not stand, and that is precisely due to the diversity of river basins. Even if States believe a norm to be obligatory, the difference between basins would always require treaties which provide for specific rules to be agreed and applied between riparian States. Thirdly, the fact that so many treaties evidence a relatively consistent normative pattern may arguably demonstrate that States believe that a principle or rule is obligatory, or at least it may indicate what the international community as a whole considers to be good policy in similar situations. These consistent patterns may be a source or reflection of normative expectations also for non-parties (Kirgis, 1983, p. 19). State practice in this respect is not conclusive, since the existence of *opinio iuris* may not be presumed (Principle 25, ILA, 2000). Thus, to assert the existence of this rule as general customary international law it is essential to clearly demonstrate the belief by States that this obligation exists as a legal duty, notably outside the treaty framework (commentary to Principle 25, ILA, 2000). This includes the practice of States parties to bilateral or multilateral treaties in relation to States non-parties and the practice of States non-parties amongst themselves.

Although the World Bank policies and good practices contributed directly to the practice of States and to the development of the law by its influence in the 1997 Watercourses Convention, state practice in this regard may be taken as reflecting the conditionality of the World Bank financing policy. Also, it may be argued that States occasionally notify other States in the course of good neighbourly relations, or simply because they consider it opportune at a given time, without the conviction of this being a legal obligation.

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[196] See, e.g., Bourne, 1972, 173 and 175, who in 1972 suggested that the rule was in the process of crystallization, and in 1992 asserted that the obligations to exchange information, to notify, to consult and to negotiate form already part of customary international law, Bourne, 1992, 72. Caflisch, 1989, 167; McCaffrey, 2001, 406-7; and Tanzi and Arcari, 2001, 204 and 210.

[197] Unless the persistent objector rule applies, i.e., the State can 'exclude itself from the operation of the new rule' by manifesting its opposition to that practice before it has developed into a rule of general international law. See Mendelson, 1998, 228.

Principle 19 of the Rio Declaration on Environment and Development, for example, may arguably serve as an indication of the view of the international community as a whole on the concerned obligation. Here, the fact that this statement of principles was approved by consensus, indicates their emerging legal significance (Birnie and Boyle, 2002, p. 105). But, as with many other international instruments, the weight of this declaration is limited as it does not have binding force.[198]

More significant is the work of the ILC for over 20 years on the topic of the law of the non-navigational uses of international watercourses. Procedural rules were drafted by different special rapporteurs in several reports and later on discussed in the Sixth Committee. Some weight may be given to the fact that procedural rules were not controversial during the negotiation of the Convention and that they were adopted with the opposition of only three upstream riparians.[199] The Convention was finally approved by the General Assembly in 1997.[200]

It is of considerable importance the fact that while the ILC was working on the draft rules, they were already influencing state practice. One example is the 1992 Helsinki Convention. This regional framework Convention subsequently led to the conclusion of particular treaties in Europe.

The 1997 UN Watercourses Convention is not yet in force. This fact may be seen to limit the weight that could be given to the argument that the Convention assisted in the crystallization of the emerging procedural rules into rules of general customary international law, since only 12 States have yet ratified the Convention.[201] However, this may be explained by the fact that other key articles, such as those on the settlement of disputes, were very controversial, and not due to any rejection of the rules in question. Moreover, the influence of the Convention on subsequent treaties is evident.[202] Some States have expressly recognised that the principles and rules embodied in the Convention reflect international law.[203]

The representativeness of the state practice also raises some questions. Some key regional States, such as Turkey, China and Brazil - upstream States of large international river basins - might challenge the legal status of the obligation of prior notification. The conduct of these States seems to indicate that they do not accept this obligation. It is arguable that in the face of opposition by a State whose interests are specially affected, a rule may not mature into a rule of general customary international law.[204] In the alternative, the rule of the persistent objector

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[198] See also Article 3 of the Charter of Economic Rights and Duties of States, proclaimed in UNGA Resolution 3281 (XXIX), UN Doc. A/9631 (1974). This article was not adopted by consensus, but by a majority of 97 States.

[199] Ethiopia, Rwanda, and Turkey. McCaffrey attributes considerable weight to this fact. McCaffrey, 2001, 406.

[200] China, Burundi, and Turkey were the only three States voting against the adoption of the 1997 UN Watercourses Convention.

[201] As of January 2003. See commentary to Principle 26, ILA, 2000, 49-50.

[202] For example, on the 2000 SADC Revised Protocol, or the 1995 Mekong River Agreement.

[203] E.g., para. 4 of the Preamble of the Incomaputo Tripartite Interim Agreement between the Republic of Mozambique and the Republic of South Africa and the Kingdom of Swaziland for Co-operation on the Protection and Sustainable Utilisation of the Water Resources of the Incomati and Maputo Watercourses, signed at Johannesburg on 29th August 2002.

[204] See commentary to Principle 14, ILA, 2000, 23-26.

might be invoked,[205] since these States have rejected this rule in their practice. The reason for their position seems to be the fact that they have been involved in disputes with their downstream neighbours after having taken unilateral action. This argument requires careful analysis of these States' practice as to consistency while the rule of international custom was being formed.
Considering the existing evidence, and the fact that this area of the law is still evolving, it is difficult to determine whether a rule of *general* customary international law has emerged. However, it is possible that a rule of *particular* customary law has matured and is thus binding on the States accepting it. In any event, there is little doubt that if a dispute is referred to international adjudication or arbitration, the court or tribunal, in line with the *dicta* of *Lake Lanoux*'s award and the International Court of Justice's decision in the *Case concerning the Gabcíkovo-Nagymaros Project*,[206] will consider the rule of prior notification to be part of the *corpus* of general customary international law.

In the international law of the environment, general rules of prior notification and consultation in cases of environmental risk are arguably rules of general customary international law (Birnie and Boyle, 2002, p. 126-9).[207] This being the case, and considering the nature of *lex specialis* of the law of international watercourses, these customary rules may be applied in the field of shared water resources.

2.2. The Impact Of World Bank Policies

The World Bank, as an international financial institution, has since its inception been financing projects on international watercourses, which enables it to impose conditions on the very procedures for the projects' implementation. Over the years, the importance of the role of the World Bank in enhancing co-operation amongst States[208] and compliance with its procedural applications has increased. This may be evidenced by the wording used in the revised Word Bank Operational Policies on Projects on International Waterways[209] where the Bank urges States to 'negotiate in good faith with other riparians to reach appropriate agreements or arrangements' and offers its assistance for this purpose.

The World Bank developed policies which required the application of notification procedures in the absence of agreement on the matter. These policies are more demanding than that of the 1997 UN Watercourses Convention, since they require the notification to *all* riparian States, both upstream and downstream, for *all* the proposed projects, notably the construction of new dams or irrigation projects, whether these may have significant adverse effects or not. According to these policies, notification has to provide sufficient project details in order to enable the other riparian States to determine within a reasonable period of time whether the proposed project may cause appreciable harm.

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[205] See n. 10 above and commentary to Principle 15, ILA, 2000, 27-29.
[206] (Hungary *v.* Slovakia) ICJ Reports (1997) 7, and 37 *ILM* (1997) 162.
[207] For a contrary view, see Okowa (1997).
[208] This may be illustrated by the World Bank assistance with good offices in the conclusion of the 1960 Indus Waters Treaty, or presently the assistance in the development of the Nile Basin Initiative. See Pitman, 1998, 155-165; and Salman, 2003.
[209] The 1994 Word Bank Operational Manual on Projects on International Waterways: Operational Policies – (OP 7.50); Bank Procedures (BP 7.50); and Good Practices (GP 7.50), reprinted in Salman and Chazournes, 1998, 193-201.

The experience of the World Bank also contributed directly to Article 30 of the 1997 UN Watercourses Convention concerning indirect procedures. This Article applies in cases where there are 'serious obstacles to direct contacts between States', e.g. where parties do not have diplomatic relations or are in armed conflict. In these cases, if the planning State indicates to the Bank that it does not wish to give notification, the Bank will itself do so.[210] Similarly, in the Convention, States have the obligation to fulfil the obligation to co-operate through any indirect procedure, that is, through third States, usually those protecting their interests under the procedures set out in Articles 45 and 46 of the 1961 Vienna Convention on Diplomatic Relations, or peace commissions, or the good offices of an international organisation (ILC Report, 1994, p. 132). But the World Bank policy goes even further: if the beneficiary State also objects to the Bank's notifying other States, the World Bank will discontinue processing the project, thus making clear that notification of the project is a *sine qua non* condition of the Bank's involvement in the project on international waterways.

As with several other international instruments, the Report of the World Commission on Dams (WCD)[211] - an *ad hoc* independent body established in 1998 by different interest groups, such as the World Conservation Union and the World Bank - evidences the wide influence of the World Bank procedures. The WCD conducted the most comprehensive and independent review of the experience with large dams to date, and presents a new framework for decision-making based on recognising rights and assessing risks of all interested parties.

In its Report, the WCD recognises the obligation to notify other riparian States of planned measures that may have significant effect on them. The Commission recommends the adoption by States of a notification procedure for the building of dams which is more sophisticated than that established in the 1997 UN Watercourses Convention, and which follows more or less closely the procedure set forth in the 1991 Convention on Environmental Impact Assessment in a Transboundary Context ("the 1991 Espoo Convention"). First, as with the notification procedure set forth in this last Convention, it provides for a notification procedure in two stages, thus increasing the communication between the States; and secondly, it recommends that dams should not be built in cases where riparian States raise an objection that is upheld by an independent panel. The Report, which is not a legally binding document, offers guidelines for the future. However, the work of the WCD has not gone as far as ascertaining whether these or other notification procedures have been followed in practice. In contrast to its work carried out in other areas, the WCD failed here to present recommendations based on empirical data (Salman, 2001, p. 1500).[212]

3. THE NOTIFICATION OF ENVIRONMENTAL IMPACT ASSESSMENTS

Since the 19th century, several treaties have included the obligation to carry out studies of possible effects prior to the implementation of a project on an international watercourse. In modern treaties, this obligation seems to have

[210] OP 7.50, para 4, at 194 and BP 7.50 para. 2, at 197.
[211] WCD, *Dams and Development: a New Framework for Decision-Making.* The Report of the World Commission on Dams, 2000. Also at http://www.dams.org/report/.
[212] For an analysis and criticism of the Report, see Salman, 2001.

focused on the requirement of States to conduct environmental impact assessments (EIA). These consist of preliminary viability studies of projects that also evaluate the effects of the proposed activities on the environment of the planning State and of other potentially affected States. Although they aim at ensuring that the environmental effects are taken into account at an early stage in the decision-making process at the domestic level, they also seem to foster the participation of the other basin States in implementing the substantive principles of equitable utilisation in the use, development and protection of the watercourse, and the exercise of due diligence in preventing any harm thereto (Tanzi and Arcari, 2001, p. 205). This is because the potentially affected State, once notified of the study, may participate in the procedure itself or enter into consultations or negotiations with a view to reaching a satisfactory resolution of the situation.

The obligation to conduct an EIA, although expressly provided for in numerous international legal instruments,[213] and well-established in domestic law, has not yet attained the status of a rule of general customary international law, that is, it is not binding on all States (Okowa, 1997, p. 281).[214] Still, it has been argued that when there is a conventional obligation to notify other States of planned activities that may entail a risk of causing transboundary harm, the obligation to carry out EIA may be taken to be implied (Okowa, 1997, p. 279). Although the 1997 UN Watercourses Convention does not expressly impose any obligation of conducting EIA, Article 12 concerning notification of planned measures with possible adverse effects provides that the notification has to be accompanied by available technical data and information 'including the results of *any* environmental impact assessment'. It may literally be construed as meaning that States are only obliged to provide the result of any EIA if these are conducted. Nevertheless, logic suggests, as well as the examination of Article 12 in conjunction with other provisions, that even when such assessments are not explicitly provided for, the discharge of other duties imposed on States, such as the due diligence obligation of prevention of causing significant transboundary harm, would usually require some preliminary assessments. Thus, environmental impact assessment may be deemed one of the 'all appropriate measures' required to be taken by States according to Article 7 on the obligations of States not to cause significant harm. In fact, in conducting an EIA, the planning State is transferring the burden of proof to the affected State. In addition, these assessments are fundamental instruments if the notified State considers that the implementation of the planned measures would result in an inequitable or harmful utilisation of the watercourse, and Article 17 on consultations come into play. That is, 'meaningful consultations can only take place if the precise nature and effects of the proposed activity have been investigated' (Okowa, 1997, p. 280).

Since the 1997 UN Watercourses Convention is the result of a compromise between the frequently conflicting interests of upstream and downstream riparian States, it

[213] Both treaties on particular rivers, such as the 1994 Convention on Co-operation for the Protection and Sustainable Use of the Danube River, Article 7 (5)(f), which follows the terms of the 1991 Espoo Convention, and other general instruments, such as Principle 17 of the Rio Declaration, 31 *ILM* (1992) 874, 879, or Agenda 21, para. 18.40 (h., iv), or the Principles of the UNEP Guidelines on Goals and Principles of Environmental Impact Assessment, UNEP Resolution GC14/25 (1987).

[214] Birnie and Boyle argue that this obligation already exists under general international law in cases of transboundary risk to the environment of the States or to the marine environment. See Birnie and Boyle, 2002, 132.

is not surprising that it falls short of establishing a clear obligation on States to conduct what is now well recognised in the international community as an essential procedural obligation.[215] In line with the 1997 UN Watercourses Convention, the International Court of Justice also recognised the importance of the conduct of EIA, as well as of subsequent monitoring, in the *Case concerning the Gabcíkovo-Nagymaros Project* (p. 7, para. 112), but it has not expressly referred to an obligation.[216]

At the European level, existing bilateral or multilateral treaties on particular rivers follow the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes,[217] or the 1991 Convention on EIA in a Transboundary Context[218] in this matter (Bosnjakovic, 1998). This framework Convention sets standards for transboundary environmental impact assessment. It sets forth the obligations of the Parties to assess the environmental impact of certain activities at an early stage of planning. The Convention provides for the obligation to notify other parties of any proposed activity that is likely to have a significant adverse transboundary impact (Article 3 (1)). This is required to be carried out as early as possible in order to ensure adequate and effective consultations. It goes on to specify the procedure of notification, which takes place before the conduct of the environmental impact assessment to allow the potentially affected State to participate in the process, notably through the exchange of relevant information. The Parties to the Convention further agreed in great detail on the format for notification under Article 3. This includes specific information requirements and the form of the notification. The main difference regarding the procedure set forth in the 1997 Watercourses Convention is that it allows potentially affected States to participate in the EIA process itself. In addition, the time frame is left for the parties to determine.
In Africa, treaties regarding international watercourses have also began to expand the nature of these national instruments by adopting these procedures in their treaty régimes.[219]

4. THE OBLIGATION TO NOTIFY IN EMERGENCY SITUATIONS

In the context of international water resources, as in other fields related to the environment, it is now generally accepted that States are under an obligation to notify other potentially affected States in emergencies that may cause significant transboundary harm. These emergencies may result from natural causes, such as floods, or from human conduct, such as industrial accidents, or from both. The

[215] Strong evidence of this contention is Principle 17 of the Rio Declaration. See Birnie and Boyle, 2002, 131.
[216] However, see Judge Weeramantry diss. op. in *Request for an Examination of the Situation in Accordance with the Court's Judgment in the Nuclear Tests Case*, ICJ Reports (1995), 288, where he asserts the existence of this obligation.
[217] See Article 3 (1)(h) and Article 9 (2)(j). This regional convention was adopted by the Senior Advisers to the Governments on Environmental and Water Problems of Economic Commission for Europe (hereinafter 'the 1992 Helsinki Convention').
[218] This framework Convention is the most comprehensive convention on the matter. See Articles 2 (1) and 3 (1).
[219] E.g., the 1987 Agreement on the Action Plan for the Environmentally Sound Management of the Common Zambezi River System.

objective of the prompt notification is to enable all potentially affected States effectively to prevent or minimise the harmful effects on human life, property and the environment, by taking all necessary measures.

This obligation is well established in treaty practice. From as early as 1948, States, in different regions, have included this obligation in numerous bilateral and multilateral treaties related to watercourses.[220] In addition, the Institute of International Law contributed to the development of the rule by setting forth the obligation in relation to a 'sudden increase in the level of transboundary pollution in the basin'.[221]

More recently and at the regional level, the 1992 Helsinki Convention goes beyond the usual notification requirement and provides for the obligation of States to set up 'where appropriate' warning and alarm systems, thus calling for co-operation between States at a stage where prevention may still be possible.

The 1997 UN Watercourses Convention also sets forth in Article 28 the obligation of notification in emergency situations. But, more importantly, the Convention also imposes a duty of action: in Article 28 (3) it lays down a duty to 'immediately take all practicable measures necessitated by the circumstances' to prevent, mitigate or eliminate harmful effects. Since the Convention's adoption, several new treaties followed its provisions in this regard, more or less closely, such as the 1995 Mekong River Agreement (Article 10).

There is enough support in state practice and case law to affirm with conviction the existence of a general customary obligation to notify in emergencies, which also applies to international watercourses. This is also sustained in the literature.[222] This obligation is recognised in treaty regimes for some decades. After the Chernobyl nuclear power plant accident in 1986 and the claim by several States of a breach of the right to be notified, the Convention on Early Notification of a Nuclear Accident was adopted on 26th September 1986 by 70 States, and entered into force one month later.[223] The promptness of the adoption of this Convention as well as the large number of signatories demonstrates, at minimum, the will of States to be bound by such an obligation. The inclusion of this obligation in the 1997 UN Watercourses Convention without opposition suggests the existence of this obligation in the context of international watercourses.

In the *Corfu Channel* case,[224] the International Court of Justice, although in a different context, also referred to an obligation to give warning to other States in case they become exposed to known dangers. This was reaffirmed in the *Nicaragua* case.[225]

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[220] For example, Article IV (8) *in fine* of the 1960 Indus Waters Treaty, and Article 16 of the 1994 Convention on Co-operation for the Protection and Sustainable Use of the Danube River.

[221] Article VII (c) of the 1979 Athens Resolution on Pollution of Rivers and Lakes and International Law.

[222] See, for example, Special Rapporteur McCaffrey's Fifth Report, *Yrbk ILC 1989*, vol. II (Part One), 91, at 113; Okowa, 1997, 330-332; or Birnie and Boyle, 2002, 322-3.

[223] There are now 86 States Parties to the Convention.

[224] UK *v.* Albania (Merits), ICJ Reports (1949) 4, 22.

[225] Nicaragua *v.* USA (Merits), ICJ Reports (1986) 14, 112.

5. THE OBLIGATION TO ENTER INTO CONSULTATIONS AND TO NEGOTIATE IN GOOD FAITH

5.1. The Obligation To Enter Into Consultations In State Practice

Consultation is a procedural mechanism used to prevent disputes - a form of negotiation - whereby potentially or actually affected States manifest their position and contribute to the decision-making process concerning existing or planned uses of the waters of shared water resources and the protection and preservation of their ecosystem. And although prior consultation does not always resolve differences, 'a considerable body of knowledgeable opinion supports the presumption that, despite its deficiencies, in a variety of cases prior consultation is worth the time, effort, and expense' (Kirgis, 1983, p. 6, n. 14).

In the *Lake Lanoux* arbitration, the tribunal explained what it considered consultation and negotiation entailed: 'according to the rules of good faith, the upstream State[226] is under the obligation to take into consideration the various interests involved, to seek to give them every satisfaction compatible with the pursuit of its own interests, and to show that in this regard it is genuinely concerned to reconcile the interests of the other riparian State with its own' (p. 139). But the tribunal also recognises that '[it] is a delicate matter to establish whether such an obligation has been complied with'.

Consultation may take place after notification of planned measures or upon request of any riparian State. It is an opportunity for both interested States to discuss the potential impact of the actual or proposed uses of the waters, and to prevent, mitigate or eliminate their potential or actual adverse effects. However, the potentially affected State has no right of veto (*Lake Lanoux* arbitration, p. 130). The danger here is that while consent is not given, the planning State may not proceed with the implementation of the project for an indefinite period of time. But once the views of the potentially affected States are put forward, the planning State may not ignore these views. The reverse is also valid, that is, if a notified State does not reply to notification and does not enter into consultations, there is a presumption that it has acquiesced.

Although general international law appears not to require prior consent, a number of treaties do include it. This may, in fact, be a useful tool to prevent conflicts in cases where water is scarce and its allocation is disputed (Sohnle, 2002).[227]

The 1997 UN Watercourses Convention provides for consultations in a number of different contexts.[228] The duty under consideration applies to both actual and planned uses. Article 11 lays down the general obligation of exchange of information and consultation on the possible effects of planned measures on the condition of the watercourse. But the Convention goes on to specify that in the notification procedure, should the notified State object to the planned measure on

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[226] The reference to the upstream case derives from the circumstances of the case in question. The obligation in fact exists for both the upstream and the downstream States.

[227] See, for example, Annex II, Article V (1) of the 1994 Treaty of Peace between Israel and Jordan, which provides that 'artificial changes in or of the course of the Jordan and Yarmouk Rivers can only be made by mutual agreement'.

[228] See e.g., Article 6 (2) and Article 24 (1) and (3).

the grounds of inequitable and unreasonable use, or if the States concerned disagree as to whether notification of the proposed project was due, States have an obligation to enter into consultations and to negotiate. The notifying State, at the request of the notified State, has to suspend the implementation of the project for a period of six months. If after this period of time, the parties have not arrived at an equitable resolution of the situation, the parties may then resort to third party dispute resolution in accordance with Article 33.

Article 17 (2) provides that States must act in good faith during consultations and negotiations. This is in line with the decisions in the *Lake Lanoux* arbitration, the *Fisheries Jurisdiction* case (ICJ Rep. (1974), 3), and the *North Sea Continental Shelf* cases (ICJ Rep. (1969) 3, 46-47). In the *Lake Lanoux* arbitration, the tribunal went further to provide examples of conduct of States in the course of consultations and negotiations which it considered unacceptable. These include 'an unjustified breaking off of the discussions, abnormal delays, disregard of the agreed procedures, systematic refusals to take into consideration adverse proposals or interests, and, more generally, violation of the rules of good faith.' (p. 128, para. 11)

The obligation to consult other States is well established in treaty regimes, thus providing evidence that States recognise the importance of consultations as a means of preventing disputes. There is some evidence in state practice[229] in support of the proposition that the rule of prior consultation is part of general international law with a 'clear common denominator – consultation with interested states is required before activities are undertaken that could reasonably be expected to cause a change in the watercourse appreciably damaging their interests' (Kirgis, 1983, p. 86). This has also been the opinion of other authors (e.g., Bourne, 1972b, p. 193), and scholarly associations.[230] As with notification, this rule is based not only on treaty practice but also on state practice outside the treaty framework. There are some cases of state practice of consultations in different regions where there has been no agreement between the States regulating their uses of the waters of the shared river basin. In some cases, notification and consultations have taken place after protests made by potentially affected States. In these cases, States entered into consultations which eventually have led to agreements.[231]

5.2. Consultation And Its Correlation With The Obligation To Negotiate

The negotiation process 'viewed as a whole is the principal vehicle for co-operation between states' (Rogoff, 1994, p. 183).[232] Consultation may be considered 'a

[229] For example, the case of the Aswan High Dam project is considered 'normatively significant and tends to support a rule of consultation, at least before final action is taken' (Kirgis, 1983, 44). After the United Arab Republic decided to build the Aswan High dam, Sudan claimed its right to be notified and consulted in a timely fashion. This led to negotiations, which culminated in the conclusion of the 1959 Nile Treaty before the actual building of the dam.

[230] See, e.g., comment to Article 8 of the ILA's 1982 Montreal Rules of International Law Applicable to Transfrontier Pollution.

[231] This is the case of the protest made by Sudan to Egypt concerning the Aswan High Dam that eventually led to the 1959 Nile Waters Agreement.

[232] Some authors consider all other procedural obligations as elements of an overall obligation to negotiate in good faith. See, e.g., Sohnle, 2002, Ch. 7, s. II D).

preliminary stage to a negotiation but differs from the latter when the country which initiates the consultation is merely seeking the opinion of the country(ies) concerned by the proposed activities or measures'.[233] On the other hand, the obligation to negotiate *stricto sensu*, that is, the obligation to negotiate in good faith in order to reach an agreement, is the link between other procedural rules and the mechanisms for the settlement of disputes. Once a dispute arises, it follows consultation as a logical sequence in procedure and as the preliminary stage of the process for its settlement. The terms are often used interchangeably and may even have the same legal effects. The main difference is that the existence of a dispute is not an essential condition for the consultation process, as it is for the negotiation process (Fombad, 1989, p. 709).

The 1997 UN Watercourses Convention makes a distinction between consultations and negotiations. Of particular relevance is the reference in Article 17 concerning planned measures to the obligation to enter into consultations and, 'if necessary, negotiations with a view to arriving at an equitable resolution of the situation'. This article comes to play when the notified State objects to the proposed works or uses. The wording in the article seems to imply that in certain cases agreement should be sought. Therefore, there is a need for evidence of the parties' willingness to reach a compromise. Examples of this 'equitable resolution' include modification of the original project in order to eliminate potential adverse effects, adjustment of the uses by either State, or the payment of some form of compensation acceptable to the notified State by the planning State.

In multilateral conventions on international rivers, the general obligation to negotiate is usually established as a *pactum de negotiando*, since it imposes on States an obligation to negotiate in order to reach an agreement,[234] as opposed to a *pactum de contrahendo*, i.e., an obligation to conclude a definite substantive agreement. An obligation to negotiate does not imply that the conduct would be unlawful merely because negotiations fail to produce an agreement (Kirgis, 62, 14). This was recognised by the Permanent Court of International Justice in the *Case of Railway Traffic between Lithuania and Poland*.[235] The Court clearly stated that 'an obligation to negotiate does not imply an obligation to reach an agreement'. The effective conclusion of the agreement is not imposed since the obligation is one of conduct, not of result. On this score, the obligation to enter into consultations 'with a view to negotiating in good faith' for the purpose of concluding an agreement is enshrined in Article 3 (5) of the 1997 UN Watercourses Convention, and may be triggered by a single watercourse State when it considers that the provisions of the Convention need to be adjusted to a particular watercourse.[236]

6. CONCLUDING REMARKS: EVOLUTION AND CONSOLIDATION

International law imposes on States a general obligation to co-operate with co-riparians regarding shared water resources. But this principle, for lack of specification, is manifested through procedural obligations. These procedural rules

[233] OECD Doc. ENV (79) 23, at 6 (1979) referred to by Kirgis, 1983, 12, n. 27.
[234] E.g., Article 4 of the 1923 Convention relating to the development of hydraulic power affecting more than one State. See also *Lake Lanoux* arbitration, p. 130.
[235] PCIJ, Series A/B, No. 42, 116, 1931-1932, Case No. 215.
[236] See also Articles 2 (6) and 9 of the 1992 Helsinki Convention.

evolved significantly in the past decades. Most of them developed from recommendations and rules of scholarly associations, and gained consistency with treaty practice. These obligations have been repeatedly affirmed in treaties and other international legal instruments, thus indicating an increasing willingness of States to have recourse to these procedural rules in order to avoid conflict.

The obligation of prior notice, qualified for the situations where the proposed measures may cause significant harm, has evolved in state practice, also due to the impact provoked by the World Bank policies and good practices. This is particularly evident in the notification procedure, and it reveals that international organisations may contribute significantly to the development of international law.

The obligations to enter into consultations and to negotiate in good faith concerning planned measures which may cause significant adverse effect have also evolved, almost *pari passu*. But even though the procedural obligations have been repeatedly affirmed in treaties and other international legal instruments, the status of some of these rules as general customary international law is still subject to debate.

As framework conventions, both the 1992 Helsinki Convention and the 1997 UN Watercourses Convention play an important role in providing a set of procedural rules.[237] Although not yet in force, the importance of the 1997 UN Watercourses Convention should not be underestimated. Of universal framework character, the Convention has undoubtedly influenced subsequent regional treaties, such as the 2000 Revised Protocol on Shared Watercourse Systems in the Southern African Development Community (SADC) Revised Protocol, as well as particular bilateral and multilateral treaties from different regions, such as the 2002 Incomaputo Tripartite Interim Agreement between Mozambique, South Africa, and Swaziland, the 1995 Mekong River Agreement, or the 1998 Treaty between Portugal and Spain on the Co-operation for the Protection and Sustainable Use of the Waters of the Luso-Spanish River Basins. These follow the 1997 UN Watercourses Convention in their general terms, and occasionally even *ipsis verbis*. Even if arguably some of the provisions of the Convention do not yet reflect customary international law rules, they undoubtedly serve as an authoritative policy guideline (Tanzi, 2000, p. 54).

The specific procedural duties may vary in each case as regards implementation, depending to a great extent on the mechanisms established between the parties in bilateral or multilateral treaties. From the examination of state practice, recommendations of conferences and resolutions of scholarly associations, and the studies of experts, it is possible to conclude that the obligation to co-operate concerning international watercourses and its applications is better fulfilled through joint institutional mechanisms, since these are the most effective vehicles of ongoing communication between the States. However, at present, international law still falls short of requiring their establishment.[238] Water treaties continuously create these institutions, and their number continues to increase. In addition, recent treaties demonstrate a trend towards the conclusion of more comprehensive agreements between riparian States. The increasing number of treaties shifting the

[237] On the importance of UNECE Conventions in the pan-European context and beyond, see Bosnjakovic, 2001, 263-282.
[238] See ILC, 1994, 125, para. 2. Contrary to the 1992 Helsinki Convention, the 1997 UN Watercourses Convention does not provide for compulsory institutional co-operation.

focus from the allocation of waters to sharing the benefits reveals the will of States to attain the optimal utilisation of the international water resources amongst riparian States.

International law evolved in order to set the framework for co-operative alternative solutions and to settle water disputes peacefully. High levels of co-operation, however, ultimately depend on the political will of Governments.

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SOME CONCEPTUAL ASPECTS OF WATER QUALITY VALUATION

A. Parparov[239], L. Hakanson [240,] A. Ostapenia[241]

1. INTRODUCTION

Policy documents of the European Union, such as the 2000 Water Framework Directive (WFD), charge Union members with implementing a set of management measures to achieve "good" status for their national freshwater bodies by 2015, and to introduce basic principles to ensure the sustainable management of water resources. The terms "good," "sustainable," and "management" require correct (in other words, quantitative) definition of basic concepts of management. The quantitative estimation (valuation) of water quality (WQ) and its relationships with the activities affecting WQ should be one of the first steps in water resources management.

The following principal stages must be gone through to incorporate WQ valuation within the framework of water resources management:

- The quantitative correspondence R = f(WQI) between values of the selected set of water quality indices (WQI), and some numerical value of $0<R<100$, should be established. The established dependence allows assessment of the permissible ranges of WQI (for the separate uses). Depending on the tasks to be resolved, WQ could be valued at different levels of integration:
  - *An expanded system of WQI*, suitable for describing different aspects of water resources use; this must serve as a "common language" for communication between separate partners in management.
  - *A reduced system of WQI* should represent a set of target variables for the mathematical modeling.
  - *Characterization of WQ by a single number:* this highest level of integration in estimating WQ should be suitable for communication with policy makers to ensure optimization of management.
- The most recent step taken in the quantification of water resources management is the suggestion that economic activities that could be considered as requiring management measures should be ranked according to their *potential ecological risk* (the PER approach: Hakanson, 1999), as well as water quality and different environmental threats. The PER of such a management measure is estimated as a product of the numerically expressed values of the ecological effect (E) of such a measure, its areal distribution (A), and time duration (T): $PER = E \cdot A \cdot T$.
- A logical continuation of the progress achieved in the quantification of water quality should be the establishment of the correspondence between the intensity of a managing measure (MM) and the water quality changes caused by this measure or measures; in other words $WQI = \Phi(MM)$. The best perspective for establishing the functional dependencies between WQI and MM is given by ecologic modeling, interconnected by means of information

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feedback with management and limnological institutions and therefore forming a self-organizing tool for water resources management. The revealed dependencies allow establishment of a correspondence between permissible ranges for WQI and permissible ranges for the management measures:

$\{WQI_{LOW}<WQI<WQI_{HIGH}\}\Leftrightarrow\{MM_{LOW}<MM<MM_{HIGH}\}$

The last expression could be considered as an operational definition of "sustainable management."

- Realization of these stages should allow a direct connection between the quantitative estimates of water quality (as *rating value*, R) and the intensity of the managing measures (MM): R = F(MM). This relationship should be given high priority in communication with water policy makers and with specialists in environmental economy.

The concept outlined above was applied in practice in 1997–2002 to evaluating water quality and estimating the permissible ranges of selected managing measures in the following lakes:

- *Lake Kinneret (Israel)*, the largest freshwater body of the Middle East. Controlling the lowering of the water level caused by over-withdrawal of water was taken as a major managing measure
- The system of interconnected *Naroch Lakes (Belarus)*. The oligotrophication of these lakes was associated with a decrease in economic activity on their watershed.

These practical tests were used to demonstrate the creation of a common platform for different water users and a powerful tool for water resources management.

As mentioned in the introduction, policy documents of the European Union, such as the 2000 Water Framework Directive (WFD, 2000), charge Union members with implementing a set of management measures to achieve "good" status for their national freshwater bodies by 2015, and to introduce basic principles to ensure sustainable management of water resources. The terms used require correct, quantitative definition of basic concepts of management, of the environmental steady state that should be sustained, and of the ecological and socioeconomic effects of the management actions. Solution of this challenging scientific problem should form an important stage in developing the scientific background of water resources management.

The consequences of the steps needed for this kind of management have already been outlined (Ryding and Rast, 1989; Chapman, 1992; Hakanson and Peters, 1995; Parparov and Hambright, 1996). Recent studies carried out in Lake Kinneret and the Belarus Lakes (Hakanson et al., 2000) have further improved our understanding of the problem. In this article we consider the aspects of water resources management associated with the quantification of water quality (WQ).

The methodological basis for WQ quantification was described many years ago (Horton, 1965; Brown et al., 1970; Ott, 1978; Smith, 1987; 1990). Practical implementation of these concepts was mostly concentrated in the United States. Examples of quantitative estimation of lake water quality in Europe have been relatively rare, and in many cases a trophic classification has been used: in other words, oligotrophic lakes are considered to have "good" water quality, while eutrophic lakes are classified as "bad" (see, for instance, Fozzard et al., 1999). We have suggested the following principles for WQ assessment (Parparov and Hambright, 1996; Hambright et al., 2000*)*:

- The system of water quality indices (WQI) and their acceptable ranges must be decided upon and quantified by an expert panel consisting of all partners in lake management: water suppliers and users, limnologists, fishing communities, and fish farmers.
- The WQIs and the processes driving them must be suitable for mathematical modeling.
- The WQIs and the model together should serve as a self-organizing tool for lake management.
- The WQI must be dynamic and adaptable to changes in ecosystem function.

This approach was used to establish a preliminary system of water quality indices for the conservation of Lake Kinneret and the interconnected Naroch Lakes in Belarus (Hakanson et al., 2000).

2. BRIEF DESCRIPTION OF THE LAKES STUDIED

2.1. Naroch Lakes (Belarus)

The system of interconnected Naroch Lakes includes Lakes Batorino, Miastro, and Naroch, and is located in the northwest part of Belarus in a glacial landscape (Figure 1). The limnology of the Naroch Lakes has been intensely studied (Winberg, 1985). The shallow Lake Batorino, the initial lake in the system, is connected by a narrow channel with Lake Miastro, which is connected in turn with Lake Naroch, the largest water body of Belarus. More than half of the eutrophicating and polluting substances that enter with surface inflow are trapped within Lakes Batorino and Miastro. Therefore, WQ in Lake Naroch is relatively higher in terms of its main uses than in Lakes Batorino and Miastro. Lake Naroch has significant aesthetic and recreational potential.

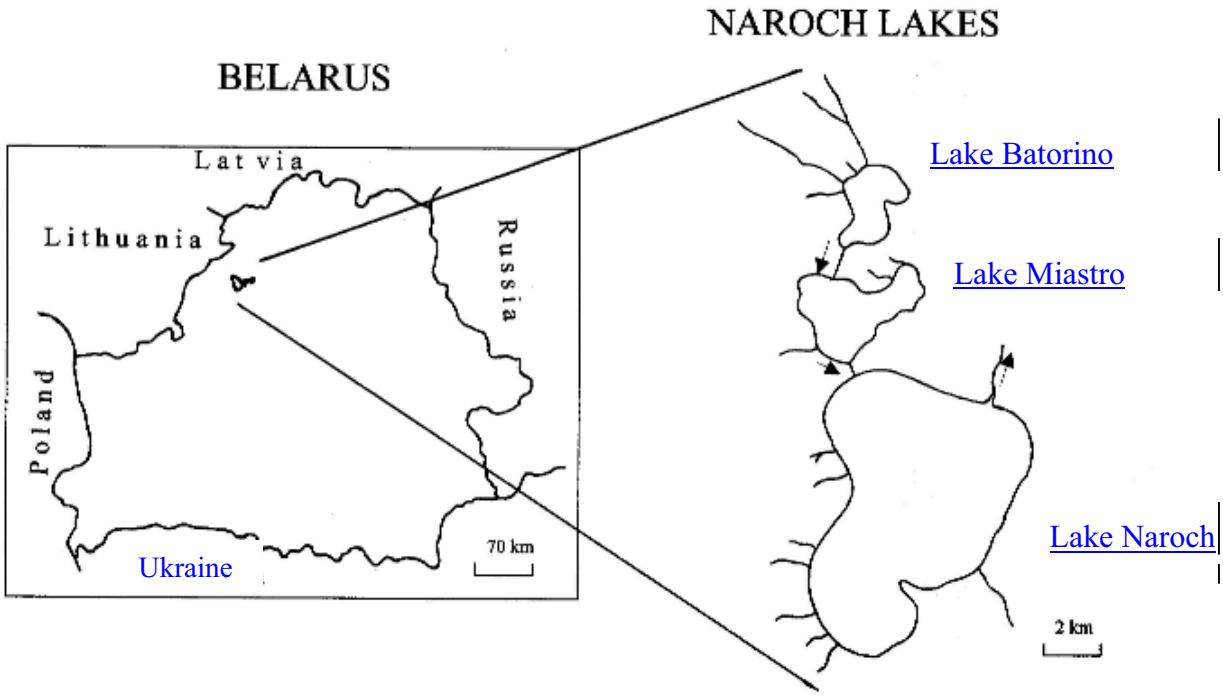


Figure 1: **The Naroch Lakes and their location in Belarus**

Until the mid-1980s, Lake Batorino was classified as a highly eutrophic lake, Lake Miastro as eutrophic, and Lake Naroch as mesotrophic. During the 1990s, however, the trophic state of the Naroch lakes has been significantly altered (Table 1).

The main factors responsible for oligotrophication of the Naroch Lakes are as follows:

- decrease in the external nutrient load, due to slowing down of overall economic activity and remedial measures taken in the catchment area
- in-lake processes triggered by introduction of the mollusc-infiltrator *Dreissena polymorpha.*

The Naroch Lakes represent a unique natural system, and therefore conservation of this ecosystem has been recognized as a principal objective of managing the use of their water resources. The most important use is recreational; fishery (both commercial and amateur) is also significant, although less important.

For the purposes of this study, the external phosphorus loading (P-load) was considered as a key factor affecting the lakes' ecosystem dynamics.

Table 1: **Limnological indices of the Naroch Lakes in 1977–88 (I) and in 1989–99 (II) (avg ±std for ice-free season)**

INDICES	Naroch		*MIASTRO*		*BATORINO*	
	I	*II*	*I*	*II*	*I*	*II*
S, m	5.10	6.10	1.70	3.80	0.78	1.10
TSS, mg L^{-1}	1.81	0.96	6.20	2.29	16.70	9.20
BOD_5, mgO_2 L^{-1}	1.06	1.03	2.05	1.39	3.55	2.63
C_{tot}, mg L^{-1}	5.36	5.23	8.76	7.99	14.60	13.00
N_{tot}, mg L^{-1}	0.87	0.58	1.14	0.70	1.62	0.94
P_{tot}, μg L^{-1}	28.00	16.00	52.00	34.00	84.00	44.00
Chl, μg L^{-1}	4.90	2.00	20.00	4.90	50.10	11.40

S – secchi depth*, TSS* – total suspended solids*;* C_{tot} – total carbon*;* N_{tot} – total nitrogen*;*
P_{tot} – total phosphorus*; Chl* – chlorophyll concentration

Source: Ostapenya, 1999.

2.2. Lake Kinneret (Israel)

Lake Kinneret (the Biblical Sea of Galilee), the largest freshwater body of the Middle East, is a subtropical eutrophic lake located at about 210 m below mean sea level in the northern part of the Afro-Syrian Rift Valley (Figure 2). The limnology of the lake is well documented (Serruya, 1978). The main inflow (about 80 percent of the total) comes through the River Jordan. The water level of the lake depends on climatic inputs and levels of withdrawal for water supply (Serruya, 1978; Shamir et al., 1985).

Since 1965, Lake Kinneret has been the primary storage reservoir for the National Water Carrier of Israel (NWC). With the economic and population growth seen in Israel since then, the main uses of Lake Kinneret's waters have been for domestic (drinking water) supply and irrigation. As in the case of the Naroch Lakes, sustaining Lake Kinneret's ecosystem should be the primary management

objective. Owing to its historical significance and climatic characteristics, the lake has great recreational potential; it is also used for fishing (Ben Tuvia et al., 1992).

The intensity of water abstraction, seen in the lowering of the lake level below 208 m below mean sea level, was considered a key issue driving this study.

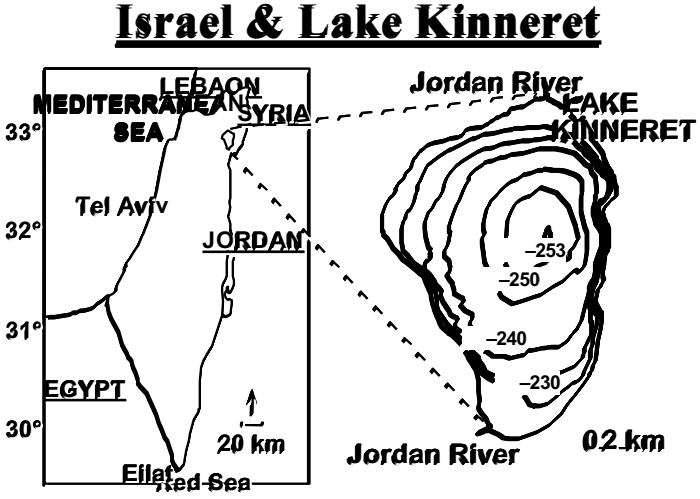


Figure 2: **Lake Kinneret and its location in Israel**

3. THE STRUCTURE OF THE WQ QUANTIFICATION

At the initial stage, the correspondence between a value of WQI (for example, nutrient concentration) and some numeric rating (R) value was established in a form of a rating curve (Figure 3):

R = f(WQI)
(1)

The form and the shape of the rating curve are strongly affected by the direction of use (for example, drinking water supply or ecosystem conservation).

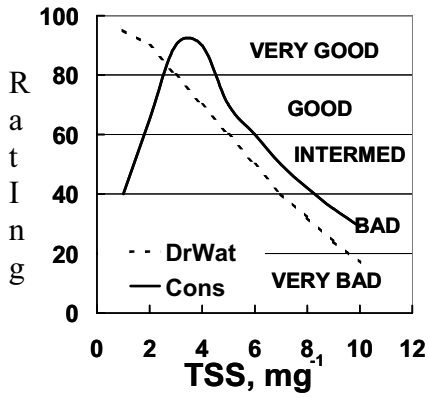


Figure 3: **Typical forms of the rating curves relating quantitative values of WQ (rating) with the value of the water quality index (here total suspended solids, TSS) for different water uses: the ecosystem conservation (Cons) and the drinking water supply (DrWat) were established by the expert panel for Lake Kinneret. The acceptable WQ corresponds to 60<R<100 ('good' to 'very good').**

Integration of the rating curves into a single "national" water quality curve should be done according to priorities established for the main directions of the

water resource's use. Such priorities have been established for the Naroch Lakes (Table 2).

Table 2: **Priorities of the separate directions of the Naroch Lakes' water resources use (in relative units) as established by the expert panel (Ostapenya, 1999)**

Directions	*Lakes*		
	Naroch	*Miastro*	*Batorino*
Conservation	54	49	49
Recreation	32	25	13
Fishery	13	23	34
Water supply	–	3	3
Other	1	–	1

Priorities for water resources use for Lake Kinneret have not yet been established.

The established dependence allows assessment of the permissible ranges of WQI (for the separate uses):

$$\{WQI_{LOW} < WQIc < WQI_{HIGH}\} \Leftrightarrow 60 < R(WQI) < 100 \quad (2)$$

where WQI_C is the current value of the index, WQI_{LOW} is the lower permissible value, and WQI_{HIGH} is the upper permissible value of the index.

Our studies carried out in Lake Kinneret and on the Naroch Lakes in 1997–9 (Hakanson et al., 2000) have shown that it is necessary to assess different levels of WQI integration:

- *An expanded system of water quality indices. This system should be suitable for describing different aspects of water resources use; it must serve as a "common language" for communication between different partners in management.* Such WQI systems have been established both for Lake Kinneret and for the Naroch Lakes (Tables 3 and 4). For Lake Kinneret, the final WQI system was subdivided into winter–spring and summer–autumn periods because of the drastic seasonal differences in many parameters.
- *Modeling of WQI using this expanded system will lead to relatively high levels of uncertainty in the estimates.* Therefore the expanded system should be reduced, using correlation analysis and other traditional mathematical methods of minimization. *Such a reduced system for WQI should represent a set of target variables for the mathematical modeling* (see Table 3).
- *Characterization of water quality by single number (Lake Ecosystem Index, LEI)*. Attempts at expressing water quality as a combination of factors (functional or numerical) have a long tradition in limnology – for example, as a trophic state index (Carlson, 1977) or as an LEI (Hakanson and Peters, 1995). *This highest level of integration in water quality estimation should be suitable for communication with policy makers and ensure optimization of management.* Usually the LEI is calculated using different methods of averaging. The LEI dynamics for Lakes Kinneret and Naroch (Figure 4) were estimated using the arithmetical mean and the weighted average (see Hakanson et al., 2000 for further discussion of the weighting algorithm).

The long-term dynamics of this "integrated" index do not contradict the qualitative estimates following from the hydroecological analysis (de-eutrophication of the Naroch Lakes and a relatively steady state in Lake Kinneret); in fact, they support them. Note that the various estimates of water quality for Lake Naroch indicate that the lake oligotrophication causes significant deterioration in lake water quality with regard to almost all areas of interest: conservation, recreation, and fisheries.

Table 3: **Acceptable winter–spring and summer–autumn ranges (100 ≥ Rating ≥ 60) for selected water quality parameters for conservation of the Lake Kinneret ecosystem**

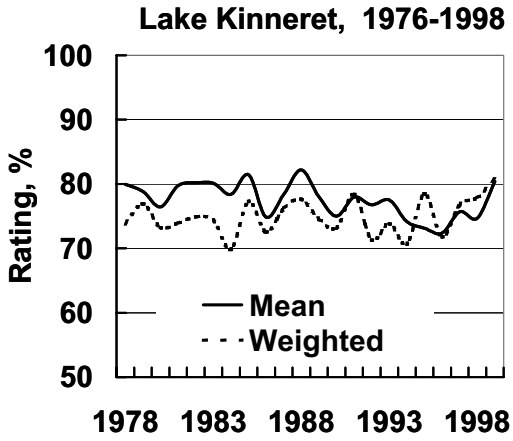
INDICES	***Winter–Spring***	***Summer–Autumn***
Chloride, mg L^{-1} (Cl)	184–244	184–246
Total suspended solids, mg L^{-1} (TSS)	1.0–7.1	0.6–4.1
TURBIDITY, NTU (Tu)	1.2–4.9	0.7–3.0
Total phosphorus, µg L^{-1} (Ptot)	9–38	5–28
Total nitrogen, mg L^{-1} (Ntot)	0.3–1.2	0.2–0.9
Chlorophyll, µg L^{-1} (Chl)	5.5–40.5	1.5–10.1
Primary production, g C m^{-2} d^{-1} (PP)	1.1–3.2	0.7–2.2
Cyanobacteria, % total biomass (%Cyano)	0–3.7	1–10.8
Biomass of zooplankton, g m^{-2} (Bzp)	13–52	7–37
Fecal coliforms, no. 100 mL^{-1} (Fcoli)	0–1 000	0–500
BOD_5, mg O_2 L^{-1}	To be established	

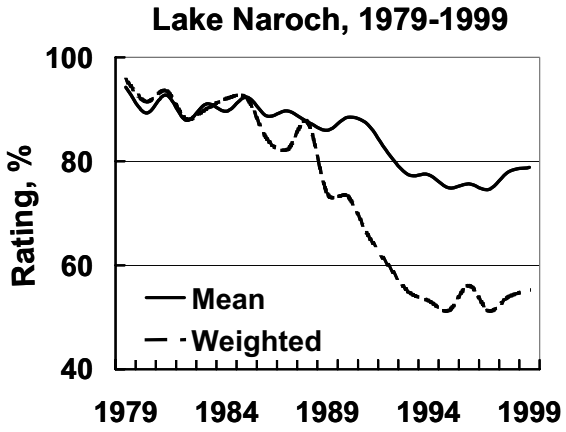
The WQIs included within the "reduced" WQI system are shown in bold.

Source: Parparov and Hambright, 1996; Hambright et al., 2000.

Table 4: **The set of water quality indices and their acceptable ranges (for the "conservation" use) for the Naroch Lakes (Ostapenya, 1999)**

Indices	*Lakes*		
	Naroch	*Miastro*	*Batorino*
Secchi depth, m	4.7–5.9	2.1–5.4	0.7–2.1
Total suspended solids, mg L^{-1}	0.3–2.5	0.6–2.6	4.3–18.0
Chlorophyll, µg L^{-1}	0.8–6.9	3.1–28.4	7–72
Oxygen, % saturation, at surface	>70–120	>70–150	86–139
Oxygen, % saturation, near bottom	58–110	62–120	65–147
Total nitrogen, mg L^{-1}	0.29–1.23	0.39–1.90	0.54–2.02
Total phosphorus, mg L^{-1}	0.01–0.04	0.02–0.07	0.03–0.10
Total carbon, mg L^{-1}	3.9–6.3	6.4–9.4	9.0–16.4
Primary production, mg C m^{-3} d^{-1}	24–64	66–276	141–525
Destruction, mg C m^{-3} d^{-1}	25–78	45–220	70–426
Phytoplankton biomass, g m^{-3}	0.3–1.9	1.0–7.2	3–23
Cyanobacteria, % of algal biomass	0.10–24.00	4–29	10–48
BOD_5, mg O_2 L^{-1}	0.6–1.7	1.0–2.3	1.7–4.1
Zooplankton biomass, g m^{-3}	0.7–2.26	1.0–6.2	2.2–16.1
PH*	8.15–8.55		





Surface area occupied by macrophytes	TO BE ESTABLISHED

* for Lake Naroch only

It should be stressed that the estimates used (both "mean" and "weighted") are not objective– "objective" estimates of WQ are simply impossible. The choice of the algorithm is strongly influenced, directly or indirectly, by management requirements.

We have already seen how the PER approach (Hakanson, 1999) represents a new system for quantification in water resources management. The *potential ecological risk* (PER) of a managing measure is estimated as a product of the numerically expressed values of the operational ecological effect variable (E), its areal distribution (A), and time duration (T):

$$PER = E \cdot A \cdot T \quad (3)$$

If the PER approach is applied to an entire lake (rather than to *lakes*, collectively), then factor A should be a constant.

A logical continuation of the progress achieved through the quantification of water quality (and in the entire management process as well) should be the establishment of a correspondence – functional if possible – between the intensity of the managing measures (MM) and the water quality changes that they cause. In other words:

$$WQI = \Phi(MM) \quad (4)$$

The most famous and widely used example of establishment of such a dependence is the Vollenweider–Dillon–Rigler concept relating phosphorus concentration to the bioproductive parameters of a lake (Dillon and Rygler, 1975). Such dependencies are statistical and applicable to a *type* of lake, and therefore they have relatively high uncertainties for individual lakes. In this study, we applied the simplest regressional analyses to simulate the potential relationships between the management measures (phosphorus loading for Naroch Lakes and water level lowering for Lake Kinneret) and the WQIs (Figure 5). These dependencies can be compared with the known limnological trends (for example, increase of salinity with the lake water level lowering in Lake Kinneret, or increase of water transparency with lowering of the phosphorus loading in Lake Naroch). Therefore, these dependencies are useful for illustrating the process of WQ quantification in the studied lakes.

Figure 4: **Multi-annual dynamics of the "average" WQ in Lakes Kinneret and Naroch (calculated as the arithmetical mean and the weighted average of ratings of the separate WQIs)**

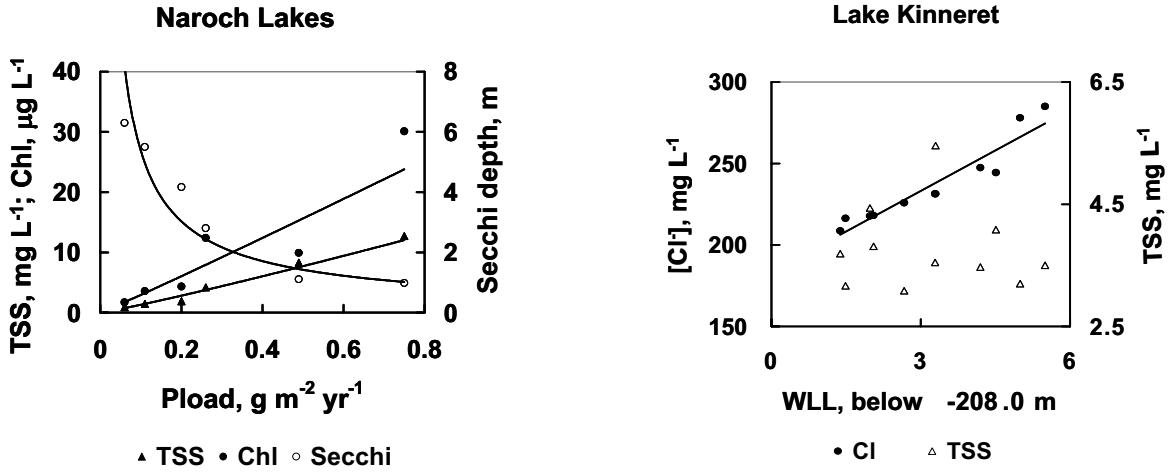


Figure 5: **Some examples of dependencies of water quality indices on managing measures (P-load for the Naroch Lakes and water level lowering (WLL) for Lake Kinneret).** The following relationships were obtained:
for Naroch Lakes: $S = 0.8\ P_L^{-0.82}$; $Chl = 32.0\ P_L^{1.04}$; $TSS = 16.5 P_L^{1.10}$
for Lake Kinneret: $Cl = 16.6WLL + 183.4$.

Note: The absence of significant relationship between TSS and WLL for Lake Kinneret should not be interpreted as showing that the suspended matter cycle was not affected by the lake water lowering.

However, in many cases the existing databases are not sufficient for the establishment of such dependencies, and especially for accounting for their possible nonlinear and non-monotonous character. A key direction in establishing the functional dependencies between WQI and MM is ecological modeling, feeding back information to management and limnological institutions and therefore forming a self-organizing tool for water resources management. *Searching for the relationships WQI = Φ(MM) represents one of the most exciting challenges for modern limnology, both theoretical and applied.*

The revealed dependencies should allow establishment of the correspondence between permissible ranges for WQI and permissible ranges for the management measures:

$$\{WQI_{LOW} < WQI < WQI_{HIGH}\} \Leftrightarrow \{MM_{LOW} < MM < MM_{HIGH}\} \quad (5)$$

The last expression, being supplemented with the requirements of socioeconomic optimization, could be considered as an operational definition of "sustainable management."

The realization of these stages of the water quality quantification should allow a direct connection between the quantitative estimates of water quality (as rating value, R) and the intensity of the managing measures (MM): R = F(MM) (Figure 6).

This relationship should be given due emphasis in communication with water policy makers and with specialists in environmental economy.

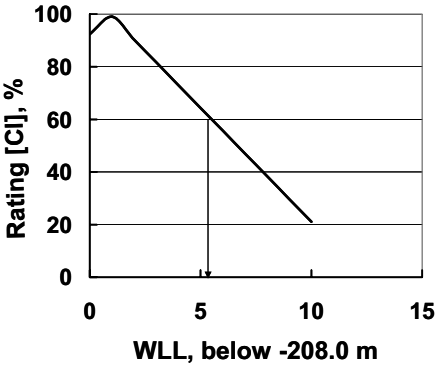


Figure 6: **Relationship between the managing measure (water level lowering, WLL) and Lake Kinneret water quality (expressed as the chloride rating value).** The arrow indicates an estimate of the upper permissible limit of WLL: a lowering in lake water level greater than 5 m (below 208.0 m below mean sea level) can lead to unacceptable deterioration of water quality (increase of Cl above the permissible limit).

Thus, the process of the WQ quantification should include the following stages:

- Establishment of the relationship between the numerical expression of WQ and the selected set of WQIs. This stage should be the result of the expert panel activity; it allows permissible ranges for the *separate WQIs* to be established.
- Establishment, as the result of limnological studies and ecological modeling, of the relationship between the WQIs and the most important management measures (see, for instance Hakanson et al., 1999). The ranking of the management measures could be done using the PER approach. This stage should allow establishment of the correspondence between permissible ranges for the WQIs and those for the management measures.
- Establishment of the direct correspondence between WQ and the management measures. This final stage should allow establishment of the permissible ranges *for the managing measures.*

We illustrate the entire process of WQ quantification with two examples for Lake Kinneret and Naroch Lake (Figures 7 and 8; see also Figures 5 and 6).

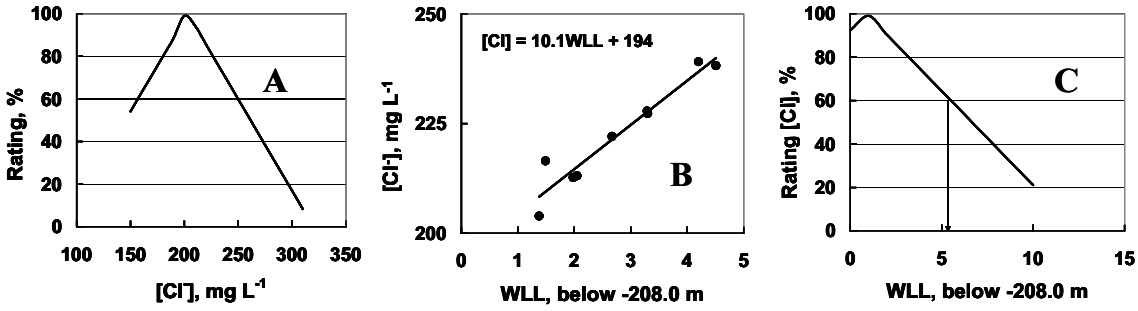


Figure 7: **Quantification of WQ (as chloride concentration) in Lake Kinneret** A. The rating curve for Cl. The established permissible range *for Cl* is as

follows: 182<Cl<244.
B. The interrelationship between the managing measure (the lake water level lowering) and Cl.
C. The direct interrelationship between WQ (as Rating of Cl) and the managing measure (as WLL). The upper permissible limit for *the WLL (the managing measure)* is WLL<5.1 m (below 208.0 m below mean sea level).

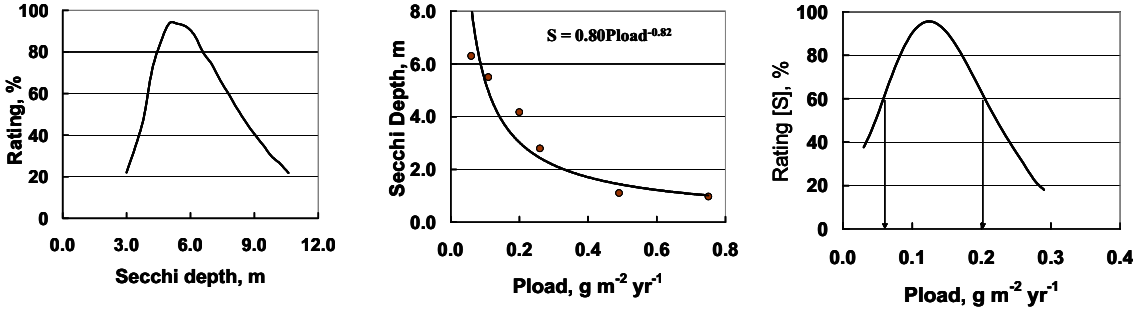


***Figure 8*: Quantification of WQ (as Secchi depth) in Naroch Lake.**
A. The rating curve for S. The established permissible range for S is as follows: 4.7<S<7.8.
B. The interrelationship between the managing measure (the lake water level lowering) and S.
C. The direct interrelationship between WQ (as rating of S) and the managing measure (as P-load). The established permissible range for the P-load (the managing measure) is as follows: 0.07<P-load<0.21. It is important to note that a decrease of P-load below 0.07 g m^{-2} yr^{-1} (leading to lake oligotrophication) is as undesirable as P-load increase above 0.21 g m^{-2} yr^{-1} (leading to lake eutrophication).

4. CONCLUSION

We must re-emphasize that the process of water quality quantification, as a part of the management framework, must be strongly affected by the requirements of the management itself. Unfortunately, both water resources managers and specialists in hydroecology often ignore this fact. The benefits from improving interaction between the various partners in water resources management are obvious: establishment of a common language of management and quantifiable tools of management, and transition from passive exploitation of water resources to quantitatively valuated management.

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WATER POLICIES IN THE MIDDLE EAST AND ASIA

SETTLING THE DISPUTE OVER THE WATER RESOURCES IN THE EUPHRATES-TIGRIS RIVER BASIN

Aysegül Kibaroglu[242]

ABSTRACT

This paper describes the negotiation mechanisms and processes between Turkey, Syria and Iraq as well as the bottlenecks and opportunities that exist over utilising the waters of the Euphrates and Tigris rivers. Negotiations over the water issues involved, both at the technical level and higher levels, have been suspended since the mid-1990s. The paper asserts that there is a need to revitalise these negotiations. A clear understanding of the respective rights and obligations of the three riparians, as well as an objective definition of such needs, are prerequisites for sustaining the negotiation process. Hence, the paper elaborates on the modalities of institution building that would facilitate negotiations over the use of the waters of the Euphrates-Tigris river system. In a series of international conferences convened by the specialised agencies of the United Nations (UN), as well as in the concerted activities of the water-related non-governmental organisations (NGOs) and in the works of the international water law community, serious efforts have long been devoted to furnishing a set of general principles and norms for achieving effective and equitable management and utilisation of transboundary water resources world-wide. In this respect, the paper underscores the significance of designing institutions that would be instrumental in promoting co-operation among Turkey, Syria, and Iraq by applying some of these principles and norms as well as rules and decision-making procedures to the Euphrates-Tigris river basin within the context of an international regime.

1. EMERGENCE OF THE WATER DISPUTE AMONG TURKEY, SYRIA AND IRAQ

The Euphrates and Tigris river basin comprises three major riparians, namely Turkey, Syria and Iraq. Both the Euphrates and the Tigris originate in Turkey, scarcely 30 kilometres from each other. The Euphrates and Tigris rivers constitute a single river basin through their confluence near the Persian Gulf to form the Shatt al-Arab waterway in Iraq. The mean natural flow of the Euphrates is about 32 billion cubic metres (bcm) per year. It is estimated that as much as 90 percent of the total flow of the Euphrates is generated within Turkey, with a further 10 percent produced by runoff from Syria (Beaumont, 1991). In Iraq, the Euphrates joins the Tigris near Basra. Except in times of unusual rainfall, Iraq's contribution to the Euphrates water is almost nil. The total water resources of the Tigris and its tributaries amount to 52 bcm per year. Turkey also contributes by 40 percent to the flow of the Tigris. Tributaries in Iraq and Iran contribute the remaining Tigris flow by 51 percent and nine percent, respectively.

These twin rivers, like all other rivers in the Middle East, have extremely high seasonal and multi-annual variance in their flow. Variation in the flow of both rivers had ranged from conditions of severe drought to destructive flooding before Turkey built upstream reservoirs capable of smoothing out such variances and providing a dependable year-round flow downstream. Before the 1960s, only these natural conditions had an impact on the availability of water to the three riparians.

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However, since the 1960s Turkey, Syria and Iraq have invested in large-scale water development projects, the largest of which is Turkey's South-eastern Anatolia Project (Turkish acronym, GAP). As a result of these supply-led developments, water demands of the riparians surpass the actual amount of water that can be supplied by the Euphrates-Tigris river system. Hence, unsatisfied demand for more water exacerbates tensions in the relations of the riparians with each other. A number of crises have occurred in the basin due to the lack of regularised consultation mechanisms among the riparians. Nevertheless, there have been notable efforts to build up a negotiation framework for data sharing and project co-ordination.

The relations between the three riparians during the period from 1920 to 1960 can be characterised as harmonious. Although planning was largely done on a country-by-country basis, there were technical consultations among the three states through the early 1960s. None of the countries were engaged in major development projects that could have resulted in excessive consumptive utilisation of the Euphrates-Tigris river basin waters. Therefore, there was during that period no exigency in devising a regime framework for better management and utilisation of the waters in the basin. Even the inefficient and ineffective development and management practices of the three riparians did not have substantial negative impacts on the quantity and quality of the waters. Populations were at manageable levels, and the rivers' flows depended only on natural monthly and yearly variations in discharge. The only serious concern of the two downstream riparians was the devastating effect of intermittent flooding (Kibaroglu, 1998). The unco-ordinated nature of these supply-led developments as well as inefficient and ineffective demand management practices within the framework of national water policy and management of the co-riparians continue to be the principal causes of water imbalance in the Euphrates-Tigris river basin (Kibaroglu and Unver, 2001).

2. NEGOTIATION FRAMEWORKS IN THE EUPHRATES-TIGRIS RIVER BASIN

The three riparians entered a new phase in their relationship over water upon the decision by Turkey to construct the Keban dam on the Euphrates. The Keban dam, while on the Euphrates, is not considered to be part of the GAP. Yet its presence makes it an integral element of the overall Euphrates development scheme. The Keban dam was designed for electricity generation and had no feature which would change the water balance of the basin. Furthermore, the Keban dam had a very positive impact upon the water storage facilities of Syria and Iraq by ensuring the regulation of variance in the flow of approximately 70 percent of the waters of the Euphrates (Bilen, 1997). However, the downstream riparians, particularly Iraq, insisted on guaranteed flows (350 m3/sec at minimum) to be released by Turkey during the impounding period. Hence, a first meeting was held on June 22-27th, 1964, with the participation of Turkish and Iraqi experts. In that meeting, the Turkish delegation asserted that it was impossible to reach a single and final formula for the pattern of water to be released from the Keban dam reservoir before impounding by the dam. This pattern, according to the Turkish delegation, depended upon the natural conditions that would prevail during the filling, and on the exact evaluation of the concerned countries' needs (State Hydraulic Works, 1975). However, under pressure of the donors through an agreement signed with the United States Agency for International Development (USAID), Turkey

guaranteed to undertake all necessary measures to maintain a discharge of 350 m3/sec immediately downstream from the dam, provided that the natural flow of the river was adequate to supply the above discharge. Turkey confirmed this orally to Syria and Iraq the same year. Moreover, during this meeting, Turkey proposed to establish a Joint Technical Committee (JTC), which would inspect each river at its source to determine its average yearly discharge. In addition, the JTC would determine the irrigation needs of the three countries through joint field studies. The JTC would be authorised, by calculating the needs of the riparians for present and future projects, to prepare a statement of main principles and procedures in order to reach an agreement on water rights.

A second meeting was held with Syria in Ankara in 1964. During the meeting both delegations exchanged information on the stages achieved in the development of the two major projects: Keban and Tabqa. The Syrian delegation clarified its irrigation targets within the Euphrates Valley Project. The two countries equally emphasised the necessity of having joint meetings with the participation of Turkey, Syria and Iraq. After these bilateral meetings, in accordance with the recommendations of the Turkish delegation, the first tri-partite negotiation was held in Baghdad in 1965. In that meeting, the three delegations exchanged technical data with regard to the Haditha, Tabqa and Keban dams. The delegations then moved to discuss the question of setting up a JTC. The Iraqi delegation submitted a draft agreement, which covered, among others, the issue of forming a permanent JTC to be entrusted with supervising the implementation of the agreement. The Turkish delegation strongly rejected the Iraqi draft agreement, and expressed that the JTC could only be authorised to maintain co-ordination of the current and future projects in the river basin. In line with the Turkish proposal, Syria suggested it would be convenient to include, among the functions of the JTC, a study of the water requirements of the irrigable lands in the three countries, and subsequently to examine the possibility of covering possible shortages of water supplied by the Euphrates through diverting a part of the Tigris River's water to the Euphrates. Iraq was strongly opposed to this proposal and insisted on negotiating only the waters of the Euphrates. Thereafter, Syria changed its position during the 1980s and joined Iraq in advocating that the rivers be considered separately. This was done despite the Turkish view that both rivers form one watercourse system including territories of the three riparian countries. During the course of the 1970s, the three delegations gathered on several occasions to exchange information about the technical issues pertaining to the Keban, Tabqa and the Habbaniye reservoirs. On 9 October 1972 the delegations agreed once again that a JTC should be formed. Hence, in 1972 and 1973 a series of JTC meetings were held, albeit on an *ad hoc* basis. No references were made to a water rights agreement. Turkey started impounding the Keban reservoir by February 1974 at the same time that Syria had almost finalised the construction of Tabqa dam. No agreement was achieved at the end of numerous technical meetings, and Turkey and Syria went their own ways in determining impounding programmes for the two reservoirs. The Tabqa and Keban were completed a year apart (1974-1975). This was a period of continuous and particularly dry weather. The impounding of both reservoirs in the following two years escalated into a crisis in the Spring of 1975 (Kut, 1993). Iraq accused Syria of reducing the river's flow to intolerable low levels, while Syria placed the blame on Turkey. The Iraqi government was not satisfied with the Syrian response, and mounting frustration resulted in mutual threats bringing the parties to the brink of armed hostility. A war over water was averted when Saudi Arabia mediated that extra amounts of water be released from Syria to Iraq.

In 1974, Turkey started negotiating with the World Bank on the construction of a second dam just downstream from the Keban, namely the Karakaya dam. A series of tri-lateral technical negotiations were also held to determine appropriate methods for impounding the Karakaya reservoir. Despite difficulties in obtaining full outside funding, contract bidding for the work on the dam was called in 1976 (Kolars and Mitchell, 1991). No crisis was encountered during either the construction of the dam or the impounding of its reservoir. This was largely due to further guarantees by Turkey to release 500m3/sec of flow to Syria during the construction, initial impounding and operation of the dam. The Karakaya dam became operational in 1987. Contracts for a high dam at the Middle Karababa site, subsequently renamed the Atatürk dam, were initiated in 1983. The imminent use of the Euphrates and Tigris by Turkey created new demands for co-operation. Because the issues involved in hydropower schemes along the Tigris and Euphrates are so complex and far-reaching, the three riparians had to find ways of structuring the dialogue among them. Hence, this time Iraq took the initiative for the formation of a permanent Joint Technical Committee. At the end of the first meeting of the Joint Economic Commission between Turkey and Iraq in 1980, a new JTC was established to discuss and finalise the water issue among the riparians. Syria joined the JTC in 1983 whereupon Turkey, Syria, and Iraq held sixteen meetings up to 1993.

The essential mandate given to the JTC was to determine the methods and procedures which would lead to a definition of the reasonable and appropriate amount of water that each country would need from both rivers. The major items on the agenda of the JTC were the exchange of hydrological and meteorological data and information on the Euphrates-Tigris Basin, the sharing of information on the progress in the construction of dams and irrigation schemes in the three riparian countries, and the discussion of initial plans for filling the Karakaya and Atatürk Reservoirs. With regard to the exchange of data, Turkey, as the headwater riparian, provided complete information including the rules of operation of the reservoirs in its territory in order to ensure better water management in the Euphrates-Tigris Basin. However, after sixteen meetings, the JTC could not fulfil its objectives. The talks became deadlocked, and it was impossible even to produce outlines of its meetings. However, the role of the Joint Technical Committee should not be underestimated. Although its meetings were infrequent and appear to have made little substantive progress on the question of water allocation, it was a useful channel for communication.[243] The major issues that led to the deadlock were related to both the subject and the object of negotiations: whether the Euphrates and the Tigris ought to be considered a single system or whether the discussions could be exclusively limited to the Euphrates. In other words, the final objective of the JTC was to formulate a proposal for the 'sharing' of 'international rivers', or to achieve a trilateral regime for determining the 'utilisation of transboundary watercourses'. Iraq and Syria consider the Euphrates an international river that should be treated as an integrated system. Both countries insist on an immediate sharing agreement under which the waters of the Euphrates would be shared on the basis of the water needs of each country. On the other hand, the Turkish position is that international rivers are only those that constitute a border between two or more riparians (Murhaf, 1996). Turkey considers the Euphrates and Tigris as

[243] The final *communiqués* of the 16 Joint Technical Committee meetings were reviewed with the permission of the officials in the State Hydraulic Works in order to come up with the above arguments -on file with the author.

a single transboundary river system, which crosses the common political border. Moreover, Turkey refuses the downstream countries having the rights of co-sovereignty on the waters of the upstream country or vice-versa.

The Joint Technical Committee meetings did not fulfil the expressed aim of co-ordinating the development and usage patterns of the three riparians. Hence, a number of crises occurred among the riparians during the 1980s and 1990s. A major crisis among the riparians of the Euphrates-Tigris river basin took place during the impounding of the Atatürk dam in Turkey. On 13 January 1990, Turkey temporarily intervened in the flow of the Euphrates river in order to fill the Atatürk reservoir. The decision to fill the reservoir over a period of one month was taken much earlier. Turkey had notified its downstream neighbours by November 1989 of the pending event. In its note, Turkey explained the technical reasons and provided a detailed programs for making up for the losses. However, the Syrian and the Iraqi governments protested officially to Turkey, and consequently called for an agreement to share the waters of the Euphrates, as well as a reduction in the impounding period. Another crisis occurred in 1996 after Turkey started the construction of the Birecik, an after-bay dam on the Euphrates river. The dam is designed to regularise the water level of the Euphrates during the generation of hydroelectricity at the Atatürk dam during peak hours when downstream flow would reach its maximum. Both Syria and Iraq sent official notes to the Turkish government in December 1995 and January 1996 indicating their objection to the construction of the Birecik dam on the grounds that the dam would affect the quantity and quality of waters flowing to Syria and Iraq.

3. INTERDEPENDENCE, CO-OPERATION AND INTERNATIONAL REGIMES

These crises reveal that the initiation of the major development projects caused increasing demands on the waters of the river system, which, in turn, exacerbated tensions among the riparians. The outcomes of the series of negotiations discussed above were fruitless. The reason behind this failure was that the parties could not reach any consensus on basic principles and norms (rights and obligations) that would sustain the negotiation process and facilitate agreement. Hence, this chapter aims to prepare an agenda consisting of necessary mechanisms, namely the *principles, norms, rules*, and *decision-making procedures* that would attain such a goal (Levy et al., 1995). Throughout a transboundary river basin, we observe an interdependent set of relations among the riparians where the impact of physical effects generated in one state is delivered to the other via the river system. The Euphrates-Tigris river basin constitutes such a medium. Since the end of the 1960s when all three riparians initiated major development projects on the rivers, they indeed began to function under the conditions of growing *interdependence* (Keohane, 1989). Interdependence, in the case being examined here specifies the degree of connectedness. It does not predict, however, what action the parties shall take. That is, the position of the riparians could be co-operative or conflict-prone. When E. B. Haas singled out the uncertainty and lack of clarity resulting from growing interdependence, he assumed that interdependence was not a sufficient condition for co-operation, and may even result in conflict (Haas, 1983). Thus, if interdependence is not a sufficient condition for co-operation and may even result in conflict, *regimes* may provide the necessary *linkage* between *interdependence* and *co-operation*. An international water regime creates through its institutions a

clear, co-operative framework in which the parties can identify their joint gains in the equitable utilisation of a transboundary watercourse. Another major function of international regimes is to facilitate the concluding of specific agreements by preparing the necessary ground for them. In the final analysis, a basin-wide accord is needed to settle the necessary conditions for effective and equitable allocation and management of the waters of the Euphrates-Tigris river basin. However, the current physical and political setting of the Euphrates-Tigris river basin is not ripe for concluding a sharing agreement, as the one the two downstream riparians insist on. In the Euphrates-Tigris river basin, the three riparians could not conclude a basin-wide accord for efficient and equitable utilisation of the waters of the system because of the uncertain political setting, the pursuit of short-term national interests, the lack of regularised institutions, and incomplete information. Data regarding the stream flow, precipitation, evapo-transpiration, water removals, return flow, salinity, and a host of other variables in relation to land resources, are notoriously scarce, incomplete, and open to questions in the basin. Information relating to water and land resources of the region are poor and are not exchanged on a regular basis among the riparians. Further, an authoritative legal framework is lacking in the region. International regimes, and the institutions and procedures that were developed in conjunction with them, reduce uncertainty and risk by linking discrete issues to one another, and by improving the quantity and the quality of information available to participants. The institutions and procedures that are developed around international regimes acquire values as permit communication arrangements, and therefore facilitate the exchange of information.

4. INSTITUTIONS FOR THE SUGGESTED WATER REGIME IN THE EUPHRATES-TIGRIS RIVER BASIN

Under the rubric of the main features of a water regime in the Euphrates-Tigris river basin, the following sections will present the necessary principles, norms, rules and decision-making procedures to be discussed among the riparians during the process of regime formation. The following institutions that are suggested, either in the form of abstract set of principles, norms, and rules, or in the form of specific organisational arrangements, are thought to constitute substantial tools the parties to the dispute can make use of as attractive institutional arrangements to foster the bargaining process, and to persuade others to come on board as supporters of such arrangements. In the case of the Euphrates-Tigris river basin, the primary sources of the principles and norms as the basic constituents of the suggested international regime can be found in the works of international water law. The emergence, evolution and the codification of universal guidelines yielded a set of principles and norms for effective and equitable management and utilisation of transboundary water resources. Hence, the International Law Commission of the United Nations set forth principles and rules that may be applied and adjusted in agreements between states situated alongside transboundary watercourses. The Draft Articles of the ILC, which were transformed into the UN Watercourses Convention of 1997, are incorporated into the discussion on the designation of the institutions for better use and management of the Euphrates and Tigris. Moreover, the works of a number of international agencies during a series of conferences convened under the auspices of the United Nations, and the concerted efforts of the international water policy institutions are analysed to derive the necessary institutions of the regime framework in the Euphrates and Tigris river basin.

4.1. Principles

The principles of an international regime reflect 'the aims and the premises of the regime, and the purposes members are expected to pursue'. In other words, the principles give the regime its identity and reason for existence. It has been presumed, in this study, that if Turkey, Syria and Iraq, as the major riparians to the water dispute in the Euphrates and Tigris river basin, adhered to the principles described below, it would be easier to resume and proceed the negotiations on the water issue, and to achieve fruitful outcomes. Two guiding principles are suggested in this study with a view to designing negotiated frameworks, that is an international regime, in the Euphrates-Tigris river basin:

Equitable and Efficient Management and Utilisation of Transboundary Rivers is a Key Determinant in Promoting Co-operation.

The first principle originates partly from international water law, and partly from the works of international agencies. Hence, the universal guidelines on water which have emerged from the designated efforts of the international agencies and international law community, rest on the basic assumption that efficient and equitable management and allocation of transboundary rivers ease the tensions over the limited supply of water, and thus promotes co-operation. The principle of 'equitable management and allocation of transboundary rivers' is concentrated on factors which are more crucial and less arbitrary, such as the needs of the states. It is not simply a formula or system of computing the most equitable allocation to which each watercourse state is entitled. Therefore, this principle does not produce a clear and concise formula which, when all the data is inserted, produces a definitive division of the waters. In other words, the result of the application of this principle would not be an immediate comprehensive reallocation of all the waters in the watercourse. Rather, equitable utilisation would enable and prescribe regional initiatives promoting efficiency, conservation, and economy of use. Efficient use and management of water resources would be achieved through 'demand management' techniques. All three riparians have neglected demand management policies, albeit to different degrees. For instance, Turkey's current water policy and management is more responsive to a certain demand of management policies such as 'stakeholder participation', establishment of proper 'water authorities', 'efficient delivery systems'. Yet, Turkish authorities should consider many more areas of demand management such as 'pricing' and 'issuing effective legislation'. Notwithstanding, both Syria and Iraq have experienced ineffective demand management strategies. They are in urgent need of review of their national water resources strategies to manage and allocate their water resources more efficiently. Thence, the governments of the three riparians of the Euphrates-Tigris river basin have a vested interest in re-evaluating their national water resources strategy to reach effective and equitable water management policies and strategies at the national level that would, in turn, be harmonised with other riparians' policy through river basin management organisation.

The National Water Sector of Each Riparian is a Part of the Global Political Economy Where Adjustments Can be Made Through International Trade

This principle originates primarily from major premises of the political economist approach. Hence, J. A. Allan comments that the international trading system has enabled the economies of the region to escape from being trapped in the closed

hydrological systems to which they have access. Indeed, the past forty years of water management in the Middle East since the initiation of major development projects cannot be explained without such perspectives since the solution to water shortages has lain much more in the capacity of the region's economies to *import food* rather than agreements to *share inadequate indigenous resources*. Moreover, in line with the same principle, it has been suggested that all countries in the region, particularly those for whom the water scarcity is a genuine concern, should reallocate their water resources at the national level by shifting the major emphasis from irrigation to domestic and industrial use. Additionally, to compensate for the overall deficiencies in agricultural production, they could import foodstuffs. However the developments are not always that straightforward: most of the countries of the region including the ones facing serious water shortages, like Iraq and Syria, did not engage in such reallocations at all. One should also mark the fact that, for a couple of decades, countries like Syria and Iraq have experienced rather a great deal of trade in terms of food staples, either through imports or exports depending on the harvests of the year in question. This principle emphasises that such economic adjustments should continue as a response to the growing water scarcity in the Euphrates-Tigris river basin. Apparently, there is a great need in the region for urgent reconsiderations of water allocation and management practices primarily at the national level and subsequently at basin-wide level. The riparians to the Euphrates-Tigris river basin are likely to depend on domestic food production to a considerable extent, in spite of the fact that the three riparians have practised inefficient and water-wasting irrigation practices for many years. However, the second principle upholds the idea that reasonable and efficient water use and conservation could be realised by importing food (cereals and wheat) through international trade in regions like the Euphrates-Tigris where water stress is getting worse.

4.2. Norms

The norms of an international regime can be regarded as a mandate for the rules and procedures of the regime. They indicate what members of the regime must or must not do, that is, what is legitimate or illegitimate. But they are still so general that it is often impossible to determine whether or not specific actions violate them. In this study, the norms of an international regime for better management and allocation of the waters of the Euphrates-Tigris have been principally derived from the General Principles (Part II) of the Convention on the Law of the Non-Navigational Uses of International Watercourses. The norms of an international regime are mostly expressed in terms of issue-specific agreements. Hence, the general principles of the regime for allocation and management of the waters of the Euphrates and Tigris would be translated into specific norms through a water allocation and management agreement. The norms that are elaborated in this study are to be incorporated into an agreement for the allocation of the waters of the Euphrates and Tigris rivers.

The Euphrates and Tigris Rivers Have to be Considered as Forming One Single Transboundary Watercourse System, and Managed Accordingly

These rivers are linked not only by their natural course when merging at the Shatt al-Arab, but also by the man-made Thartar Canal connection between the two rivers in Iraq. Consequently, all existing and future agricultural water uses need not necessarily be derived from the Euphrates. Irrigation water for areas fed by the

Euphrates, may also be supplied from the Tigris. The possibility of diverting surplus water of the Tigris in Iraq to the Euphrates has been discussed as a viable alternative for optimal utilisation of available water resources of the basin. This point forms the most important technical feature of the Euphrates-Tigris system. By utilising this feature, it is possible to connect the two rivers at various points and to transfer the surplus water of the Tigris to the Euphrates.

The Inventory of Water and Land Resources Should be Drawn up and Evaluated Jointly

The methods for data collection, interpretation and evaluation show disparities from country to country and are not readily applicable to transboundary watercourses. Thus, the necessary means and measures should be determined to attain the most reasonable and optimum utilisation of resources on the basis of these studies.

Each Riparian Has the Right to Use the Waters of the International Watercourses in Their Respective Territories in an Equitable and Reasonable Manner

This norm relies basically on the doctrine of *limited territorial sovereignty*. A brief account of the official stance of the two downstream riparians vis-à-vis 'the right to use the waters of the international watercourses in their respective territories' displays a totally different picture. To begin with, Iraq maintains that it has *acquired rights* relating to its 'ancestral irrigation' from the Euphrates and Tigris rivers. Thus, the Iraqi government claims that there exist two dimensions of these acquired rights. One outlines the fact that for thousands of years these rivers have given life to the inhabitants of Mesopotamia, and thus constitute an acquired right for this people. The second dimension of these acquired rights stems from the existing irrigation and water installations. Iraq has 1.9 million hectares (mha) of agricultural land in the Euphrates basin, including the ancestral irrigation systems left from Sumerian times. Syrian official arguments are more or less overlapping with the Iraqi ones. That is to say, Syrians also claim that Syria possesses acquired rights over the rivers that pass through Syrian territory dating from antique periods (Syrian Proposal, 1994). Iraq's, and to a lesser extent Syria's, claims to acquired rights will probably be ignored in line with the specialists' opinion that prior rights have no relevance to equitable water allocation. Concerning acquired rights, most publicists argued that this doctrine should not be applied to international disputes because it is often wasteful and is not conducive to the optimum economic development of the river basin (Lipper, 1967). One commentator argues that the historical or acquired rights doctrine claimed by Syria and more often by Iraq are inadequate in the sense that prior uses of water by downstream countries represent only one of many factors that have to be taken into account in reaching an equitable utilisation of a transboundary river. On the other hand, Turkey has been advocating the necessity of common criteria in allocating the waters of the Euphrates-Tigris basin, based on the principle of equitable utilisation, which is grounded in the doctrine of *limited territorial sovereignty*. The needs-based approach of Turkey is simply a reflection of the limited sovereignty doctrine which combines the two contentious principles of international water law in an effective way: a) equitable right to use, and b) obligation not to cause significant harm. In order to make this doctrine operational, the needs of each riparian have to be determined through the exchange of reliable and accurate data. In addition, Turkey recognises that all riparians in the basin have correlative entitlements and

obligations regarding their use of water resources. To this end, Turkey embraces the principle of equitable utilisation as the primary rule governing the allocation of the waters of the basin. Hence, obligations should be shared just like the benefits. Each riparian has to pay attention to the efficiency and equity criteria in utilising its portion.

To Attain Optimal Utilisation and Adequate Protection of the Euphrates-Tigris Rivers Co-operation Should be the Norm Among the Riparian States

Articles 8, 9 and 10 of the Part II (Principles) of the Convention embody a series of obligations, which are certainly very useful in drawing up the norms of the regime in the Euphrates-Tigris river basin. In line with art. 8 of the Convention, a fourth norm can be set for the envisaged regime in the Euphrates and Tigris region. Co-operation may take the form, *inter alia,* of the exchange of data and information, notification, communication, consultations and negotiations. Co-operation in the basin may start at a minimal level. In determining the manner of the co-operation, riparian states may consider the establishment of joint mechanisms, as they deem necessary, to facilitate co-operation on relevant measures and procedures in the light of experience gained through co-operation in existing joint mechanisms and commissions in various regions. In the first place, reviving the JTC would be an affirmative step to materialise the co-operation among the riparians.

Regular Exchange of Data and Information

The regular exchange of data and information appears as the first step of co-operation between co-riparians. At the same time, it is a precondition for the realisation of higher degrees of co-operation. This norm will facilitate the protection and preservation of the watercourses, along with the fulfilment of the obligations pertaining to the equitable and reasonable utilisation. It might be recalled that the foremost recommendation of the Mar del Plata Action Plan put forward that 'to improve the management of water resources, greater knowledge about their quantity and quality is needed; regular and systematic collection of hydro-meteorological, hydrological and hydro-geological data needs to be promoted; thus countries should review, strengthen and co-ordinate arrangements for the collection of basic data'.[244] For about a decade (1982-1992), the JTC provided the appropriate platform to the Euphrates-Tigris river basin for regular exchange of hydrological and hydro-meteorological data. Even after the suspension of the JTC meetings, riparians continued to share some hydrological information, albeit occasionally. Revitalisation of the JTC activities would serve the compilation of data relating to the hydrological features of the river basin, which will in turn facilitate the negotiation process.

Duty of Prior Notice

This norm finds direct references in Part III (Planned Measures) of the Convention. It constitutes a substantial part of international customary law defined as 'duty of prior notice where possible significant harm exists'. However, in this case, the Convention does not serve the end to formulate major clauses of this norm for a regime framework in the Euphrates-Tigris river basin. Part III of the Convention

[244] Report of the UN Water Conference, Mar del Plata, 14-25 March 1977, U.N. Doc. E/CONF.70/29 (1977), Part One, Chapter 1, pp. 24-75.

comprises detailed procedural arrangements such as determining the period to reply to a notification. In the event, each transboundary watercourse possesses different and specific characteristics. Therefore, such time limits should be determined according the specific circumstances of each watershed with the consent of the riparians. Starting in the early 1960s, as the three riparians prepared their unilateral water resources development plans, the bilateral and trilateral talks and the technical meetings held on an ad hoc basis permitted the three riparians to exchange information on achievement of the development projects, namely the dams. The continuation of these meetings, at technical level in particular, would evidently provide the necessary platform to exchange the unilateral development plans of the three riparians and to possibly harmonise them at the well-advanced stages of co-operation.

Due Attention Should be Paid to the Protection and Preservation of the Ecosystems of the Euphrates-Tigris River Basin

Part IV (Article 21) of the Convention deals with protection and preservation of the ecosystems of the environment. Indeed, the complex interconnectedness of freshwater systems demands freshwater management to be holistic (adopting a catchment approach) and based on a balanced consideration of the needs of the people and environment. The three riparians should, individually and, where appropriate, jointly, prevent, reduce and control the pollution of the transboundary rivers that may cause significant harm to other watercourse states or to their environment, including harm to human health or safety, to the use of the waters for any beneficial purpose, or to the living resources of the watercourse. Hence, they have to take steps to harmonise their policies in this connection. The above analysis of the hydro-politics of the Euphrates-Tigris river basin demonstrates that the dispute is about the 'water quantity' rather than 'quality'. In the medium run, the 'quality' of water will constitute a major concern, due to the drastic increase in the consumption of the waters of the river system,.

4.3. Rules

Rules are the most concrete components of the international regimes. They are often stated explicitly in the formal agreements on which regimes are commonly based, and they facilitate assessment of implementation and compliance. The rules of an international regime are prescriptions and guidelines for actions the member states are expected to perform on or refrain from performing. They define the relevant actors, the expected behaviour, and the specific circumstances under which the rules are operative. Rules make the principles and norms operational, measurable and verifiable, and they institutionalise procedures. The origin and functions of the rules as described by the above sentences may lead us to think that it is, for the time being, not possible to design rules for the Euphrates-Tigris river basin because no formal agreement or legislative text exist to comprise such prescriptions or guidelines. Nevertheless, there are two formal protocols and a plan concerning the utilisation (use rules) of the Euphrates-Tigris river basin, which make the following elucidation constructive rather than a merely superficial exercise.

The Protocol of 1987 Between Turkey and Syria

The Turkish-Syrian Joint Economic Commission meeting on 17 July 1987 had an important outcome regarding the negotiations on the water issue. Hence the first arrangement was the Protocol of Economic Co-operation signed by Turkey and Syria in 1987. The Protocol was not solely devoted to the water issue. It is important to note that it was regarded as a temporary arrangement. It embodies several articles pertaining to the water issue.[245] The text of Article 6 of the Protocol reads as follows: 'During the filling up period of the Atatürk dam reservoir and until the final allocation of the waters of Euphrates among the three riparian countries the Turkish side undertakes to release a yearly average of more than 500 m3/sec at the Turkish-Syrian border and in cases where monthly flow falls below the level of 500 m3/sec, the Turkish side agrees to make up the difference during the following month'.

Water Allocation Agreement Between Syria and Iraq: The Protocol of 1990

Syria and Iraq perceived the interruption to the flow of the Euphrates, due to the impounding of the Atatürk dam, as the beginning of many such interruptions that would be the consequences of envisaged projects within the framework of GAP. Hence, the 13th meeting of the Joint Technical Committee held in Baghdad on 16 April 1990, provided the occasion for a bilateral accord between Syria and Iraq, that is the second arrangement in mention here, according to which 58 percent of the Euphrates waters coming from Turkey would be released to Iraq by Syria.[246] These bilateral accords were interim measures, and were largely products of the then-prevailing political atmosphere in the basin. They did not serve the goal, namely achieving efficient and equitable allocation and management of the water resources in the Euphrates-Tigris river basin. Such a proposal is thought to provide ample opportunity to initiate rules for a water use and management regime in the basin.

The Three-Stage Plan

In the Euphrates-Tigris river basin, both Syria and Iraq proposed similar plans for a 'sharing agreement'. During the negotiations emerged the fact that the water potential was unable to meet declared demands of the three riparians. And, more importantly, there have been rooted uncertainties and inadequacies related to the data on water and land resources. In response to Syrian and Iraqi demands for the formulation of urgent 'sharing arrangements' depending on the criteria that they put forward, Turkey proposed the 'Three-Stage Plan for Optimum, Equitable and Reasonable Utilisation of the Transboundary Watercourses of the Tigris-Euphrates Basin'.[247] According to this plan, which, in the present analysis, constitutes the essential rules of the proposed regime, the inventory studies of water and land resources of the whole region comprising the territories of respective states would be undertaken and evaluated jointly. Based on these studies, 'necessary means and measures to attain the most reasonable and optimum utilisation of resources would be defined'. The makers of the Plan indicate that the problems in the basin basically

[245] *Resmi Gazete*, Ankara, Turkey, 10 December 1987.
[246] The Official Paper of Syria, 9 May 1990.
[247] Minutes of the Fifteenth Meeting of the Joint Technical Committee (1990). Ankara.

stem from mismanagement and misallocation. By quantifying the problem through the implementation of the Three-Stage Plan, the water issue will become more manageable. Data sharing would facilitate the negotiation process and foster the creation of many co-operative structures. With the Plan, Turkey calls for the establishment of a joint body for collecting, handling and exchanging data regarding water and land resources so that annual and seasonal variations can be incorporated in the calculations made to decide about the allocations. Along with reaching agreed criteria in data sharing, negotiations could move on to talks on co-ordination of projects and the creation of joint projects. The Three-Stage Plan incorporates guidelines and prescriptions for the three riparians. The plan suggests the application of advanced and appropriate technologies in order to minimise water requirements for agriculture. This would turn the norm of conservation into an essential solution to what is basically the problem of a scarce resource. Furthermore, the plan proposes to regulate the flow of the Euphrates river *according to seasonal needs of the downstream countries* instead of keeping a steady flow which may not match seasonal agricultural demands. Such adjustments would take place within the limits of the average annual flow of 500 m3/sec, the amount that Turkey promised to release at the Turkish-Syrian border by the Protocol of 1987. However, Syria and Iraq have insisted on increasing the minimum quota to 700-750 m3/sec through *ad hoc* bilateral or trilateral sharing agreements. Both countries are concerned because they could loose most (even receiving lower rates than 500 m3/sec) if GAP is completed without a water-sharing agreement. Hence, with a view to guarantee the bulk of the supply, Syria and Iraq have proposed *sharing* the waters of the rivers based on a simple arithmetic formula. This would mean that regardless of the discrepancies between the riparians' actual needs for water, the waters of the Euphrates-Tigris river basin would be shared simply 'equally', but not necessarily 'equitably' or 'effectively'. Moreover, dividing the waters by volume, as suggested by Syria and Iraq, does not take into account the highly variable character of the Euphrates whose flow varies considerably on a seasonal and annual basis. Such *ad hoc* arrangements would inevitably require frequent negotiation of new quotas to adjust the shares to the existing flow rates of the river system. This would further frustrate the relations among the riparians.

4.4. Decision-Making Procedures: From Joint Technical Committee to River Basin Organisation

Decision-making structures of the regimes function as platforms on which participants meet regularly. Then, a certain level of institutionalisation tends to occur, though its degree may be minimal at the beginning. The decision-making procedures of an international regime are those mechanisms that deal with situations requiring a collective choice, which may be necessary to amend or clarify the principles, norms, and rules of the regime, and to deal with compliance issues, including monitoring, verification and sanctioning of violators. Concerning the Euphrates-Tigris river basin, the Joint Technical Committee acts as a technical forum meeting regularly for general project discussions and exchange of hydrological data.

Apparently, institutionalised co-operation through a technical body or joint commission is more successful in preparing the necessary data for decision-makers: collecting and standardising information, investigating facts, and considering special circumstances which are prerequisites of a more equitable determination of shared water benefits. Moreover, as most of the watersheds, like

the Euphrates-Tigris, begin to reach the limits of supply due to augmented rates of demand. The flexibility of decision-making procedures to respond to the water stress becomes crucial. This flexibility is most needed to provide new forums for dealing with water allocation problems, which cross both time and space. In that manner, the JTC meetings were not totally without value. First of all, the issues at stake revealed to be more complex than they appeared at first sight, and the concerns and official stance of the parties were openly put on the table at the meetings. Secondly, vital information exchange on regional waters has been possible. For instance, hydrological data were exchanged regularly by telex. And, more importantly, certain proposals were more or less discussed. Still, none of the parties was content with the outcomes. Therefore, more appropriate decision-making procedures need to be set up in conformity with the original definitions of the regime theorists, a river basin organisation with broader tasks needs to be established in the Euphrates-Tigris river basin along with a technical committee.

5. CONCLUSION

The institutions listed above are designed to support and determine the agenda of the negotiations for the use and management of the waters of the Euphrates-Tigris river basin. As a matter of fact, these can only become operational if the three riparians agree to commence the negotiation process on the use and management of the rivers. For the time being, the two downstream riparians keep insisting on concluding an immediate sharing agreement (comprising only the Euphrates river) that would entitle one third of the waters to Turkey and the remaining amount to the downstream Syria and Iraq, to be shared between them according to the Protocol of 1990. However, it is generally argued in this paper that conditions are not conducive to concluding a sharing agreement due to the aforementioned reasons the present. Thus, a water use and management regime following the principles, norms, rules, and decision-making procedures listed here, will prepare the necessary ground to reach an agreement for equitable and efficient utilisation of the Euphrates-Tigris river system.

On the other hand, in the field of water development, management and use, the three countries can exploit the potential areas for co-operation by benefiting from the experience and practices of one another, and develop these into common practice. Under the recent promising developments between Turkey and Syria, the GAP, which once constituted a bone of contention in regional politics, is gradually becoming a source of co-operation for development-related activities. Hence, in 2001 the GAP-Regional Development Administration (GAP-RDA), the major co-ordinating agency for water based development related activities, took some useful steps to initiate contacts with Syria by sending a delegation to that country on the invitation of the General Organisation for Land Development (GOLD), Ministry of Irrigation, Syria. Following this mission, a Syrian delegation headed by the Minister of Irrigation paid a visit to Turkey. As a result of these bilateral relations, a Joint Communiqué was signed between the GOLD and the GAP-RDA on 23 August 2001. This agreement envisions the co-operation of the two sides in such areas as training, study missions, technology exchange and conduct of joint projects. The agreement intends to further improve the relations between the two countries, by training of staff from both countries, and hosting specialists from Syria in Turkey for specific training activities. If such training were institutionalised, courses will be organised either in Syria or in Turkey for other Arab speaking countries as well. In fact, steps have already been taken, and a technical team from Syria has been

invited to the region to discuss the principles of implementation. This agreement between GAP-RDA and GOLD also includes provisions about 'twin protection areas'. One area from each country is to be studied, planned and implemented as a Twin Development Project that can be implemented in both countries. Hence, the agreement is designed to build up and balance the necessary institutional, technical and personal capacities. The overall goal of this agreement is to provide sustainable utilisation of the region's land and water resources and to deal with water management within a larger picture of overall socio-economic development and integration of the underdeveloped regions in Turkey and Syria.

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WATER ISSUES AMONG THE RIPARIAN STATES OF EUPHRATES AND TIGRIS TRANSBOUNDARY RIVERS

Gurer Ibrahim[248] and Bora Sonmez[249]

ABSTRACT

Turkey is a country located between Europe and Asia and has a surface area of 779 452 km^2 with a total population of about 68 million according to 1998 census. Annual rainfall in Turkey varies between 220 mm to 2500 mm with an average of 642.5 mm which corresponds to an average annual rainfall of 501 km^3. Approximately 186 km^3 of this water flows into the rivers as surface water. The Euphrates and the Tigris rivers, providing 28.5 % of all the water resources of the country, are the most important water resources in the eastern and southeastern part of Turkey. After originating in Turkey, they cross the border to Syria and Iraq. There have always been discussions on water issues among these neighboring countries. It is necessary to find an equitable and satisfactory means for allocating water of Euphrates and Tigris river system to the riparian states. At present, Iraq has the highest and Syria the lowest amount of water consumption per capita among the riparians, but compared to water rich countries all three states use a relatively small amount of water.

Key Words: Transboundary rivers in Middle East, Turkey, Euphrates river, Tigris river

1. INTRODUCTION

Turkey is a country located between Europe and Asia. There are seven geographical regions in Turkey. The climate is continental in the interior part and Mediterranean in the Aegean and Mediterranean coastal regions. The mean annual precipitation is 642.5 mm which corresponds to 501.0 km^3 of the total water volume. The figures for the surface water potential of Turkey can be stated at 186.05 Km^3 as surface runoff, the surface runoff coefficient being 37 %. 95.0 km^3 is consumable water, 25.9 km^3 is the actual consumed volume, 12.0 km^3 is potentially exploitable ground water with an allocated volume of 7.6 km^3, and the really consumed volume is 5.7 km^3.

Turkey has been divided into 26 river drainage basins to study the water resources as extensively as possible. The water and soil resources of each basin are given in Table 1 (DSI, 1999). It is also possible to get information on the size of drainage area, the specific discharge expressed in l/sec/ km^2, volume of annual runoff total in km^3 for main drainage basins of Turkey from the table. In some of the drainage basins, the construction of dams, and thus utilization of water for multiple purposes, is impossible due to topographical and geological conditions. About 91 km^3 of surface water can not be utilized because of technical and economical reasons. Thus, the volume of water which can be utilized for various purposes will 95 km^3 after the construction of all the planned water structures to regulate the

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rivers. In order to regulate the existing river system of Turkey, 730 dams (DSI, 1999) are planned to be built, but it is noted that this number may change as a result of detailed studies on the drainage basins. The Euphrates and the Tigris rivers are the most important water resources in eastern and southeastern Anatolia and constitute 28.5 % of all the Turkish potential.

2. EUPHRATES AND TIGRIS RIVERS

The water issue among the riparian states of the transboundary rivers of the Euphrates and the Tigris can be discussed referring to a series of paragraphs expressing the same idea by a different wording as "Satisfactory means for allocating water of Euphrates and Tigris river system to riparian states is to be devised if the scramble for water is not to become another item for further poisoning the relations among the neighboring states"(SAM, 1996).
The main river courses supplying most of the fresh water to the Middle East countries are the Nile, Jordan, Euphrates and Tigris rivers (MFA, 1995). Each river basin varies considerably from the others, they have their own problems requiring different solutions.
It is believed that if harnessed by modern technology, the Euphrates and the Tigris rivers have the potential to make agricultural flourish in a very short period of time. The water resources of three countries vary considerably, Iraq having the highest and the Syria the lowest amount of water per capita (Table 2) (MFA, 1996). Thus, Syria, Iraq and Turkey need to arrange the optimum use of water of Euphrates and Tigris river system, which should be equitable and should stand the test of time.

***Table 1*: The annual amount of water consumption per capita in Middle East (MFA,1996).**

Country	Iraq	Turkey	Syria	Israel	Jordan	Palestine
Water quantity m^3/yaer/capita	2110	1830	1420	300	250	100

The following points are mentioned in all meetings as the starting points for any kind of discussion, but, of course, they are not the preconditions to start the dialogue on the water issue.
Water is an important theme for peace in Middle East
Turkey is not a water rich country.
The river Euphrates is sometimes seen as a panacea for the water problems of the riparian countries.
The problems in the Euphrates-Tigris basin are a very different from the problems in the search for peace in the Middle East. The Euphrates and the Tigris rivers rise in the high mountains of northeastern Anatolia to flow down through Turkey, Syria and Iraq and join and form the Shatt Al-Arab at about 200 km before reaching the Gulf (Fig. 1.) (MFA, 1996). Turkey contributes respectively 31 km^3 and 21 km^3 to the long term annual mean water volumes for the Euphrates and Tigris (DSI,1999). The surface runoff contributions of the riparian states to the Euphrates and Tigris river system are given in Table 3 (MFA, 1996).

***Table 2*: Water and soil resources of Turkey (DSI,1999)**

Basin			Water Potentials Of Basin			Impounded Water Within The Basin		Soil Resources Of Basin	
No	Name	Area (km^2)	Annual Precipitation (mm)	Flow (km^3)	Discharge (lt/s/km^2)	Number of Dams	Impounded Water (hm^3)	Land Area (ha)	Irrigable Land Area (ha)
1	Meric Ergene	14 560	604	1.33	2.9	21	1 817	1 095 320	1 077 992
2	Marmara	24 100	728.7	8.33	11	58	2 8 94.5	865 704	729 957
3	Susurluk	22 399	711.6	5.43	7.2	26	3 848	850 046	755 934
4	North Aegean Basin	10 003	624.2	2.09	7.4	15	797	367 479	316 348
5	Gediz	18 000	603	1.95	3.6	16	3 565.9	667 207	623 403
6	K. Menderes	6 907	727.4	1.19	5.3	17	1 697.7	223 437	194 799
7	B. Menderes	24 976	664.3	3.03	3.9	22	2 739.9	104 296	907 383
8	West Mediterranean	20 953	875.8	8.93	12.4	25	1 830	437 356	406 601
9	Antalya	19 577	1 000.4	11.06	24.2	14	2 858	451 224	448 111
10	Burdur Lakes	6 374	446.3	0.5	1.8	9	161.7	251 403	249 484
11	Akarcay	7 605	451.8	0.49	1.9	3	172	364 411	359 938
12	Sakarya	58 160	524.7	6.4	3.6	45	6 827.9	2 814 341	2 681 137
13	Western Black Sea	29 598	811	9.93	10.6	28	2 784	855 008	640 557
14	Yesilırmak	36 114	496.5	5.8	5.1	44	6 287.9	1 617 206	1 401 213
15	Kızılırmak	78 180	446.1	6.48	2.6	78	23 774.3	4 049 796	3 761 142
16	Konya Closed Basin	53 850	416.8	4.52	2.5	25	2 800.8	2 182 762	2 134 915
17	East Mediterranean	22 048	745	11.07	15.6	11	10 173.5	438 281	327 790
18	Seyhan	20 450	624	8.01	12.3	18	6 124.5	764 673	714 014
19	Asi (Orontes)	7 796	815.6	1.17	3.4	8	11 086.5	376 240	331 719
20	Ceyhan	21 982	731.6	7.18	10.7	27	8 229.3	779 792	713 670
21	Euphrates	127 304	540.1	31.61	8.3	89	112 193.2	4 293 793	4 111 316

22	Eastern Black Sea	24 077	1 198.2	14.9	19.5	41	1 491.6	712 575	350 717
23	Coruh	19 872	629.4	6.3	10.1	21	7 467.3	326 220	303 362
24	Aras	27 548	432.4	4.63	5.3	20	4 085.2	642 017	641 137
25	Van Lake Closed B.	19 405	474.3	2.39	5	7	608.7	436 485	433 319
26	Tigris	57 614	807.2	21.33	13.1	42	30 630.5	1 148 238	1 137 628
	Total	779 452 (1)	642.6 (2)	86.05	209.3	730	246 853.9	28 054 310	25 753 586

(1) Drainage area outside Turkey is not included. (2) Long term mean value

***Table 3*: The surface runoff contribution of riparian states to Euphrate and Tigris rivers**

State	Turkey	Syria	Iraq	Total
Euphrates	89 %	11 %	0 %	100 %
Tigris	52 %	0 %	48 %	100 %

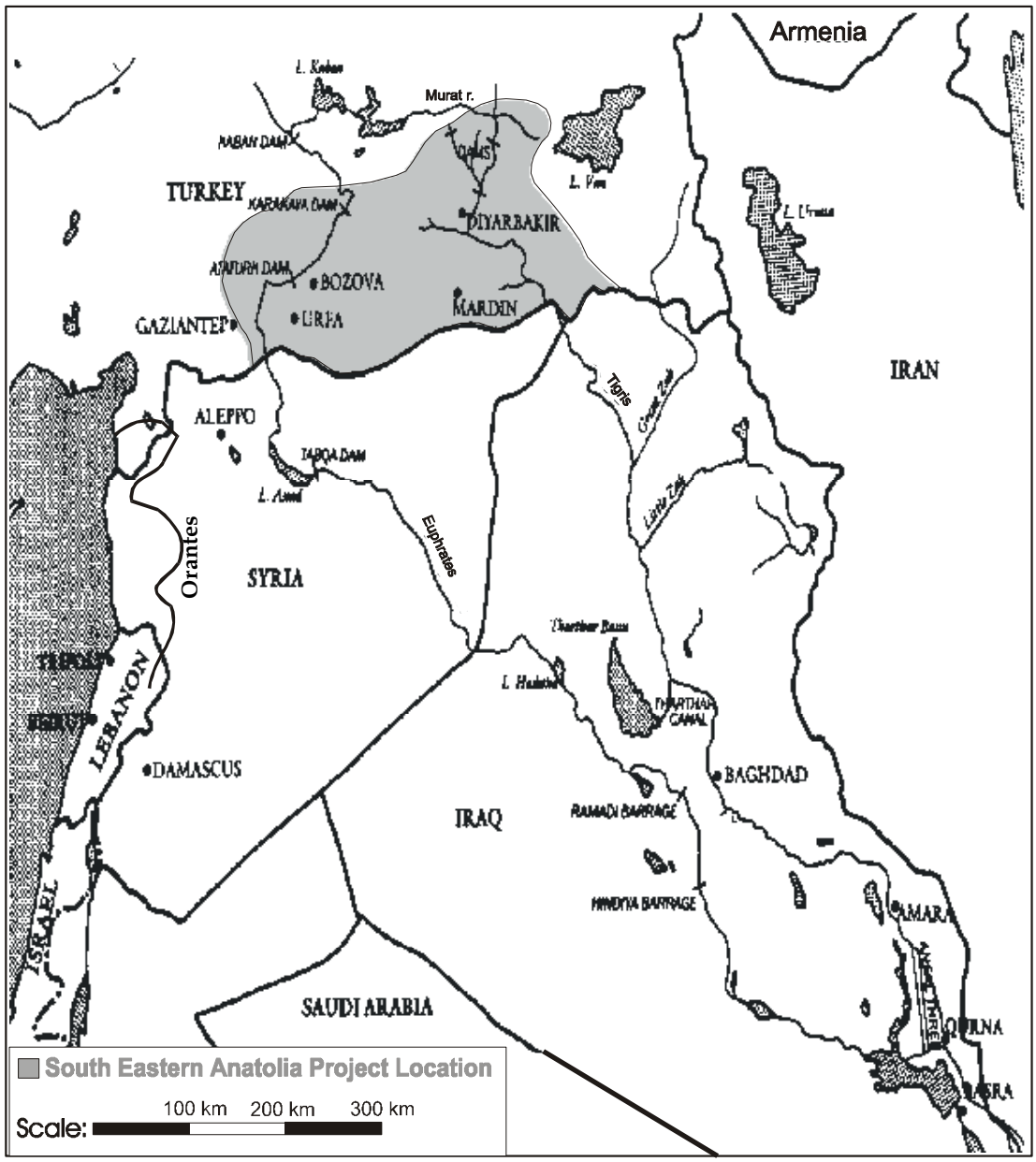

***Figure 1*: The close up view of Euphrates and Tigris river system**

3. THE PRESENT DEMANDS

It seems that the anticipated combined demand for water from transboundary rivers by riparian counties is actually greater than the total volume of the river system as could be seen from Table 4. Also, the demands of the riparian states do not seem very realistic (MFA,1996).
It is common knowledge that Turkey, more than Syria and Iraq, depends on the waters of this river system for both energy production and irrigation. Indeed, Iraq and Syria are considered as petroleum producing countries, but Turkey produces so little that part of the energy need is planned to be compensated by hydropower production.

***Table 4*: The claims by the riparian states as the percentage of annual flow.**

State	Turkey	Syria	Iraq	Total
On Euphrates	52 %	32 %	65 %	149 %
On Tigris	14.1 %	5.4 %	92.5 %	112 %

In the eastern and southeastern part of the country, the agricultural industry and the percentage of the population involved in it are much higher than in Syria and Iraq, and therefore they need more water. Turkey is said to have seven times more irrigable land in the river system basin than Syria, and out of 2.5 million ha, 1.7 million ha high quality land is planned to be irrigated by the water of the river system of Euphrates and Tigris within the Southeastern Anatolian Project (GAP) (see Fig. 1.). Syria plans to irrigate 770 000 ha of her land by the water of Euphrates but due to low lying topography and high content of salt and gypsum of the soil, most of the water is believed to be wasted. Iraqi's irrigable area is larger, but topographical conditions make it more difficult to build dams on the river system in Syria and Iraq. At present, Turkey uses a very small portion of the water of the Tigris. In Iraq, part of the water of Tigris river is diverted to Euphrates after having been used for irrigation (Fig. 2.). If the waters of the Euphrates and the Tigris were combined in one river system concept, it is believed that it will be possible for all three countries to apply their irrigation plans along the Euphrates river.

4. SOUTHEASTERN ANATOLIAN PROJECT GAP

For decades, the southeastern part of the Anatolian peninsula was the least economically developed region of Turkey. Turkey started the GAP project in the 1960s with the intention to harness the hydropower potential of the Euphrates and Tigris rivers. The Southeastern Anatolian Project is said to be one of the biggest projects about the utilization of irrigated water resources. It covers an area of 74 000 km^2, including the plains lying between the rivers of Euphrates and Tigris, and having a population of 5 275 000 which is about 9 % of the national total (See Fig. 1.). GAP is a group of thirteen projects and has numerous purposes: irrigation, hydropower, domestic water supply and flood control. With the full development of 22 dams and 19 hydropower plants, the irrigation of 1.7 million ha of land, and a capacity of 75 % of the present capacity of the country, Turkey will produce 27.3 TWh energy (DSI, 1999).

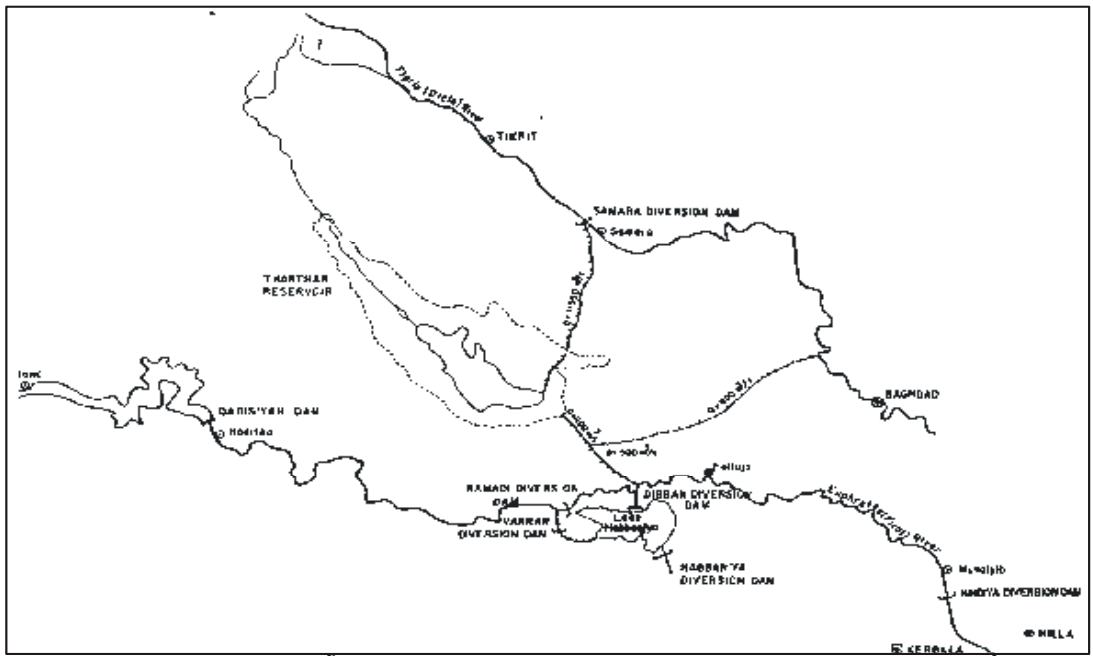

***Figure 2*: The close up view of Tharthar project ;diversion from Tigris to Euphrates**

5. DIALOGUE ON WATER

The most important institutional forum among the riparian states is the Joint Technical Committee (JTC), set in 1980 by Turkey and Iraq to discuss the water issue. Syria joined the JTC in 1983. The committee held 16 official and ministerial level meetings since its beginning (MFA, 1996). With the signing of a protocol in 1987, Turkey committed itself to provide a minimum water flow to Syria of 500 m^3/s, and fulfilled its responsibility even in the most difficult situations like impounding water in the reservoir of the Ataturk dam. In 1990, during the filling of the Ataturk dam, Turkey notified Syria one month beforehand, thus following the protocol. A 768 m^3/sec flow was released from the Euphrates in the month prior to filling, and during the filling of the reservoir an extra of 60 m^3/sec flowed into Syria from downstream of the reservoir. On average, a 509.12 m^3/sec flow was released from the river Euphrates to Syria between 23 November 1989 and 13 February 1990,.

In 1995, the annual average flow of the Euphrates river was computed as 830 m^3/sec, and in the first half of 1996,Turkey released a flow varying between 1147 m^3/sec and 1684 m3/sec, which was far above the amount of water specified by the protocol. According to latest computations of the Turkish State Hydraulic Works experts, a 500 m^3/sec flow is to be released in the months of August and September in normal years when the rainfall is almost at the level of the long term average value. In the case of dry years, it will be difficult to reach this value in the period from June to September (Gurer, 1996).

5.1. The Perspectives Of Syria And Iraq

Syria and Iraq bring up the following points related to the water issues of the Euphrates and Tigris rivers:
Turkey failed in informing her neighbors in advance about her plans to build dams and did not follow the customary practices of international law on water courses.
The hydropower projects built on the Turkish side, reduce the amount of in flowing water to Syria and harms in this way the farming on the Syrian side.
Turkey releases polluted water across its boundaries (SAM,1996).

5.2. The Perspective Of Turkey

In connection with the perspectives of Syria and Iraq listed in the above paragraph, Turkey emphasizes the following points:

At the beginning of each of the JTC meetings, Turkey provided complete data on Euphrates and Tigris rivers.
Hydropower dams like Keban, Karakaya and Atatürk regulate the water levels of the Euphrates and sharpen the fluctuations between different seasons. After its regulation of the Euphrates, Turkey provides a 500 m^3/sec flow to Syria and Iraq. The discharge figure is computed from the monthly mean values, but if it is impossible to release this amount during a dry month, there should be compensation during the following month. But during 2001, due to the very dry spell Turkey was not able to provide to her neighbors the total annual volume of 500 m^3/sec. The improving relations between the riparian states helped to judge the situation with understanding.
In the case of the Tigris river, there is no regulation on the river and almost all the water contributed from Turkey flows into the neighboring countries.
When studying the Euphrates, it is important to mention the use of regulating reservoirs (dams) at Birecik and Karkamis on the Turkish side, the Al-Baath dam just below the Tabqa dam on the Syrian side and the Badush dam below the Saddam Dam on the Tigris and the Bagdadi dam at the downstream of the Qadissiya dam on the Iraqi side. All these reservoirs are to protect the ecology of the downstream parts of the dams during the peak flow in the reservoirs, and to regulate and enable the country to release more water downstream whenever there is need for.
The pollution of the Euphrates and Tigris rivers can be due either to industry or irrigation return flow, but at present there is almost no industrial development which can pollute the river. Also, so little area is left open for irrigation that the return water from it is not important at all. Therefore, Syria's claim is unfounded because Turkey releases unused water to Syria (SAM,1996).
At later stages of GAP, Turkey will have completed all the irrigation projects irrigated 1.7 million ha. At that moment, a rather big return flow will go back into the river. But since Turkey is aware of this risk, the flow will be diluted with 30 % fresh water. This can easily be done with the planned regulation dams.

5.3. The Case Of The River Orontes

The river Orontes rises in the mountains of Lebanon and flows 40 km in Lebanon to continue into Syria for about 325 km before arriving in Turkey for its last reach of 88 km to the Mediterranean Sea (See Fig. 1.) (MFA,1995). In this case Syria is the upstream country, and with its dams and regulatory reservoirs it uses about 90 % of the water for irrigation and municipal water. The natural flow of the Orontes at the Turkish border is computed at 1.2 billion m^3, but before the completion of the

two impoundment structures at Zeyzoun and Kastun locations only 120 million m^3 was released. Furthermore, when two more reservoirs on the Orontes river will be completed only 25 million m^3 is expected to be released. Therefore, Turkey believes that Syrian claims over the Euphrates river can also be judged against the records on the Orontes (SAM,1996).
In June 2002, the El Zeyzoun dam, located nearby the city of Hama in Syria, suddenly released about 70 million m^3 of water. 22 Syrian lost their lives and the flood damaged some villages in Syria and cultivated land in Turkey. Thanks to their good mutual understanding, the disaster was handled by the two neighboring countries with a minimum of damage to theirmutual relations (Sabah 2002, Star 2002).

6. THE CONCEPT OF ACQUIRED RIGHTS ON WATER

Syria and Iraq claim to have acquired the right to use the water of the Euphrates. This historical claim is not acceptable. As the new water projects will be built on the rivers, the flow will be regulated and sharing conditions should be refixed. Another point is that the doctrine of acquired rights is not shared very widely elsewhere (MFA,1995, and 1996).

7. INTERNATIONAL LAWS ON TRANSBOUNDARY RIVERS

There are few international laws defining the rights and obligations of the riparian states of transboundary rivers. In this matter, we can mention several examples of the multilateral approaches of dealing with the water issue: "The Helsinki Rules on the Uses of the Waters of International Rivers" adopted in 1966, the "Complementary Rules Applicable to International resources" adopted in 1986 at Seoul, and the "United Nations Convention on the law of Non-Navigational uses of International Watercourses" adopted in1997. The treaty signed between the United States of America and Mexico in 1944, on "The Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande ", and the treaty signed between the Kingdom of Lesotho and the Republic of South Africa on "The Utilization of the waters of the Senqu/Orange River system " are examples of bilateral agreements (SAM, 1996, MFA, 1995 and 1996). The Nile Basin Initiative Shared Vision Program (SVP) project was created by the riparian states, and all their Technical Advisory committee (TAC) members provide inputs to improve transparency, proper accountability and smooth implementation of the project along Nile river (NBI Press Release, 2002).
A series of bilateral and multilateral agreements such as Ankara Agreements at 1921, 1939, 1946 and the treaty of Lausanne of 1923 have recognized the Euphrates, the Tigris and the Orontes rivers as transboundary rivers. According to the Joint Technical Committee, the rivers Euphrates and Tigris are "regional waters". The regional water rights are also studied by the United Nations to develop the guidelines to settle the conflicts. In 1970, the general assembly of the United Nations asked the International Law Commission (ILC) to develop international law on the non-navigational use of international waters by riparian countries. The text was submitted by the ILO to the UN in 1994, and the Convention was finalized in 1997, but has not entered in vigor yet. It will have no direct bearing on potential disputes between countries using a common transboundary watercourse, but it will embody the latest legal norms and guidelines on these issues.

8. WATER MANAGEMENT APPROACH OF TURKEY

The flow regime of the Euphrates and Tigris rivers is quite variable because the mean annual average flow and the difference between the Q_{max} and Q_{min} show great variations from year to year. Therefore, Turkey proposes at present a "Co-operative Water Management" approach, to consider the existing natural conditions and to deal with the issue.
In 1984, Turkey proposed a three stage plan to solve the dispute. The aim was not only to fulfill the expectations of the present generation, but also these of the future generations. This plan is based on two simple principles:

The Euphrates and the Tigris rivers form a single transboundary river system.
The riparian countries should prepare a common inventory of water and land resources to define and answer the real needs of each country. The countries should work together in a scientific way and use the same principles and methodology in collecting and interpreting the available data.

Stage One: Compiling an Inventory of Water Resources with available data on river discharges, stages, rainfall, evaporation, temperature and other related data. The quality of the data will be checked.
Stage Two: Compiling an Inventory of Land Resources of land classification. The existing drainage conditions, appropriate crop pattern and corresponding irrigation water requirements will be defined.
Stage Three: Analysis of Water and Land Resources. In this matter, it will be necessary to define the potential method of irrigation with a minimum loss of water, to accord the data of stage one and two, and also to modernize and upgrade the existing irrigation networks according to international norms and standards.

9. CONCLUSION

When all three riparian countries will have reached a common agreement, they will obtain the equitable and optimal use of the waters available in the region. That means that the Euphrates, Tigris and Orontes river system will help to solve the water problems of Turkey, Syria and Iraq. In order to reach an agreement on the water issue of these river systems, and to assess the water and soil resources and the needs of all the riparian states, it is very important to use the same social, scientific and engineering criteria adopted internationally.

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WATER: FROM CONFLICT TO COOPERATION
THE CASE OF PALESTINE AND ISRAEL
Article 40 Between Theory and Practice

Aiman JARRAR[250]

1. INTRODUCTION

Over the last seven years, implementation of Article 40 of the Oslo II Agreement has been restricted and extremely slow. Decision making within the Joint Water Committee (JWC) has mostly been unilateral and dominated by Israel. The dominant factor in the Israeli evaluation and rejection of Palestinian projects has been the "no harm principle." In theory, if goodwill were present and practiced, Article 40 would have formed a good base for cooperation between the two sides. In practice, however, implementation of Article 40 has done little to further the development of the water sector in Palestine during the interim period.

2. COOPERATION IN THE INTERIM PERIOD

The Declaration of Principles signed on September 13 1993 (Oslo I) was the first bilateral agreement between the Palestinians and the Israelis. According to this agreement, water resources issues would be discussed by the Permanent Palestinian Israeli Committee for Economic Cooperation. The parties agreed to prepare plans for defining water rights and equitable use of water resources. However, the agreement did not identify or establish any explicit water rights for the Palestinians.

A basis for cooperation in the field of water and sewerage was established and framed after the signing of the Oslo II Agreement on September 18 1995. A JWC was formed under clause II of Article 40. "In order to implement their undertakings under this article, the two sides will establish, upon the signing of this agreement, a permanent Joint Water Committee (JWC) for the interim period, under the auspices of the Civil Administration Committee." Article 40 is the basis for water sector planning and project implementation during the interim period until final agreement is reached. The original plan states that the interim period should not exceed five years from the date of signing of Oslo II (September 2000).

3. THE NEED FOR COOPERATION

During the period of the interim agreement, the geographical situation means that the territories of the Palestinian Authority and Israel are situated on the West Bank and Gaza Strip in an intertwined layout of areas, A, B, and C. The borders between the two sides' territories are to be determined in the final status negotiations: it is clear that both will occupy areas overlying the Mountain Aquifer, which is the main source of groundwater for both sides. The Mountain Aquifer consists of three basins, one flowing east to the Jordan Valley, one west to Israel, and the third to the northeast with outlets in the Beit-Shean and Yezrael Valleys.

Israel lies downstream of the West Bank, in terms of the flow of both surface and groundwaters. For Israel, the Yarkon–Taninim Aquifer is a major source of high

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quality drinking water, which is tapped largely to the west of the 1967 border between the West Bank and Israel. Increased water use in both the West Bank and Israel will affect its flow and water level, and pollution originating in this area has a significant effect on both surface and groundwater quality.

The Gaza Strip is situated over the southern part of the Coastal Aquifer, to the south of the Israeli part. Flow is largely perpendicular to the coastline. Increases in pumping from the Israeli wells along the borders of the Gaza Strip will cause great harm to the quality and flow of groundwater to the strip.

The presence of Israeli water resources and distribution systems in the West Bank and Gaza, and some Palestinian communities' dependence on Israeli systems for their water supply, add further important reasons for cooperation. With regard to all the above-mentioned points the agreement on water and sewage is quite detailed in its provisions on quality, quantity, and management issues.

4. CURRENT SITUATION IN PALESTINE

The present situation in the water sector in Palestine, and the challenges to be faced after seven years of cooperation in management and planning in the water and wastewater sector, may be summarized as follows:

- Water resources in the region are extremely scarce, disputed, mainly controlled and utilized by Israel, and increasingly costly to develop, limiting opportunities for regional transfer. Water resources, particularly in the Gaza Strip, fall well below the threshold defining stress due to water scarcity.
- Water demand is continuously growing due to population growth, economic development, and rising standards of living. The current population – about 2.2 million in the West Bank and 1.3 million in the Gaza Strip – is expected to double within twenty years due to natural growth and influxes of returnees.
- Water supply and sanitation services are inefficiently delivered, and are inadequate in respect of quantity, quality, and reliability. Coverage is limited. Around 12 percent of the population, living in 254 communities, are un-served. Of the served population, 66 percent suffer from severe water shortage in summer, being supplied with less than 50 litres per capita per day (l/c/d). The present consumption of 58 l/c/d in the West Bank and 81 l/c/d in Gaza Strip falls far below acceptable standards.
- There is insufficient control on water infrastructure development, and water losses in the system are excessive. In most communities, water that is unaccounted for ranges between 30 and 50 percent of the available supply.
- Wastewater treatment is mostly unavailable, inadequate, or not functioning. Wastewater is potentially a significant resource, but it is not yet reclaimed and utilized satisfactorily.

5. REMARKS ON THE PERFORMANCE OF THE JOINT WATER COMMITTEE

Despite the basis of goodwill upon which the Agreement was reached and signed, and the fact that "both sides agreed to coordinate the management of water and sewage resources and systems in the West Bank during the Interim Period," the performance of the Israeli side in the JWC is not considered to be based on goodwill, for the following reasons.

5.1. Conduct of JWC Meetings

Delays in the JWC meetings have greatly impeded the development of the Palestinian water and sewage resources and systems, since according to Article 40 every water and sewage project, including the rehabilitation of existing resources and systems, requires its prior approval. Donor funding commitments are also dependent on the approval of this committee.

Another obstacle was placed by the Israeli side with regard to project approval in Area C. This area, which is totally controlled by the Israelis, constitutes 58 percent of the total area of the West Bank. Projects approved by the JWC require additional approval from the Israeli Civil Administration (CA); this requires the approval of twelve offices inside the administration, which is a lengthy procedure, and rejection by one office can overrule the approval of the others. Objections by the CA can overrule approval by the JWC. There is no item in the Agreement that requires the CA's approval of the projects, however. The JWC – with the CA representative present at its meetings – places another obstacle in the path of the development of the water sector.

It has been noted at meetings of the JWC that it proceeds without delay when the Israelis need to get approval for their projects in the West Bank. The Palestinians take the opportunity of seeking approval for their projects as a condition for approving the Israeli projects, but when it comes to considering Palestinian projects there is always a reason for the meeting to be delayed. When the meeting is adjourned after a continuous delay, most of the projects will remain pending, either in the JWC or in the CA, for a variety of unjustified reasons.

5.2. Status of Water Infrastructure Development Projects

From the establishment of the JWC in 1996 to November 2001, 241 Palestinian water supply development project proposals were submitted. Out of these, 184 projects, most of them rehabilitations of existing systems, were approved and the remaining fifty-seven projects were either rejected or are still awaiting a decision. Of 200 well projects submitted – eighty of them for the rehabilitation or replacement of pre-existing wells drilled in the period 1950–67 – only eighteen were approved. Out of the 120 projects for drilling new wells only fifty were approved, nineteen of them test-monitoring wells. Out of fifteen wastewater treatment plant projects submitted, only five were approved and the remaining are pending.

5.3. Meeting Unfulfilled Palestinian Needs

As stated in the agreement, the remained quantities required to meet unfulfilled Palestinian needs – 41.4–51.4 million cubic meters (MCM) – "shall be developed by the Palestinians from the Eastern Aquifer and other agreed sources in the West Bank. The Palestinians will have the right to utilize this amount for their needs (domestic and agricultural)." Over the past six years, the Palestinians have developed only 12 MCM/Y. While another 15 MCM/Y is currently under development, the Israelis have restricted this development to the Eastern Basin, and mainly to the southern part of the basin due to the widespread Israeli wells in its middle and northern parts. The Israelis are restricting the development of the Eastern Basin through the CA and its various red lines – nature reserves, blue lines of settlements, Israeli wells, and militarized areas cover a large area in the basin, thus restricting sustainable utilization of its water resources. Over two years ago

the Palestinians applied to drill two wells, near Ramallah, in the Eastern Basin to meet the increasing demand for water, but these applications are still pending in the JWC.

Recently the Israelis approved the drilling of three production wells in the Northeastern Basin to supply around twenty-two unserved Palestinian communities in the Nablus and Jenin areas. The Western Basin is completely closed to the development of additional production, however, and even to rehabilitating or replacing existing wells closed due to technical problems.

5.4. Protection of Water Resources and Systems, and the Reimbursement Principle

Despite the joint declaration by both sides of the JWC to their respective media stating that water should be kept outside the current circle of violence, during the two years of the Intifada, the latest invasion, and the military actions accompanying it, the Israeli army sabotaged and seriously damaged parts of the developing Palestinian water and wastewater resources and systems. The estimated direct cost for rehabilitation is around $15 million, not including indirect costs and the value of spoiled water. The Israelis refused to reimburse the Palestinians for the damage caused by their army or even to apologize for these actions, which violate the signed agreement. Instead, by stating that the principle does not apply in this particular case, they again interpret the agreement in the way they wish to.

5.5. Adjusting the Utilization of Resources According to Variable Climatological and Hydrological Conditions

This principle is applied only to the Palestinians. Previous drought years have seen a 10 percent decrease in the quantities of water supplied to the Palestinian communities through the Israeli water company Mekoroth, while the settlements inside the West Bank maintained constant levels of supply (350 l/c/d). Pumping from the basins remained the same for both sides.

5.6. Exchange of Data on Existing Extractions, Utilization, and Potential of the Three Basins

The Palestinians do not have access to data on the joint watercourse basins inside the green line, and are not allowed to perform field studies inside the green line. Palestinians obtain unreliable data from Israeli publications, yet the Israelis have full access to the Palestinian data through the JWC's Joint Supervision and Enforcement Teams (JSETs) and the JWC itself. Over the last two years the JSETs have not been performing their work due to security concerns on the part of the Israelis, and to the Palestinians' current transport problems, including closures of roads and bans on movement by car. This has led to a major shortage of water data needed to estimate the potential of the basins. Despite the Palestinians' continuous requests for Israel to resolve the data collection problem, no action has yet been taken.

5.7. Cooperation in Developing Mechanisms For Dealing With Water and Sewage Emergencies and Crises

Situations of this kind may arise as a result of natural or anthropogenic events. Due to the problems of the past two years and the closure of roads in the West Bank,

most water sector development projects are either delayed or on hold. While the Palestinian side requested Israeli help in this matter, nothing was gained from this except the continuous distribution of chlorine to domestic wells and coordination with the CA – a difficult and lengthy process – in addressing water related issues.

5.8. Preventing the Deterioration of Water Quality

Israeli settlements inside the West Bank are a major source of pollution to water resources since they dispose of untreated wastewater in the recharge areas of the aquifer basins. The Israelis require very high standards of the Palestinians – which they do not themselves observe – in the specification of treatment plants, which the Palestinians cannot afford to operate or maintain.

5.9. Sustainable Use of Water Resources

Sustainable use must consider the future in terms both of quality and quantity. Field evidence from the Palestinian wells in the Western Basin, and a decline in water level, indicates that the Israelis are overpumping from their wells, which are situated downstream along the green line. Overpumping from Israeli wells in the Eastern Basin has dried many Palestinian springs downstream of them.

5.10. Conclusion

It clear that most of the principles of Oslo II were tailored to be implemented by the Palestinian side to ensure continuous Israeli control, at least for the interim period. The two meetings of the final status negotiations conducted two years ago before and during the Camp David meetings brought nothing new in the Israeli position with regard to Palestinian water rights. Israel still refuses to accept implementation of the International Customary Law, offering instead an increment of 30 MCM/Y in the Palestinians' rights of use.

6. PROSPECTS FOR GENUINE FUTURE COOPERATION

Today, part of the problem involved in resolving the water dispute is that the Oslo Agreement institutionalized almost total Israeli control over Palestinian water use and planning, as well as a discriminatory allocation system.

Continued real cooperation with Israel in the water and wastewater sectors is conditional on the recognition of Palestinian rights to surface and groundwaters in the West Bank and Gaza Strip, in addition to the water of the Jordan River and the seasonal flow of the eastern wadis of the Gaza Strip that flow to the Strip, according to an equitable and reasonable utilization as stated by the international customary law. This will result in full legal sovereignty over the land and water resources that lie within the political borders of the West Bank and the Gaza Strip, and compensation both for damage to Palestinian water resources caused by the Israeli occupation and for the Palestinian water utilized by Israel during the years of occupation.

As a result of the hard lessons learned by the Palestinians from the implementation of Article 40, future development and management of water and wastewater resources and infrastructure within the political borders of the West Bank and Gaza Strip will lie beyond the scope of future cooperation between the two sides.

It is hoped that he Joint Monitoring Committee to be established to facilitate cooperation and ensure that both parties comply with agreements governing rights to water from the joint watercourses and measures for protecting water quality will be accepted by the Palestinians.

The Palestinians will be ready to discuss and participate in regional and international cooperation to increase the availability of water, and to develop and protect available water resources. They will also be willing to supply the Israelis with water, under a limited commercial agreement, if there is a surplus of water.

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WATER: FROM CONFLICT TO COOPERATION THE CASE OF PALESTINE AND ISRAEL

Aiman JARRAR and Yousef AWAYES[251]

1. INTRODUCTION

The Middle East has a long history of conflict and dispute over its limited water resources, with the Palestinian–Israeli conflict at its core. A main aim for Israel was achieving control over water resources, and this was accomplished as a result of its military success in the 1967 war.

The Declaration of Principles signed on September 13 1993 (Oslo I) was the first bilateral agreement between the Palestinians and the Israelis, and a first step in the long road to peace. According to this agreement, water resources issues would be discussed by a permanent Palestinian–Israeli Committee for Economic Cooperation. The parties agreed to prepare plans for water rights and the equitable use of water resources. However, the agreement did not identify or establish any explicit water rights for the individual parties.

The talks between the Israelis and the Palestinians were characterized by the political asymmetry between an occupying power and an emerging autonomous entity. Article 40 of Annex III of the Oslo II Agreement, signed on September 18 1995, was the result of intensive discussions on water. It formed the basis for water sector planning and project implementation during the five-year interim period, by the end of which a final agreement was supposed to be reached.

Principle 1 of Article 40 of the Oslo II Agreement is the most significant element of the Agreement here. It states for the first time that "Israel recognizes Palestinian water rights in the West Bank." These rights are to be settled in the permanent status agreement after the final negotiations. The Israeli government explicitly acknowledged the Palestinians' sovereign right to water in the West Bank. Due to the complexity of the situation, however, and the significance of water to both sides, water issues have been deferred to the final status negotiation, together with other critical unresolved issues such as Jerusalem, borders, refugees, settlements, and security.

Although their pretext is one of security, Israel's desire to control water resources is actually one of the main reasons why it is reluctant to transfer more territories to the Palestinian Authority. During thirty-five years of occupation, a growing population and ongoing settlement expansion have increased the burden on the limited water resources and worsened already fragile political relations.

2. HISTORICAL BACKGROUND

With the occupation of the West Bank, the Gaza Strip, and the Golan Heights in June 1967, Israel greatly improved its hydrological position. The occupation of the Golan Heights gave Israel control over Lake Tiberius and most of the headwaters of the Jordan River, while their control over the West Bank provided access to the lower part of the Jordan River and to three major aquifers. Soon after the occupation, Israel issued Military Order No. 92 on August 15 1967, transferring authority over water resources to the area military commander. This was later

[251] Palestinian Water Authority

followed by Military Order No. 158 (November 19 1967) forbidding unlicensed construction of new water infrastructure, and Military Order No. 291 (December 19 1968) confiscating all water resources, declaring them state property. In 1978, Israel confiscated fifteen Palestinian wells that were used for domestic supply; currently Palestinians are purchasing part of their water requirement from these wells.

In 1982, the Israeli water company Mekoroth took control of water resources and supply. The Palestinians' problems were not taken into account and a catastrophic situation developed in some Palestinian wells and springs, which dried up because of widespread drilling and over-pumping from deeper wells for Israeli use. An additional burden for the Palestinians was a reduction in abstraction quotas for their wells by 10 percent, imposed in 1986. Additionally, loss of water due to the poor condition of the water distribution system is estimated at 30–50 percent of the total quantities supplied. This poor situation developed during the years of occupation because no serious development of the water infrastructure took place.

3 INTERNATIONAL WATERCOURSES IN THE CONTEXT OF INTERNATIONAL LAW

The region's water crisis is not merely a question of supply. It has always been linked to power structures, which maintain inequalities among those who share water. To date, all negotiated attempts at reallocation of water supply have failed because they have not been based on the principle of the right to equitable and reasonable utilization. According to international law, Palestinians should have full sovereignty over the ground and surface waters of the Eastern Aquifer, and at least equitable water utilization rights over the Western and Northeastern Aquifers, as their groundwaters are mainly recharged, and their surface waters flow, almost entirely from the West Bank. They should also enjoy equitable water utilization rights in the Jordan River system, and in the eastern wadis that flow to the Gaza Strip, in addition to equitable utilization of the southern part of the Coastal Aquifer.

3.1. Ruling Principles

International law provides the normative framework and procedures for coordinating behavior, controlling conflict, facilitating cooperation, and establishing shared values among civilized states in their relationships with one another.

3.2. International Law of Water Resources

The international law of water resources is still at an early stage of development, but the following guidelines offered by three international bodies offer a powerful and useful basis for future water treaties. Unfortunately, these guidelines have yet to be widely adopted in nation-states' practice in this field.

1. The *Institute de Droit International* offered two resolutions concerning shared water resources:
   - The Salzburg Resolutions (1961) declare that a state's right to make use of shared water is limited by the right of use of other riparian states.
   - The Athens Resolutions (1979) declare that states must ensure that activities within their borders cause no pollution to the waters of international rivers and lakes beyond their boundaries.

2. The *International Law Association* adopted the Helsinki Rules (1966) on the use of the waters of international rivers, reflecting the following principles:
   - An entire drainage basin is an indivisible hydrological unit. It must be managed as a single unit in the development of any portion of its waters in order to ensure maximum utilization.
   - Sovereignty is restricted through a rule of equitable utilization. States are entitled to a reasonable and equitable share in the beneficial value of the waters of an international basin. An existing use may have to give way to a new use, however, in order to achieve an equitable apportionment of shared water resources.
3. The *International Law Commission*, a United Nations-affiliated body designated to codify customary international law, submitted sets of draft articles to the UN General Assembly in 1994. These led to the Convention of the Law of Non-Navigational Uses of International Watercourses, which was adopted on May 21 1997 by the General Assembly of the United Nations.

The 1997 Convention may be taken to represent de facto international law. It is worth noting that the convention does not provide definitive rules for water allocation, but only a list of factors to be taken into account and adopted under specific local conditions.

Most international water treaties have been based upon the international law doctrine of "equitable and reasonable" use. This rule puts the emphasis on the allocation of water quantities. The UN Convention makes clear that the obligation to avoid significant harm is subordinate to the principle of equitable utilization.

In the case of the West Bank and the Gaza Strip, Israel has refused to comply with the above-mentioned rules, which constitute part of the international customary law, by claiming that Palestine is not yet a state.

3.3. Rules and Conventions Applicable to Belligerent Occupation

As an occupier, Israel has not complied with the rules applicable to a belligerent occupation that are encompassed in the Hague Regulations of 1910 and the Fourth Geneva Convention of 1949. These rules oblige a belligerent to safeguard the natural resources of the occupied country, and to provide the citizens with their needs from these resources. Since the beginning of the occupation, Palestinian water use has been controlled by laws, rules, and military orders imposed by the state of Israel. The enduring occupation has persistently deprived the Palestinians of their equal rights in the use of international water resources.

3.4. UN General Assembly and Security Council Resolutions

The UN General Assembly and Security Council have adopted, and repeatedly reaffirmed, numerous resolutions in relation to the Palestinian people's right to self-determination. An important aspect of that right is permanent sovereignty over natural resources, including water. All UN resolutions have been guided by the principles of the UN Charter, reaffirming the applicability of the Fourth Geneva Convention on the Protection of Civilian Persons in Time of War of August 12 1949 to the occupied Palestinian Territories, including Jerusalem and other Arab territories occupied by Israel since the 1967 war. Furthermore, they have expressed continuous concern regarding Israel's exploitation of natural resources, including the impact of Israeli settlements on Palestinian and other Arab resources, and especially the confiscation of land and the forced diversion of water bodies. The

UN Security Council Resolution 465 of 1980 affirmed that any Israeli change to the geographic or demographic nature of the occupied Palestinian territory, including East Jerusalem, contravenes the Fourth Geneva Convention and any other resolutions adopted by the Security Council with regard to these aspects.

3.5. Basis of the Peace Process

The entire peace process was based on the UN Security Council Resolutions 242 and 338, and the principle of "Land for Peace."

4. COMPARISON BETWEEN THE UN CONVENTION AND ARTICLE 40 OF OSLO II

Article 40 of the Oslo II Agreement fell far short of fulfillment of Palestinian water rights and needs. Although it recognized Palestinian water rights its terms were broad, and there was no elaboration on the nature of these rights or the principles governing the rights and obligations of both sides. Comparing the UN Convention and Article 40 (even if it applies only for the interim period), it will be clear that the latter guaranteed Israel continuous control of the water resources of the West Bank and is an obstacle to the development of water and sewage resources and infrastructure. At the same time, however, it set out a good basis – had it been developed and implemented by both sides – for future cooperation in the water and sewage sectors.

4.1. UN Convention Part I: Scope and Watercourse Agreements

Protection of water quantity and quality, and of the environment, are integral elements of the Oslo II Agreement. It is more comprehensive in scope and more detailed than the UN Convention, and states: "While recognizing sovereignty in their respective areas, both sides agree to coordinate the management of water resources and systems in the West Bank" to attain "sustainable use in the future in both quantity and quality."

The agreement established a Joint Water Committee (JWC), whose size is not specified but which must include equal numbers of representatives from both sides. One of the main functions of the JWC is to approve all new water development projects in the area under its jurisdiction, from the planning stage onward. All decisions of the JWC are to be "reached by consensus, including the agenda, its procedures and other matters." The agreement also established enforcement arms of the JWC, termed Joint Supervision and Enforcement Teams (JSETs). There were to be no less than five teams, each with at least two members from each side and with costs shared equally. "The JSETs shall operate, in the field, to monitor, supervise and enforce the implementation of Article 40, and to rectify the situation whenever an infringement has been detected." The JSETs must report on their findings and operations to the JWC.

While Oslo II is stronger than the Convention in terms of scope, it is weaker with regard to watercourse agreements. It does not include definitions of the resources to which it applies; it deals with specific elements of the regional water resources, leaving other parts that may be of interest to the two sides outside the scope of agreement.

4.2. UN Convention Part II: General Principles

The Oslo II Agreement makes no specific reference to equitable and reasonable use; in principle it aims to maintain the existing levels of aquifer utilization while taking into consideration the need for additional water for the Palestinians. The Agreement provided only 28.6 mcm/y for immediate domestic use, and estimated the future needs in the West Bank at 70–80 mcm/y.

The Oslo II Agreement is both comprehensive and specific in terms of the effects of the two parties' water usage on each other, and takes into consideration the need to "coordinate the management of water and sewage in the West Bank, maintaining the existing quantities and utilization from resources, preventing the deterioration of water quality and treating, re-using or properly disposing of all domestic, urban, industrial and agricultural sewage." The Agreement states that "each side shall take all necessary measures to prevent any pollution or contamination of the water and sewage systems, including those of the other side," and goes beyond that to direct "each side to reimburse the other for any unauthorized use of or sabotage to water and sewage systems situated in the areas under its responsibility which serve the other side." This is more specific, both in terms of intent and implementation, than the UN Convention, which includes a general reference that obliges due diligence in not causing significant harm to other users. However, it does not bar activities that might cause such harm, and is silent on issues of compensation when harm is caused by one side to the other.

The Agreement goes beyond the UN Convention with regard to regular exchange of data and information, and the obligation to cooperate in achieving optimal utilization and adequate protection of international water resources. The establishment of the JWC reflects this principle. The Agreement goes into even greater detail on this point: the responsibilities of the JSETs include setting up supervisory control and data acquisitions (SCADA) systems for monitoring and operation of water supply and sewage systems.

The UN Convention does not establish any ranked priority for different kinds of use. However it does state that, in the event of conflict between users, special regard must be accorded to the requirements of vital human needs. Oslo II preserves the existing utilization regime and takes into consideration the need for additional water for Palestinian domestic use. The Agreement makes no provision for dealing with the requirements of vital human needs when conflicts among users arise.

It is clear that the Agreement is weaker than the UN principles with regard to equitable and reasonable utilization, but stronger in terms of the obligation not to cause harm, and in the scope of information and data exchange, while it conforms with the principles in reinforcing the obligation to cooperate and the relationships between different kinds of uses.

4.3. UN Convention Part III: Planned Measures

The Oslo II Agreement subjects all development of water resources and systems to prior JWC approval – "plans for construction of new water and sewage systems or modification of existing systems require the prior approval of the JWC" – without specifying the length of the advance notice required. The UN Convention calls for notification concerning planned measures with possible adverse effects. The Oslo II Agreement is somewhat similar to the Convention with regard to planned measures, and leaves the door wide open with regard to timing.

4.4. UN Convention Part IV: Protection of Water Resources and Sewage Systems

The subject of protection, preservation, and management is covered well by the Agreement. The sections relating to water refer only to water quality in general, without spelling out the need to preserve ecosystems or the broader environment. Oslo II spells out the need to prevent deterioration of water quality. It calls for water resources to be utilized in a manner that ensures sustainable use, and to "take all necessary measures to prevent any harm to the water and sewage systems."

The functions of the JWC are based on coordinated management, and on protection of resources and water and sewage systems. The agreement specifies that "existing regulations concerning measurements and monitoring shall remain in force until the JWC decides otherwise." The agreement calls for cooperation in many areas, such as water-related technology transfer, research and development, training, and setting of standards and protection of water quality. The Agreement does not deal with marine environmental protection issues, such as the introduction of alien or new species, in the manner of the UN Convention.

With regard to the regulation of water flow, the Agreement calls for cooperation in the development of water and sewage related projects, and it commits the parties to protect installations against deterioration and damage. However, there is no reference to the magnitude of costs or how they would be allocated.

In conclusion, it is noted that the Agreement does not spell out the need to protect and preserve ecosystems, for instance by monitoring the introduction of alien or new species. It conforms with the UN Convention with regard to the regulation of water flow, while it exceeds the Convention with regard to prevention, reduction, and control of pollution, stipulating management techniques, and enjoining protection of installations.

4.5. UN Convention Part V: Harmful Conditions and Emergencies

The Oslo II Agreement explicitly states the parties' individual and joint responsibilities in the prevention and mitigation of harmful conditions, as required by the UN Convention. However, the agreement does not include reference to specific actions required in emergency situations, nor to the development of mechanisms to deal with water and sewage-related emergencies, of natural or human origin, and other extreme conditions as required by the UN Convention. It is assumed that the JWC will deal with such emergencies.

While the agreement conforms to the UN Convention with regard to prevention and mitigation efforts, it does not mention any specific actions to be taken in emergency situations.

4.6 UN Convention Part VI: Miscellaneous Provisions

This part of the Convention focuses on information vital to national defense, and on settlement of disputes. The Agreement does not refer to the first topic, in the absence of a firm resolution to the Arab–Israeli conflict. The subjects of third-party mediation, arbitration, or fact-finding are not mentioned in the Agreement. Oslo II calls for all decisions of the joint oversight bodies to be reached by consensus, including agreement on the agenda, its procedures, and other matters.

Nowhere else in the Oslo Agreement generally is there any reference to arbitration or third-party dispute resolution mechanisms, although the JWC is obviously entitled to seek advice or involvement from external entities if its members agree to do so.

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AN AGREEMENT BETWEEN THE SYRIAN ARAB REPUBLIC AND THE LEBANESE REPUBLIC FOR SHARING THE GREAT SOUTHERN RIVER BASIN WATERS, AND FOR BUILDING A JOINT DAM UPON THEM

Abdul Aziz Al-MASRI[252]

1. INTRODUCTION

The distinguishing characteristic of water resources on Earth is the constancy of the annual volume; on the other hand, there are many variables that affect the actual supplies of water. Population increases are leading to increased demand for finite water resources; furthermore, some areas suffer from water shortage while others are prone to flooding. Current changes in global climatic patterns complicate these issues further.

2. WHY COOPERATION?

We should cooperate in order to achieve an equitable balance between humans, water resources, and the requirements of nature, especially since we know that more than 60 percent of world water resources are shared international waters. Cooperation among riparian states is based on many things, including:

- appropriate aims and good intentions
- technical data (on water resources, land areas, population numbers, and so on)
- a legal framework to which everyone may refer.

These three elements may be used to achieve international cooperation in these matters, and we can apply them at two levels:

- agreeing how to share international watercourses
- post-agreement cooperation concerning management, sustainability, and maintenance.

These efforts can lead to sustainable sharing of water resources. Since we cannot change geography, we should regard such cooperation as essential.

3. THE COOPERATION MECHANISM

3.1. Constitute Specialized Technical Committees

Water resources should be managed across entire basins of shared waters, facilitating calculation of the natural flow within the basin and of the volume that may be shared. Factors to be considered include:

- areas of irrigable land
- number of people who depend on the basin water

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- economic and social conditions.

3.2. The Sharing Mechanism

It is very important to adopt an international frame of reference from the sources of the relevant international law. The Convention on the Non-Navigational Uses of International Watercourses may act as a framework for comprehensive agreement, especially if translating the texts of the laws (for example, Article 6) into geometrical numbers, with the agreement of the riparian states, will lead to an equitable and reasonable sharing of joint resources.

3.3. Mechanisms for Cooperation After Agreement on Sharing

Cooperation is represented by setting up a mechanism for joint administration and implementation of measures, including periodical joint water measurements, the development of water basin resources, and controlling pollution within it. This may be achieved by a mechanism to be agreed upon among the riparian states, making use of dedicated technical and specialist committees.

4. FROM THEORY TO PRACTICE

Since Syria works in cooperation with its neighbors in Lebanon, we have applied all the stages cited above to the case of an international border river, the Al-Kaber Al-Janoubi. Joint efforts between the two nations led to the following measures:

- signing an agreement between Syria and Lebanon for sharing the waters of the river basin and constructing a joint dam on it
- establishing a mechanism for study and the implementation of measures (Annex 1) of the agreement
- setting up mechanisms for management of the basin and sharing of river water (Annex 2) of the agreement.

5. ARTICLES Of THE AGREEMENT

The Agreement's introduction invokes international law, especially the regulations of the Convention on the Law of Non-Navigational Uses of International Watercourses. With the establishment of joint relations, the results of the technical negotiations, and the Agreement's basis in the principle of cooperation, the focus lies on sharing the river basin waters in a reasonable and equitable manner. To this end, the agreement is composed of fifteen articles.

The first article defined the average annual water volume flowing through the system, using available water records from the two countries. This figure was to act as a basis for all agreements on sharing water.

- In the third article most of the relevant factors listed by Article 6 of the 1997 International Agreement, such as reasonable and equitable use, have been taken into consideration. The factor chosen to achieve equity between the two countries has been volume, expressed proportionally as a 60 percent allocation to Syria and one of 40 percent for Lebanon.
- The fourth article provides that the same proportions would apply in sharing the burdens of drought and excess water.

- The agreement is flexible, allowing each country to take advantage of its share of resources as and when required within the basin as a whole, in order to maximize benefits, minimize the transportation of waters, and make fullest use of the natural watercourses. The fifth article also adds the important proviso that the system's environment should be safeguarded.
- There is an annual excess flow that exceeds the storage capacity of the established dams in the basin. In order to benefit fully from the water-carrying capacity of the river, especially since there are sometimes periods of drought, the two states have decided to construct a joint reservoir with a storage capacity of 70 million m^3. This will ultimately be specified on the basis of the results of economic studies.
- The criteria for managing these important works were established in order to assist in sharing or obtaining access to water resources, and to build the joint dam and then manage it through a basic technical committee, which is able to form technical subcommittees as needed.

The two states have decided to settle any differences that might occur by applying the regulations of this agreement at the level of the two specialist ministers who signed it.

Of the two annexes that form inseparable parts of the agreement, one sets out the mechanism for developing and implementing the dam project; its provisions are self-explanatory (Annex 1). Annex 2 deals with international cooperation in practical terms, starting with consideration of storage, exploitation, and maintenance; some criteria are set out for handling repair and maintenance works (not singly).

6. CONCLUSION

We have seen how the Agreement uses the three elements listed in Section 4 to achieve international cooperation, both in deciding how to share international water resources and in managing this allocation. It takes into account such important issues as cooperation and equitable and reasonable distribution, and is based explicitly on regulations in international law, especially the Convention on the Law of Non-Navigational Uses of International Watercourses. It offers a practical example of the application of international regulations to an international river.

We are certain that the processes involved in sharing water can prove beneficial to communication and friendship between riparian populations. Water does not only call for international cooperation: it may also foster it.

THE AGREEMENT

As a substantiation of the joint relations between the two countries and the Arabic brotherhood, starting from the sincere cooperation between them in the field of joint international waters, and on the basis of the regulations of international law – especially the Convention on the Law of the Non-Navigational Uses of International Watercourses – an agreement was ratified by the two governments in 1997. This constitutes the solid base of a reasonable and equitable system for sharing joint international river waters.

The government of the Syrian Arab Republic and the government of the Lebanese Republic were informed of the results of negotiations held between the delegations from the two countries. They appreciated the common advantage to

both countries of sharing the water of the Great Southern River Basin in a reasonable and equitable manner, and the building of a common dam on the main course of the river at the Edlin-Nora Tahta Site. They have therefore decided to conclude this agreement to deputize:

- H.E. Eng. Muhammad Redwan Martini, Minister of Irrigation, as a representative of the Syrian Arab Republic government.
- H.E. Dr. Muhammad Abdual Al-Hammed Baidoun, Minister of Energy and Water, as a representation of the Lebanese Republic Government.

The First Article

Here we list and clarify the meaning of key words and statements used in this Agreement:

- Syria: the Syrian Arab Republic
- Lebanon: the Lebanese Republic
- The state (side) or country: Syria or Lebanon, as appropriate.
- The competent Minister: the Minister of Irrigation in Syria, and/or the Minister of Energy and Water in Lebanon
- The Great Southern River: the river separating Lebanon (to the south) and Syria (to the north)
- The Edlin-Nora Tahta Dam and Reservoir: a dam for storing water on the Great Southern River, occupying both Syrian and Lebanese territory
- Joint Committee: the Syrian–Lebanese Committee for Shared Water
- Average annual water resources: estimated to be 150 million m^3.

The Second Article

The implementation of Annexes 1 and 2 is considered an inseparable part of implementing the Agreement as a whole.

The Third Article

On the basis of the facts set out in the Introduction to this agreement, and taking into consideration all the related factors laid down in the Sixth Article of the Convention on the Law of the Non-Navigational Uses of International Watercourses, and for environmental and legal reasons, the two countries have decided to share the waters of the Great Southern River at a rate of 60 percent of all annual water resources for Syria and 40 percent of all annual water resources for Lebanon.

The Fourth Article

The percentages stated in Article 3 of this agreement apply to sharing the water resources of the river basin in all circumstances, whether the year is wet, normal, or dry.

The Fifth Article

Both the states have the right to make use of their shares determined in Article 3 of this Agreement at locations and at times of the water year that suit them.

Maintenance of the environment system, according to the criteria adopted by the main Syrian–Lebanese Committee for Joint Water, must also be taken into account.

The Sixth Article

In view of the volume of annual water resources held by the river water basin, and the need for water for different purposes (drinking, irrigation, industry) in both countries, the two states decided to establish a joint reservoir at the site of Idleen-Nura Al-Tahta with a total storage capacity of about 70 million m^3, acting on the results of technical and economic feasibility studies.

The Seventh Article

The already-existing main Syrian–Lebanese Committee for Joint Water is charged with implementing the rules of this Agreement and laying out the internal regime that organizes its work, to be endorsed by the Minister of Irrigation in Syria and the Minister of Energy and Water in Lebanon.

The committee undertakes all the tasks entrusted to it according to the rules of this Agreement, respects all rights and obligations under it, and considers all cases that arise from its application.

The Eighth Article

The main Syrian–Lebanese Committee for Joint Water may form a committee or sub-committee from both sides, working under its supervision, if necessary. In the case of any disagreement between the members of the joint committee that cannot be resolved decisively, the committee should present an immediate report to the two ministers concerned. The ministers should settle the disagreement by contacting each other directly and finding an objective solution that guarantees the rights of the two countries according to the rules of this Agreement.

The Ninth Article

The above-mentioned Joint Committee is charged in Article 8 of this Agreement with taking all measures necessary to plan and construct the joint dam at the site of Idleen-Nura Al-Tahta according to the provisions of Annex 1 enclosed with agreement.

The Tenth Article

Syria and Lebanon will each bear half the cost of planning and constructing the joint dam, with both sides seeking to obtain the necessary finance internally or from external sources.

The Eleventh Article

The international borders currently existing between the two states will remain on the water surface as they are currently considered to be drawn, whatever the water volume in the reservoir resulting from constructing the joint dam might be.

The Twelfth Article

If Syria or Lebanon wishes to use quantities of water from upstream of the dam within their agreed shares (60 percent and 40 percent respectively), especially in dry seasons, they may do so provided that they maintain the environment, as required by Article 5. This volume would be subtracted from their shares in the reservoir holdings. A state that has not used its full share of the stored water in the reservoir at the end of the water year cannot, according to the program for taking water stated in Annex 2 to this Agreement, use this water in subsequent years.

The Thirteenth Article

The members of the Joint Committee, members of the sub-committee, and workers on the project will benefit from the facilities necessary to study and work in the lands of the two states, and have the freedom to move without any restrictions or payment of fees.

The Fourteenth Article

This Agreement is to be endorsed according to the constitutional procedures followed in both countries and will become valid from the date at which the concluding documents are exchanged.

It is permitted to amend this Agreement by supplying annexes for endorsement, and by exchanging the concluding documents according to the procedures by which this Agreement was endorsed and concluded.

The Fifteenth Article

Two copies of this Agreement, in Arabic, were signed in Beirut on April 20 2002. These copies, each with the same force, have been sent to each state.

On behalf of the Lebanese Republic
Dr. Mohammed Abdul Al Hammed Baidoun, Minister of Energy and Water
On behalf of the Syrian Arab Republic
Eng. Mohammed Redwan Martini, Minister of Irrigation

ISRAELI WATER POLICY IN A REGIONAL CONTEXT OF CONFLICT: PROSPECTS FOR SUSTAINABLE DEVELOPMENT FOR ISRAELIS AND PALESTINIANS?

Stefan Deconinck[253]

"With water, you can make politics. With land, you can make wars".
Shimon Peres on the International Symposium on Sustainable Water Management in Arid and Semiarid Regions, May 15-19, 1995.

1. INTRODUCTION

In our newspapers and on our TV-screens, we can observe the events that take place every day on the surface of the Israeli-Palestinian conflict. These reports from the region west of the Jordan River barely mention the importance of water resources in the clash between Israel and the Palestinian population living under Israeli occupation. Nevertheless, water is one of the five major remaining stumbling blocks in the attempts to establish peace, the four others being Jerusalem, Palestinian refugees, Jewish colonies and the status of a future Palestinian entity.
In August 2000, the Israeli government accepted a long-term water policy document proposed by the Water Commissioner[254]. The plan outlines the general framework for a water policy towards 2020. Within this period of time, Israel faces the challenge to cope with increasing water scarcity, as a result of the limited availability of natural water resources combined with an increasing demand for water due to population growth and economic development and regular droughts. Therefore, the plan aims at the maintenance the actual level of water consumption by households, industry and agriculture while preserving the country's natural water resources – especially during years with under average winter rains that fail to recharge the underground and surface water systems.
In April 2002, the Water Commission presented a transitional master plan for the water sector, covering the period towards 2010. In this master plan, the main lines of the 2000-water policy plan are reconfirmed, with additional attention for institutional reform of the national water management.[255]
These policy plans should not uniquely be read as a document defining the internal aspects of water policy. It also involves important water resources that are shared with the state of Jordan and with the Palestinian population in the Occupied Territories. As such, domestic Israeli water policy will have direct implications for these populations as well. This makes policy planning an interesting parameter to assess prospects for regional sustainable development.

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[254] Ministery of National Infrastructures – Water Commission, *Long term tasks of the Israeli water sector*, Tel Aviv, 2000.
[255] Ministry of National Infrastructures – Water Commission Planning Division, *Master plan (transition) for the development of the water sector in the years 2002*-2010, Tel Aviv, 2002. Quoted in: *Report of the Parliamentary Committee of Inquiry on the Israeli water sector*, Jerusalem, 2002.

Therefore, in this contribution water policy will be regarded as an instrument in the struggle for development, in which water plays a crucial role. We will take a close look at the problem of growing water scarcity resulting from the combination of limited water resources and increasing population. We will describe how water has become a tool in the political conflict, and how it can undermine the prospects for sustainable development for the region.

2. THE CONTEXT OF WATER SCARCITY FOR ISRAEL AND PALESTINIANS

2.1. Shared Water Resources for Israelis and Palestinians

The inhabitants of Israel and the Palestinian Territories share their main sources for drinking water. The largest resource is the Jordan River. Compared to other rivers in the Middle East like the Euphrates, the Tigris or the Nile, the Jordan River is a rather modest one - in length as well as in flow. Its main tributaries are the Hasbani, Dan, Baniyas and Yarmuk rivers. The first three rivers converge in Israel, north of the Lake of Galilee, to form the upper Jordan River. Only the sources of the Dan originate within the Israeli borders. The Hasbani springs lie in the part of Lebanon that was part of security zone occupied by Israel in southern Lebanon until June 2000, and the Baniyas water drains from the Golan Heights – a territory formerly under Syrian control and occupied by Israel since the war of 1967.
South of the Lake of Galilee, the Jordan meets with the Yarmuk River, containing water originating from Syria and Jordan, and continues to flow south toward the Dead Sea. Syria and Jordan established a series of dams on the Yarmuk River for maximum profit of every drop of water. When the river reaches the Palestinian West Bank the upstream riparians used all the water they could. Israel uses the Lake of Galilee as a reservoir to extract drinking water through its National Water Carrier – a network of canals and pipelines – to the populated coastal plain and the farms in the Negev desert. Due to the occupation of the Jordan valley by the Israeli army, the Palestinian population on the West Bank is unable to get access to the river at all, and cannot use the water for irrigation or human consumption. But even if they could, they would not find more than a brackish muddy stream. The former Israeli Prime Minister Shimon Peres once declared that nowadays one could find more history than water in the Jordan River.
The other sources for potable water are the aquifers, underground geological structures with the capacity to store water. The water from the aquifers comes in a natural way to surface as a spring; the people living on top of the aquifer can also get access to the water by drilling wells. This is a renewable water resource, replenished by the yearly cycle of the winter rains. Human activity can endanger this resource. Sewage, industrial waste and agricultural pollutants like pesticides and fertilisers can harm the water quality and make it unfit for human consumption. Over-exploitation can cause irreversible damage to the geological structure, and the aquifer can lose its water-storing capacity.
Israel and the Palestinians share two aquifer systems. The first one, the mountain aquifer, is located under the hills of the West Bank and shared by Israelis and Palestinians as well as Jewish settlers on the West Bank. Although the aquifer is replenished by the winter rains that mainly fall on West Bank territory, a major quantity of the water flows underground across the 'Green Line' (the armistice line that marks the Israeli borders between 1948 and 1967) - thus outside the West Bank - and moves gradually towards the slopes of the hills mainly within Israeli

territory. There the water appears on the surface as natural springs and sources, out of reach of the Palestinian population of the West Bank. The second shared aquifer is located under the coastal zone, covering an area including the Palestinian Gaza Strip.

2.2. Water Under Israeli Occupation

After the war of 1967 and the occupation of the Palestinian West Bank and Gaza Strip, Israeli military commanders became responsible for the governance of these Occupied Territories. A new water regime was imposed and the resources became subject to the Israeli water legislation. Therefore, the water resources in the Occupied Territories became public property that could be "destined for the requirements of its inhabitants and for the development of the country", quoting the Israeli water law. Landowners could no longer claim any rights to the water on their property, and the authority over the water resources in the Occupied Territories was transferred from villages and local communities to the so-called Civil Administration. The military commanders of the area, as head of the Civil Administration, became responsible for granting exploitation licences for existing and new water installations, or planting new citrus gardens. The military commander has the power to withdraw a licence that was previously granted with no possibility of appeal against his decisions. Meters were placed on the Palestinian wells to limit their capacity. The institutional control over the water resources was finally completed in 1982 when water management was transferred to the Israeli national water company Mekorot.

The result of this water policy was that the growing Palestinian demand for water was systematically ignored and the necessary licences were almost always refused. The use of more powerful water installations and deeper wells in the Jewish settlements caused the older Palestinian wells to dry out. The majority of the Palestinian wells are now out of operation. Most of the Palestinian villagers are not connected to a waterworks; people have to rely on tank lorries or women have to carry water from distant wells for their daily needs. The present Intifada has made things even worse, due to the Israeli siege of Palestinian towns and villages, which made the price of water deliveries to rise to unbearable heights. A lot of water is lost due to collateral damage by shelling and bulldozing pipelines and other infrastructure, as reported by the World Bank and UNDP.[256]
On the other side of the hill, Jewish settlements do not have to deal with these restrictions. Settlers can cherish themselves with the surroundings of green lawn and refreshing swimming pools. Unsurprisingly, this adds a great deal to the frustrations on the Palestinian side. Even in the Israeli press opinion makers aired their criticism on these effects of the occupation policy.
The Israeli authorities deny the accusations of a double water policy. It is argued that the existing Palestinian water network has expanded under Israeli governance, and that water consumption has increased by 20% since 1967. Should the supply be insufficient, it is said to be mainly a result of Palestinian mismanagement of the water system. The Palestinian authorities respond that, although the water consumption increased, population grew even faster and caused a net decrease in consumption per capita.

[256] In a UNDP-publication, the damage to water and sewage infrastructure during the period September 2000 to March/April 2002 is estimated at more than $6,9 million (UNDP, FOCUS, 2, 2002, p. 38);

2.3. Coping With Scarce Resources and Rising Demand

The Israeli-Palestinian water conflict can be visualised by comparing figures of Israeli and Palestinian water consumption. In the water policy plan discussed below, the Israeli government handles an average per capita consumption of 35m³ for a Palestinian on the West Bank, and 321m³ for Israelis in Israel and the settlements. According to the standards of the World Health Organisation, people with an average per capita consumption less than 500m³ live in a condition of severe water stress. Although the Israeli average is well below this level, it does not keep the Israeli society from adopting a standard of living that is comparable with Western Europe. Israel has adopted strategies to cope with the limited availability of water resources. It has the necessary capacity and vast financial and technical resources to compensate the lack of abundant water resources. Israel succeeds e.g. to enforce high-tech irrigation and to raise public awareness in order to prevent wasting or polluting water resources.

Water is an important resource for the Israeli agriculture, and in the mid-80's up to 70% of the available water resources were allocated to agriculture; based on the 2002 'Statistical Abstract of Israel' (Central Bureau for Statistics), a figure of 59.2% can be calculated for 2000. This is still an astonishing figure, considering the rather limited and ever declining importance of agriculture in Israeli economy; it now generates only 2% of the Israeli GNP, while households, industry and services generate 98% of the GDP with the water that is left. An important part of the agricultural production, like citrus fruits and flowers, is for export – in a way it can be considered export of virtual water. The fact that Israel, as a country that lives under a condition of severe water stress, can waste so much of its scarce water resources in an economically inefficient way and even export virtual water, is again an illustration of the capacity of the country to cope with this water stress. But problems arise at the horizon. A rising birth rate and continuing immigration make the population grow, and as a result the demand for drinking water in the households increases. Economic development increases the demand of water as well, and the Israeli government expects that it will need 60% more water to meet the direct needs of the population in 2020[257]. At the same time, it sticks with the creed of the Zionist founding fathers of 'making the desert bloom', which means that sufficient water for agriculture must be safeguarded, as well as for industry and services. Because Israel is presently already using nearly every available natural water resource, the only possibility to add extra water to its national water system is by means of 'non-conventional' water resources, like recycling and desalination. To compensate the other sectors for the loss of their share of drinking water to the households, the long-term water policy plan of the Israeli government aims to increase the use of recycled water in agriculture and to construct a series of desalination plants alongside the seaside. The amount of water generated here must allow the Israeli water management agencies to protect the natural water resources like the Lake of Galilee or the aquifers against irreparably damage during years of drought.
The Palestinians are in a less favourable position. Like the Israels society, the Palestinian society faces the problem of growing demand for potable water due to population growth and necessary economic development. Moreover, the Palestinian economy relies for a greater part on (irrigated) agriculture. But almost fifty-five years of displacement and thirty-five years of Israeli occupation of the West Bank

[257] See the second part of this contribution for more details.

and the Gaza Strip left their traces. Israeli water shortages are shifted on the Palestinian society, which cannot count on the necessary financial means for investment or the necessary institutions to impose good management of the limited water resources. As a result, Palestinian households are far from the safety levels set by international organisations, or even the 100m³ per year which is a minimum standard for household consumption in Israel. The lack of access to water is a heavy burden for future development and the viability of a Palestinian state.
Five successive years of under average winter rains between 1998 en 2002 painfully confronted the population in the whole region with the threat of water shortages. Bygone summer, the Lake of Galilee crossed again the 'red line' which indicates its sustainable yield and reached its lowest point in human memory. The same happened to the mountain aquifer under the West Bank. These resources now risk to be contaminated by pollution or intrusion of saline water – risking the irreversible loss of this natural water resource. This already happened to the aquifer system under Gaza, the only source for drinking water for the Palestinians on the Gaza Strip: 80% of its potential drinking water is unsuitable for human consumption.
Although gloomy projections since the 1970's urged for measures to avert a catastrophe, we are still waiting for reorientations of the regional water policies. In Israel, short-term policies seem to prevent an open discussion about the fundamental issues related to water consumption. When an Infrastructure Minister suggested to impose restrictions on irrigation in agriculture, in order to safeguard drinking water for the Israeli households, his colleagues in the government blew a whistle on him and refused to discuss any measures of this kind. In 2001, the Water Commissioner, who is the most senior officer responsible for water management, requested in vain the municipalities to save 15% of the water consumption, e.g. by urging citizens to abandon watering their gardens or washing their cars.

3. ISRAELI LONG TERM WATER POLICY

In the second part of this contribution, we focus on the specific situation of Israeli policy measures in times of water scarcity.
In 2000, Shimon Tal was installed as the new Water Commissioner. He prepared a long term water policy document, which was presented to and approved on a cabinet meeting of the Israeli government in August 2001. This water policy plan will grant us a glimpse at what is behind every day's water issues, and we will see how the Israeli government is dealing with fundamental problems related to water shortages[258].

3.1. Main Outline of the Long Term Water Policy Plan

The plan presents in only nine pages a brief introduction to the present problems of water shortage and the concerns for future water consumption. The year 2020 is the reference year for calculations and predictions in the long term.
In the introductory section, it is stated that the projections of future water requirements are based on the assumption that the yield of the natural water resources will be average during the whole planning period of twenty years. This means that the proposed measures are minimum measures for statistical 'normal'

[258] Unless marked otherwise, the elements used in this discussion of the plan originate from the plan itself or from the interview at the Water Commissioner's office on June 6, 2001.

years, and that the stock created in 'good' years must be sufficient to compensate the deficit of 'bad' years, when there is not enough rain to recharge the natural water reservoirs. By way of example, an overview of annual extraction of water from the coastal aquifer between 1980 and 1996 shows that in 16 years, there were only 5 years without over extraction and 11 years with a deficit. The cumulated deficit now results into a continuing salinisation of the coastal area, causing destruction of land and water resources, and an assumed accumulation of 1000 tons of salt every day.
The thread of the plan is to guarantee a constant supply of water for consumption, while protecting the natural water resources. Therefore, the Israeli government decided to produce additional water, from recycling sewage water for agricultural purposes to desalination of brackish and sea water.

3.2. Consolidating the Long Term Water Consumption

One of the basic objectives of the policy document is to maintain the actual level of per capita consumption (private/domestic and public). Between 1989 and 1998, this level varied from 101m³ (1991) to 128m³ (1989 and 1998) for the Jewish sector[259]. In the same period, the level of water consumption by the non-Jewish sector increased slightly from 29m³ to 47m³. The long term task is to fix the consumption for every Israeli on 130m³ a year.The plan estimates that the population of Israel will be around 8,6 million people in 2020. The total water requirement to meet the per capita needs will then be 1120 million m³ (an increase of 415 million m³ or nearly 60%).Another important objective is the preservation of the agricultural production in Israel: 'the land must remain green', to cite a staff member at the Water Commissioner's office. In an average year, the agricultural consumption of potable water is estimated at 880 million m³. To preserve agriculture in 2020 at its present scale, an amount of 530 million m³ of high quality water is required each year, supplemented with 620 million m³ of treated sewage water. Industrial water demand will increase too in the next 20 years: 30 million m³ for potable water and 25 million m³ for water of lower quality.
The plan also mentions the Palestinian population in the Occupied Territories. The water supply of the population of the Gaza Strip is presumed not to be based on the Israeli national water system, and will not be taken into consideration for redistribution. Because Israel and the Palestinian population share the western part of the mountain aquifer, the plan proposes an additional transfer of 115 million m³ from the Israeli national water system to the Palestinians on the West Bank. This will gradually raise the average level of water consumption on the West Bank from 35m³ to 70m³ in 2020. These amounts include domestic, agricultural and industrial water consumption.

As part of the peace agreement with Jordan, Israel agreed to transfer a yearly amount of 55 million m³ to the Hashemite kingdom. For the sake of the argument, it is presumed that this amount will remain the same in 2020.

The figures mentioned above are resumed in the following table:

[259] 'Jewish sector' and 'non-Jewish sector' is the jargon of the document. The Jewish sector are Jewish Israeli citizens living in Israel and the Jewish colonists in the Occupied Palestinian Territories and the Golan Heights. The non-Jewish sector are non-Jewish Israeli citizens (carrying Israeli passports) living in this area, thus not including the Palestinian population of the occupied West Bank and Gaza.

***Table 1*: Distribution of The Israeli Water Resources (million m³)**

Year	Water consumption in Israel					West Bank	Jordan
	Domestic	Industry		Agriculture			
	Drinkable water	Drinkable water	Other	Drinkable water	Treated sewage water	Drinkable water	Drinkable water
2000	705	100	35	880	270	30	55
2020	1120	130	60	530	620	145	55

In 2020, the overall demand for water will be 22 650 million m³, with a need for potable water that will be 210 million m³ larger than now[260]. The amount of water of lower quality (including treated sewage water) needed for agriculture and industry will be 375m³ million higher. At this moment, the exploitation of the available natural water resources reaches already its maximum level – the actual freshwater consumption of 1785 million m³ a year mentioned in the plan is already causing a deficit for the average sustainable water yield (1555 million m³). The even larger demand in 2020 (2000 million m³) cannot be met by the rivers and aquifers at all. Therefore, the Israeli government has to call upon additional, non-conventional water resources.

3.3. Creating Additional Water Resources

In the plan, the Israeli government clearly states its preference for desalination of salt water to remove the pressure on the natural water resources. Table 2 brings together the necessary figures to calculate the extra amount of water that is needed to bridge the gap between the available natural water resources and the consumption needs in 2020.

***Table 2*: Water Resources and Consumption Needs in 2020 (million m³)**

Quantity required in 2020	Quantity available in nature	Deficit	Existing non-conventional resources in 2000	Desalination capacity needed in 2020
2000	1555	455	50	395

The deficit of potable water will rise to 395 million m³ a year in 2020. In the plan, desalination of salt water is brought up as the solution to provide the necessary water to restore the natural balance. To achieve a desalination capacity of 395 million m³ a year, a series of additional desalination plants has to be built in the next twenty years, and the plan charts a timetable for their construction. Based on the simple calculation that the capacity must gradually increase with a rate of 20 million m³ per year, the government has to initiate every two and a half years the construction of a desalination plant with a capacity of 50 million m³.
Treated sewage water will be an other major source. This water can be used for irrigation in agriculture. Alternatively, a part of the water can also be returned to the rivers. This extra water will prevent them from running dry, or prevent pollution by keeping the flow of the water strong enough to carry pollutants into the sea. The

[260] In the 2002 master plan the overall demand in 2010 is estimated at 2,288 million m³.

waste water coming from households and industries (1 120 million m³[261] and 160 million m³[262] respectively), increased with an amount of sewage water flowing into Israel downhill the West Bank (50 million m³) brings the potential recycle quantity from 1 300 to 1 320 million m³. Not all the consumed water will reach the treatment plants as waste water (part of it is used for irrigation of gardens and cleaning, some water will be lost through leakage or evaporation, part of the water of will be discharged directly into rivers or the sea, etc). Through a series of calculations, it is estimated that the amount of treated sewage water available in 2020 will be 830 million m³. To handle this amount, the capacity of the treatment plants has to be increased with 560 million m³, or 25 to 30 million m³ a year (table 3).

***Table 3*: Waste Water Treatment and Output Of Clean Water in 2020**

	Potential waste water	Available after treatment	Treatment capacity in 2000	Required additional capacity in 2020	Required for agriculture	Surplus
Million m³	1300/1320	830	270	560	620	210

Table 1 mentions that agriculture will require 620 million m³ of treated waste water for irrigation. The plan suggests to use the surplus of 210 million m³ for river rehabilitation or even expansion of irrigated agriculture. A preferred third alternative, if possible, would be to continue the cleaning process until the water quality is high enough to make the treated water suitable for municipal use (high quality, but non-potable water). This can save some amounts of potable water in the natural water reservoirs, that would otherwise have been reserved to consumption.

3.4. Protection of the Natural Water Resources

It is important to recall that the measures enunciated in the policy plan are expected to be sufficient to safeguard future Israeli water consumption in situations of average rainfall. In fact, this 'average' situation also presumes an average amount of natural water resources as a starting for the planning period. In other words, for an optimum take-off, the surface and underground water reservoirs (Lake of Galilee and the aquifers) are supposed to be half full, in order to act like a buffer in under average years. But in reality, this was not the case, and the take-off of the planning period started in the least favourable position as the natural water resources reached their point of unsustainable yield.
To make the plan work, it would be essential to build up this buffer by raising the actual level of the natural resources. Table 4 contains the figures concerning the amounts of water needed to accomplish this:

[261] This is the figure of municipal and domestic fresh water consumption.
[262] 130 million m³ from potable water consumption, plus an estimated half of the consumption of water of lower quality (60/2 million m³).

***Table 4*: Restoring the Natural Water Resources until the Level of a Sustainable Yield**

	Lake of Galilee	Western aquifer	Coastal aquifer	Total
Number of meters to rise	2	4	2	
Necessary amount of water (million m³)	350	350	400	1100

The total amount of fresh water necessary to rise the levels of the natural water resources from to actual level of unsustainable yield, to a safe average level is 1100 million m³. To obtain this additional water, the policy document opts once again for desalination. If the pace of construction of the previously mentioned desalination plants were accelerated with an additional capacity of 100 million m³ within the next 10 years, the amount of 1100 million m³ would be generated. When climate changes or an accidental series of years with poor rainfall causes the average rainfall fails to occur - and the average yield of the natural water resources keeps dropping - the pace of the construction of desalination plants has to be increased to guarantee a safe water yield. After a period of abundant rainfall when the natural water reservoirs will receive their additional water from precipitation instead of desalination, it may be decided to slow down the average pace of construction.
In addition to ideas to recharge the natural water resources, the plan contains a detailed section on the extraction of salt from the aquifers in order to preserve the quality of the water.

3.5. Brief Annotation on the Plan

a) a policy plan at last!
With this plan, the Israeli government made explicit its view on the role water has to play in long term development. It chooses unambiguously a certain direction and clearly points out which steps have to be taken in order to achieve the goals.

b) an integrated approach?
An integrated approach to the water system is essential from the standpoint of sustainable water development, and the long term policy plan is an example of the initiation of such an approach.
The policy document involves the totality of the Israeli (fresh) water resources, it stresses the different functions of the water systems (consumption, environmental conservation, desalination, treatment, water quality, water quantity) and focuses on the evaluation of different system components (precipitation, sewage, surface and ground water, reservoirs).
However, the plan seems to go no further than this initial impetus. The proposed implementation remains on a very general level. The proposed measures contain e.g. no reference to an examination of the evolution of needs for water consumption, and does not distinguish the needs within the sectors. The document outwards the continuation of the traditional water Israeli policy where agriculture holds a prominent position. As previously shown, agriculture is a minor economic sector but a major water consumer, and the document affirms the devotion of Israeli politics to this water-inefficient way of economic production. The unqualified support for agriculture seems the basic principle around which the policy document is constructed, and not the inverse. The choice for desalination to provide additional

water gives the same impression. The plan does not discuss the various alternatives for extra water (conventional nor non-conventional) or opportunities for water saving (e.g. possible reduction of water in agriculture). Desalination seems to be taken for granted as the most appropriate way to solve the water shortage, without any reference to studies that can substantiate this preference. With respect to desalination, the plan confirms the water policies developed since the 1980's. But the plan does not mention any necessary measures for desalination, like increased energy needs and emission of combustion's products (how will Israel deal with the engagements of the Kyoto protocol it signed in 1998?) or the disposal of residual products of inland desalination and waste water treatment.

c) feasibility of the implementation

An analysis of the costs and the benefits of the implementation of the proposals is not included in the plan. This makes it difficult to assess the feasibility of the plan in practise. Much seems to depend on the administrative transaction of the government's decisions. Anyway, the implementation fell behind at the very beginning. In June 2001, on the eve of the umpteenth summer with increasing water scarcity after a period with under average rainfall, the Finance Ministry gave up its opposition against water desalination and approved and tendered for the construction of the first plants with a capacity of 200 million m³ could be issued. In September 2001, the first tender was granted for a plant with a capacity of 15 to 65 million m³ a year (construction cost: $ 150 million). The desalination facilities will come into operation only after 2002, thus too late according to the schedule.
In the Autumn of 2001, difficulties appeared concerning the import of fresh water from Turkey. A tender was issued to invite companies to sign up for the delivery of 50 million m³ water a year for a period of five years (when the fist series of desalination plants would be operational). Purified water from the Manavgat River near Antalya at the south coast of Turkey will be shipped to the Israeli harbour of Ashkelon into giant tankers. Here the water will receive a second treatment, and it will be piped to other areas in Israel. The facilities in Ashkelon ought to be ready to receive the Turkish water in 2002. But in the autumn of 2001, the first problems surfaced when Turkey revised the initial water price agreed upon – and thus endangering the cost-effectiveness of the whole operation. In January 2002, the whole project suffered a major setback when the tender was cancelled. In August 2002, the Israeli government announced its renewed commitment to the import-scheme. It agreed to purchase 50 million m³ of water from Turkey each year for the next 20 years – for a total of 1 billion m³ at an estimated rate of $0,80 per m³. Although this price is a bit more expansive than the expected rates for local desalination (the average basic price for desalinated water will be around $0,50), government sources declared that the decision to import water was made due to political-strategic considerations, connected to the complex relations between the two countries. In fact, as a result of the setback, Turkey threatened to call off deals with Israel, as the $7 billion modernisation of Turkish M60-A1 tanks and the refurbishment of military aircrafts, or the participation of Israeli companies in a $20 billion irrigation project in the Southern Anatolia GAP-project.

d) Lacking a regional approach

With this long term water policy document, the Israeli government chooses a national solution to a regional problem. In some degree the water needs of neighbouring countries are taken into account, but only as the result of a unilateral Israeli initiative. The decision to raise the Palestinian per capita consumption to 70

m³ in 2020 is a step to democratisation of access to the water resources. At the same time it is a matter the Israeli government cannot decide on its own since the division of the shared water resources (Jordan, western and north-eastern aquifer) between Israel and the Palestinian population on the West Bank is subject to a final peace agreement that still has to be concluded. The plan states that the amount of 70m³ is a figure agreed upon during the activities of the Joint Water Commission[263], but Palestinian members of the committee assert that this is not true to the facts[264].
The yearly transfer of water to Jordan is part of the peace agreement of 1994 between Israel and the Hashemite kingdom. The 55 million m³ is political 'small change' that Israel pays to preserve a cordial relation with its neighbouring country. In practise, the yearly transfer is even larger (around 75 million m³ a year).[265] Despite these transfers, the plan fails to look more profoundly for solutions to the water crisis on a regional level. Although it seems premature to suggest co-operation among all the basin states in this stage of the Israeli-Arab conflict, the plan might have involved at least a Jordanian input to tackle the common challenges. Looking further than 2020, it will be even harder to cope with water scarcity and development, and solutions on a regional level involving scale effects will be inescapable. To reach the desired effect in 2020, a thinking process should introduce the necessary skills, ideas and financial capital as soon as possible.

CONCLUSION

Since the beginning of the Oslo peace process in 1993, no fundamental progress was made towards the solution to the water conflict or the aversion of the predicted scarcity. In the present stage[266], the Palestinians can manage their own water supply in the area where civil authority was transferred to the Palestinian Authority after the re-deployment of the Israeli army. Israel acknowledges the Palestinian water rights but made clear that this would not lead to practical implications in the field. A Joint Water Committee supervises the implementation of the engagements and discusses issues such as co-ordinated management and protection of water resources, management of water and sewage systems, exchange of information, or dispute resolution. No necessary measures are established to develop additional water resources to contain the future scarcity in a structural and sustainable way. In the present situation, it is not clear when a final solution of the Israeli-Palestinian conflict can be expected.
In the peace agreement between Israel and Jordan of 1994, both countries found a way to solve their differences over the use of the shared water resource. In 2001 and the autumn of 2002, Lebanese infrastructure building affecting the water flowing to Israel from the Hasbani and Wazzani rivers, caused extra tension between the two countries. The Golan Heights still stand in the way of a rapprochement between Israel and Syria. The continuing Israeli occupation of Palestinian territory and the displacement of millions of the Palestinian Diaspora will

[263] In the Joint Water Commission (JWC) has been established according to the Interim Agreement between Israel and the PLO (1995). Its composition and competences are established in article 40 of the agreement.
[264] Interview at the Palestinian Water Authority, June 9, 2001.
[265] Interview at the Water Commissioner's Planning Office, June 7, 2001. See also http://waternet.rug.ac.be/ for background on the Israeli-Jordanian mini crises in 1998 and 1999.
[266] Present stage of the Oslo process: Interim Agreement, 1995 – article 40.

not bring peace in the area west of the Jordan River. Without a sustainable solution for the water conflict, Israel and the Palestinians are heading for a disastrous water crisis in the first quarter of this century. A unilateral approach by Israel, Syria and Jordan, based on a better and more efficient use of the existing water resources is not sufficient to guarantee a sustainable solution. Recycled and desalinated water, improved irrigation techniques, the shift of water consumption from agriculture to domestic use, modernisation of water supplies, prevention of leakage, and water pricing policies can only be considered as possibilities for the short term. On the long term, they cannot provide the extra amount of water that is necessary to meet the demand caused by population growth and economic development. A sustainable water policy can only be achieved on a regional level, and has to include the other states in the Jordan River basin in a co-operation scheme. A prerequisite for success is the joint administration of the existing water resources. Of course, this cannot be achieved without regional peace.

The challenges of combating water shortages are as massive. Huge financial inputs as well are necessary to enhance the capacity of the whole population of the region to cope with this threat. The international donor community can play an important role in providing this financial support – under conditions of regional peace. But the international community is still more preoccupied with day-to-day events like the so-called 'war on terrorism' and less interested in a sustainable solution that will spare many people, including those who are as 'outsiders' not directly involved, much misery in the future.

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CO-OPERATION IN THE NILE WATER RESOURCE MANAGEMENT AS AN ANTIDOTE TO POTENTIAL TRANSBOUNDARY CONFLICTS AMONG EAST AND NORTH AFRICAN COUNTRIES: CHALLENGES AND OPPORTUNITIES.

Richard Kimutai Kerich[267]

1. INTRODUCTION

The Nile water resource, shared by several East, Central and North African countries has been a source of conflict between neighbouring states. This is due to the way the Nile has been managed over the years. Till now, the only legal management tool is the "Nile treaty" signed between Egypt and colonial rulers in East and Central Africa in 1929. For many, this is archaic considering the changes that have occurred since then. These changes include, technological advancement, increased demand of water emanating from population growth, divergence of interests caused by environmental and political differences, improved awareness, globalisation and historical development. In this paper, the Nile water resource management is reviewed in a historical and current perspective with the aim of recommending a more sustainable and approach to the river basin. It is hoped that through such a co-operative mode of management, recurrent interstate conflicts will reduce.

2. LOCATION AND FEATURES OF THE NILE

River Nile basin occupies the area bound by latitudes O^{o} and 32^{o} N and longitudes 24^{o} E and 39^{o}E. With many tributaries, the Nile has two major arms the White Nile which originates from Lake Victoria and the Blue Nile which originates from Lake Tana in Ethiopia. Considering the entire basin, the river serves the following countries: Egypt, Sudan, Eritrea, Ethiopia, Kenya, Uganda, Tanzania, Congo, Rwanda and Burundi. (see map 1below)

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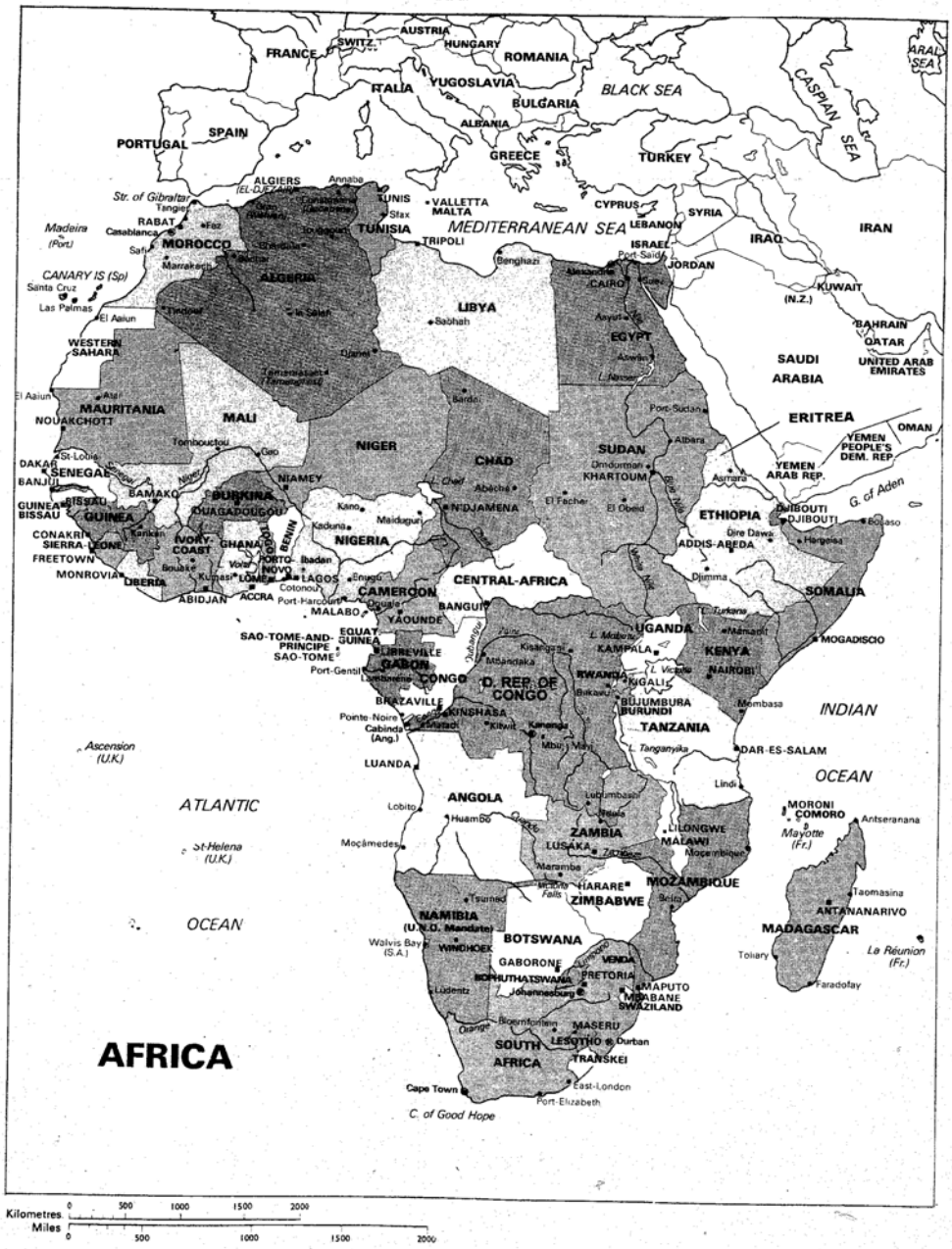
Map 1: Africa



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As the Nile river flows from its source towards the mouth, it traverses contrasting environments. The White Nile at the upper course occupies a humid and marshy sorrounding especially in the Kyoga region of Uganda and Sudd region of South Sudan. Thereafter, the river crosses an area of dry conditions with little or no rain at all, particularly within the Egyptian Sahara desert. Here the soil ranges from sandy in the Sahara region to a fertile alluvial soil where deposition has occurred in the Nile valley and delta region. The blue Nile likewise experiences more humid conditions of the Ethiopian highlands at its upper course and drier conditions at its lower part. The Nile river flows over hard crystalline rocks in some parts of its course - a feature that has encouraged formation of cataracts across the river. In all there are six identified cataracts across the Nile. (see map 1). These, together with existence of gorges, have made dam construction in the Nile river a worthwhile venture. A greater part of the Nile valley occupies an area of gentle slope except in its upper parts where the gradient generally rises. This favours soil deposition in the lower course which in turn encourages agricultural activities.

3. IMPORTANCE OF THE NILE

For one to appreciate the importance of the Nile, it would be critical to consider how the resources therein are utilised. The major uses of the Nile resources are discussed in the foregoing paragraphs.

3.1. Transportation

For many centuries the river has been used as a means of transportation. Egyptians have, for many years, been using canoes as means of travel along the Nile. Modern technology, however, has brought notable improvements in this sector. Introduction of modern motor boats has eased transportation along the river. More recently the linking up of the Nile to the Red sea by Suez canal has greatly boosted the link between African continent and countries in the middle and Far East.

3.2. Irrigation

The Nile water has been considered the backbone of agriculture in the Nile valley. Where spontaneous overflow of the Nile water has not been received, irrigation has remained an option to the farmers. Records show that irrigation in the Nile is an ancient activity dating back to the early Egyptian civilization. Use of "shaduf" type of irrigation was common among the old Egyptians. However after the advent of the modern technology, a more sophisticated mode of irrigation has been developed which involves dam construction and build up of water distribution channels or canals. In this modern approach, one is able to control the amount of released water as well as its time of release. Good example of such projects along the Nile are: Aswan High Dam of Egypt, Jonglei scheme and Gezira project of Sudan.

3.3. Electricity generation

Use of the Nile water for electricity generation has been recognised for many years. In addition to the dams mentioned above, the Owen falls dam in Jinja Uganda serves as a good example of Hydro Electric Power plants on the Nile. Here it should be noted that management of power produced by the respective countries is done independently despite the "common source"- the Nile.

3.4. Source of Fish

The Nile serves as an important source of fish considered by many as the major source of protein to majority of people in tropical Africa. The river thus greatly enhances the food security status of the region.

3.5. Centre of Ancient Civilization

The Ancient Egyptian civilization can be traced to the Nile valley. Here the early Egyptians left behind a detailed account of their lives. Through examination of their paintings, and carvings as well as the relics of the time, one could reconstruct a story about them, their rulers and their mode of life. The magnificent pyramids of Egypt attest to this importance.

3.6. Source of fertile silt

Deposition of fertile soil by the Nile at its lower course (especially the delta region) has assured the people of improved agricultural products. This in addition to increased level of income from agricultural produce, enhances food security of the people along the river.

3.7. Increase of Biodiversity

Through impoundment of water by dams and irrigation of dry lands, bio-diversity has increased where originally it was low.

4. PROBLEMS EMANATING FROM THE USE OF NILE RESOURCES

Considering the diverse uses of the Nile resources several problems have been realized by the inhabitants of the region. These problems are determined by the type of resource use, location, and the proximity of people to the river basin. The problems are considered in the foregoing paragraphs.

Irrigation projects along the Nile has caused the following problems:

- Displacement of settled people through increased water behind the dams.
- Disruption of social cohesion caused by displacement of settled communities.
- Rapid spread of water borne diseases (e.g. bilharzia) accelerated by water distribution canals. This is clearly demonstrated by the Aswan Dam project of Egypt.
- Territorial conflicts caused by spread of dammed water beyond the political boundaries, obstruction or diversion of water needed by people in the lower part of the established dam, and increased exposure to flood risks caused by impoundment of water behind built up dams. The Aswan dam project is known to have made impounded water to cross over from Egypt to Sudan. Similarly the Sennar dam project has made impounded water to overflow from Sudan to Ethiopia causing concern among the territories.
- Overuse of the land resources leading to environmental degradation where farming is practised especially in the delta region. This is caused by concentration of people where silt deposition has occurred. Associated with overconcentration of people and rapid increase of the population, the

common problems encountered are inadequate sanitation, and social decay among the inhabitants, and environmental destruction.

- Pollution of the Nile water caused by agrarian activities. Because of falling soil fertility, farmers who are so dependent on agriculture, are constantly compelled to use agrochemicals to improve their produce hence creating a strategic avenue for pollution.
- Alteration of biodiversity emanating from altered environmental conditions. Where dams are build, naturally habitat conditions are changed to suit new species. Similarly where water is spread to a desert, it is possible that the more humid conditions form a thriving habitat for species that would otherwise not be expected. This phenomenon has created introduction of new species which in some cases have become controversial. The arrival of the Nile Perch commonly known as "Mbuta" into Lake Victoria - the source of the Nile, has caused heated debate among the managers of the Lake. Most believe that the specie is a preditor to Tilapia fish which is preferred by majority of people living around the lake. Hence alteration of species could be for better or worse.

5. CONTEMPORARY ISSUES IN THE MANAGEMENT OF THE NILE

Current management of the Nile water resource is largely dependent on participation by individual countries lying within the Nile basin. However their contribution towards the management of the resource is largely fragmented and only depends on the goodwill of those respective countries. Adjacent to the Nile are the following countries: Kenya, Burundi, Congo, Egypt, Eritrea, Ethiopia, Rwanda, Sudan, Tanzania and Uganda. Upto the present, therefore, management of Nile water resources has largely depended on the cummulative contribution of the countries as well as other well wishers. Yet for a resource of the magnitude of Nile system, it would be necessary to have an upto date unified legal framework for management whereas the majority of countries mentioned above currently have their own individual national resource management plans, there is no jointly prepared legal framework for the management of the Nile water resource. According to the Nile basin initiative, an Uganda - based organization, the only legal document concerning the Nile basin management is the Nile treaty, signed between Egypt and colonial rulers in East Africa in 1929 and revised in 1959 (Nation, Nairobi, September 7th 2002). Among other things, the treaty restricted the use of the Lake Victoria waters and banned all riparian countries south of Egypt from using the Nile water for their own irrigation without Cairo's consent. Unfortunately, this as a management tool was not negotiated by all the affected countries and doesn't form presently a useful tool of management because it favours Egypt at the expense of the other riparian countries. For example 98% of Egyptians use electricity while 2% and less than 10% use electricity in respectively Rwanda and Kenya.

The inequitable sharing of benefits from the Nile resources and the inappropriate legal framework has rejuvenated the interest of the riparian countries to develop a more unified legal framework for Nile water resource management. This, it hoped, would pave the way for a repeal of the Nile Treaty which is archaic. Noteable in this venture is the Uganda - based inter-state organisation named "Nile Basin Initiative" launched in 1999 and whose co-ordinatior is Mr. Antoine Sendama. According to the co-ordinator a final draft of the legal framework on the management of the Nile

resources is ready and would soon represented to all the riparian countries. In principle all the countries are committed to the repeal of the Nile Treaty and are ready to sign the future document.
In concluding this section I would like to emphasize the importance of the need to jointly prepare a management tool for the Nile water resource. Unless co-ooperation among all the stake-holders is assured, antagonism and conflicts among the riparian countries would continue. No doubt the applications of the current Nile treaty has caused animosity among states and in some cases even rebellion. In words of some Kenyan members of parliament "Kenya should violate the treaty". This would of course be unnecessary if the document was jointly prepared with sufficient consultation among all the stakeholders.

6. WAY FORWARD IN THE MANAGEMENT OF THE NILE

As may already have been noted, the conflicts and antagonism between the Nile basin countries are mainly caused by an unequal use of the river and unadequate management tools. The best way of resolving transboundary conflicts is co-operation between countries. This would result in an effective control of water pollution, diversion, impoundment as well as on concensusbuilding concerning effective management regulations. Currently this has been achieved through established institutions like Nile Basin Initiative - earlier mentioned, Organization of African Unity (OAU), and East African Community (EAC. For the co-operation to succeed, it is recommended that
*joint review of laws and statutes governing the Nile resources are undertaken,
*joint development of a masterplan of management is done.
*joint periodic awareness campaigns with regard to the river basin are issued
*capacity building by the member states on competent resource managers are developed with the possibility of an establishment of a common regional training institutions
*sharing of technological innovations and management skills are developed among member states
*joint monitoring and evaluation of resource utilization within the Nile basin and institutionalization and strengthening of self initiative ventures working on objectives similar to those of the region e.g. Nile basin initiative.

7. CONCLUSION

The great Nile system, through its links with the Lakes Victoria and Tana and all the rivers that feed them, belongs to the peoples of Rwanda, Burundi, Kenya, the Sudan, Ethiopia, Egypt Eritrea and Congo. Any attempt to assign ownership to any one of them individually would potentially result in territorial conflicts. And when conflicts occur, the only sure way of resolving them is through dialogue and co-operation among all the states. To optimally manage the resource, a consensus has to be reached among all the riparian states on the best strategy to adopt. Failure to do this will result in a catastrophe.

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NATIONAL AND REGIONAL WATER POLICIES

TRANSBOUNDARY WATER BASINS IN THE AZERBAIJAN REPUBLIC: CONFLICT OR CO-OPERATION

Rauf G. Israfilov[268]

ABSTRACT

With the disintegration of the former USSR and the emergence of the newly independent Commonwealth of Independent States (CIS) countries the issue of the shared water resources has attracted the attention of officials at many levels of the new governments as well as former neighbouring countries of USSR. During the last decade the problem of transboundary water resources has affected most of these countries and their neighbouring states in one way or another. In some instances it appears that the issue may be the cause of sharp conflict in the inter-governmental relations. Of course, the practical and fair solution of this problem requires a multidisciplinary approach that encompasses various expertise and disciplines such as scientific research, legal, socio-economic, institutional, ecological, international relations, etc. The breach of established norms or their absence in any of the above stated areas could lead to the increase of tension and in the most extreme cases to confrontation among states. Thus, what is the basic reason for tension or conflict situations related to transboundary water resources at present?

Firstly, this is linked to the changing of political situations, that is, the creation of newly independent states from the former USSR republics and the Balkan countries of former Yugoslavia, as well as the real independence of the former socialist countries in Eastern Europe. Unfortunately, the evolved processes leading to independence were accompanied by numerous military conflicts that have substantially aggravated the situation from the pre-existing arrangements.

Secondly, the real understanding of the facts, which is necessary to find an integrated solution for all of the issues related to the management of resources within transboundary basins (both surface water and ground water resources) is lacking. There is also the problem of transboundary aquifers, which are as important as the shared surface water resources. One should take into consideration that the absence of a comprehensive and unified scientific approach (acceptable criteria) when evaluating peculiarities of transboundary basins complicates the issue.

In some of these countries resources of fresh water are limited and this problem has been and remains the most vital national issue. But there are countries where there is no real deficit of water resources. However, the necessity for regulations to safeguard the quality of the water resources exists and requires intergovernmental agreements in the field of water resources protection from contamination or of regulated withdrawal to prevent saline water intrusion into the aquifers.

The main factor is the absence of a single regulatory body for these countries to develop regulations that are agreed to and abided by all parties involved and if interpretations are required can be relegated to authoritative international bodies (UN, OSCE, etc.). The basis for such laws and regulations should be that water is an indispensable necessity for all people and as such the observance of generally accepted (common to all mankind) norms of use and protection of transboundary water resources, even in case of absence of bilateral intergovernmental agreements, is a vital interest to all.

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Therefore, study and analysis of existing transboundary agreements among other nations in similar situations can assist in the solution of the problem and lead to decisions and regulations for transboundary water resources management. This is an important factor, because it can be an exemplary model for the transition from conflict to co-operation. In this regard, the analysis of the situation associated with the use and protection of transboundary water basins of Azerbaijan Republic (where in our view there are major issues to be resolved) can be of great interest and help to all parties concerned. This paper elaborates the outstanding issues and suggests approaches to be negotiated by the interested parties to safeguard the vital water resources of the Caucuses region.

1. INTRODUCTION

Azerbaijan is situated within the Alpine fold belt and includes mountain regions of the Greater and the Lesser Caucasus, the Kura inter-mountain depression and part of the Caspian Sea. Topographic relief varies from -26 to 4459 m above mean sea level (MSL). 45 % of the country (86,600 km^2) is situated above 500 m above MSL. The geology ranges from Precambrian rocks to recent materials. Sediments are of marine, volcanogenic and continental origin. Azerbaijan has common borders with Armenia, Georgia, Iran, Russia and Turkey, and maritime boundaries with Iran, Kazakhstan, Russia and Turkmenistan.

Of the available annual average fresh water quantity of 367 billion m^3, roughly 70% comes from the transboundary rivers Kura (Turkey and Georgia), Araz (Turkey, Armenia and Iran), Ganykh (Georgia), Saumur (Russia), and Astrakhan (Iran). The transboundary aquifers retain a great quantity of quality groundwater. In the current situation, the surface and ground waters play an important role in all azerbaijan's efforts for sustainable development.

Within the geologic-structural features of the region, several groundwater basins (aquifers) can be recognized: the Greater Caucasus basin, the Kura basin, and the Lesser Caucasus basin. Within these basins, sixteen sub-regions (corresponding to field survey of fresh groundwater) are identified based on the nature of the hydrogeological setting and the geologic-geomorphologic structure. From the 16 identified fields of fresh groundwater resources, seven of them are Transboundary Aquifer Resources – Nakhchivan (with Armenia, Iran, Turkey), Lesser Caucasian, Jebrail, Mil-Garabakh, Mugan-Salyan (with Iran), Alazan-Agrichai (with Georgia), and Gusar-Divichi (with Russia). About 90% of the fresh groundwater of the Republic falls in the category of transboundary basins, and it can produce over 12 million cubic meters per day. If we take into consideration that Gyanja-Gazakh aquifer (with Armenia), the Mountain-Talysh, the Lyankaran (with Iran) and the Ajinour-Jeiranchol (with Georgia) aquifers of fresh groundwater resources are transboundary aquifer resources for Azerbaijan (i.e., despite the fact that the whole groundwater basin is situated within the Republic, the recharge areas are in other countries), one can readily surmise that 11 out of 16 groundwater basins need individual consideration and assessment (Fig. 1).
Therefore, Azerbaijan requires a well-conceived transboundary water resources management integrating the common interests of all neighbouring countries. Since the collapse of the USSR, there is no inter-governmental agreement ratified by parliaments of the countries concerned. Thus, the issue is grave. Only temporary agreements between Azerbaijan Republic and Georgia, Iran, Russia and Turkey exist in terms of the use of transboundary water resources (mainly surface waters), which do not alleviate the tension or provide a lasting solution for this problem.

There is no temporary agreement with Armenia because of the military conflict with with the country.

Thus, the outcomes of existing scientific and hydrological studies on the peculiarities of transboundary water basins, the analysis of specificities of intergovernmental relations of other countries and regions, as well as the existing legislative base of international institutions of which these countries are members, such as the UN, can be very helpful to Azerbaijan.

2. BACKGROUND INFORMATION

2.1. Transboundary River Basins

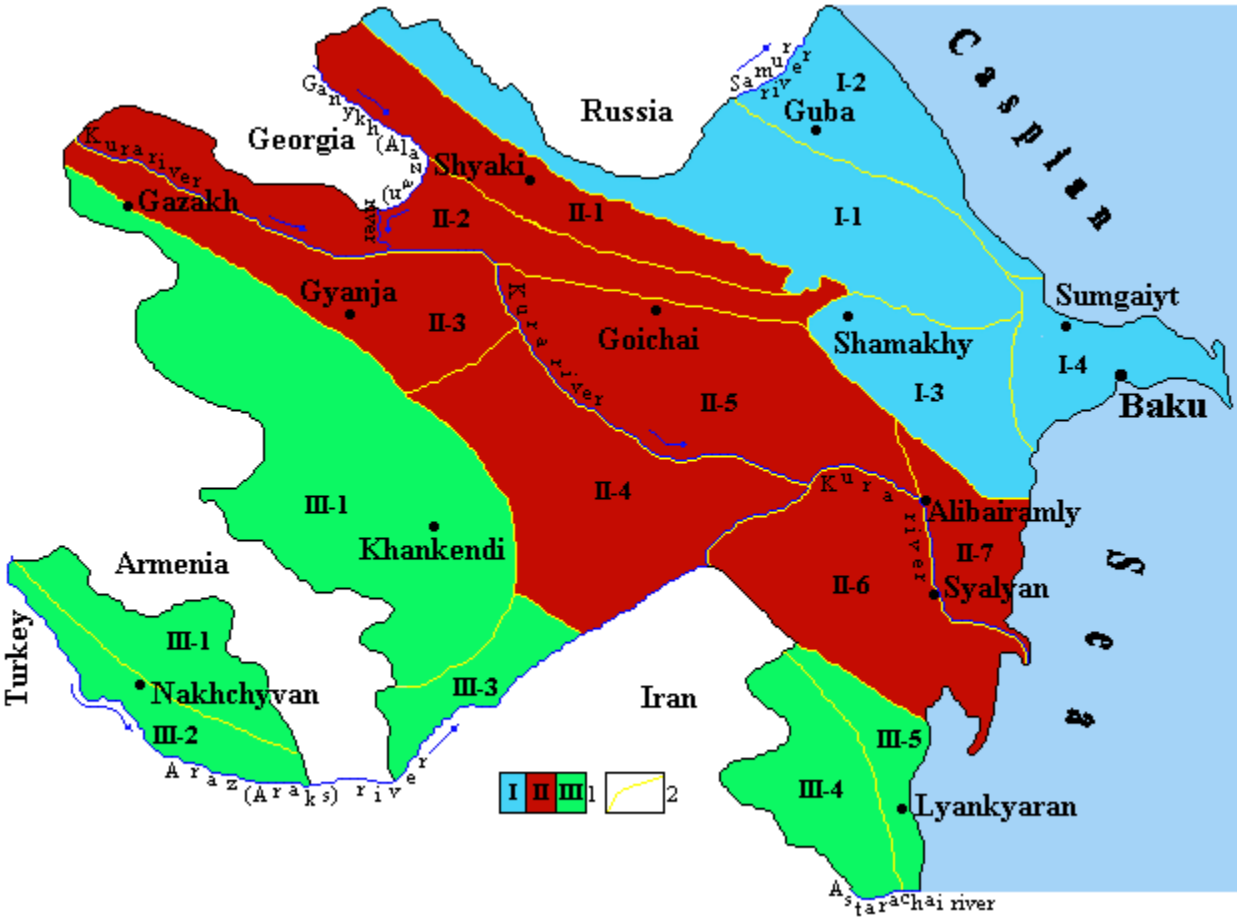
The analysis of numerous studies on different aspects of river basins in Azerbaijan (references 1, 6, 15, 16, 19, 26, 29, 30 etc.) leads to the conclusion that out of 8 350 small, mid size and large rivers in the Republic with a total flow of 32.2 km^3/year, approximately 70% of the water resources (22 km^3/years) are from 5 of the transboundary rivers.
The river Kura, with its vast river system, is the key water source for the Caucasus. The river flows through the territories of Turkey, Georgia and Azerbaijan Republics. The total length of the river is 1 364 km, 185 of which are within the territory of Turkey, 390 in Georgia and 790 in Azerbaijan. The total area of its watershed is 188 000 sq. km, of which 58 000 km^2 is in Azerbaijan, 34 700 km^2 is in Georgia, 29 800 km^2 is in Armenia and 65 500 km^2 in Iran and Turkey). The average elevation of the Kura river upper watershed in the Azerbaijan-Georgia border is 1700 meter. The headwaters of the Kura river are a group of streams formed in the Gizil-Gadik Mountain at an elevation of 2 700m in Anatolia area of Turkey.

The second largest river is the river Araz (Araks). It flows through Turkey, Armenia and Azerbaijan territories and joins the Kura near Sabirabad town. The total length of the river is 1 072 km with a total watershed area of 102 000 km^2 of which 18 740 is in Azerbaijan, 22 090 in Armenia, and 61 000 in Iran and Turkey.

The river Ganikh (Alazan) is the third largest river, and flows through the territory of Georgia and Azerbaijan before falling into the Mingechaur reservoir on the Kura river. The total length of the river is 413 km with a total watershed area of 12 080 km^2 with the highest elevation in the watershed at 900 m. The Saumur river watershed area is 3 620 km^2 and the Astarachai river watershed area is 242 km^2. The watershed area of the rivers that flow directly into the Caspian Sea from the Northeast slopes of the Great Caucasus Mountains and Lyankyaran-Astara zone are respectively 22 500 km^2 and 52000 km^2.

As reported in the references (16, 26, 29 etc.), the total water resources of the Eastern Caucasus rivers flowing into the Caspian Sea within the Azerbaijan Republic, including those of the Saumur and Astarachai rivers make 31,5 km^3. Total water resources of the Kura River are 26.6 km^3 and of the Araz River are approximately 10 km^3. Water resources of other rivers directly flowing into the Caspian Sea (rivers of the Greater Caucasus North-East slope and Lyankyaran-Astara zone) are approximately 4,67 km^3, of which 2,17 km^3 is from the Samur river and 0,22 km^3 from the Astarachai River. 25% (7,5 km^3) of the total water resources of these rivers are from within the Azerbaijan Republic.

***Figure 1*: Scheme of Azerbaijan hydrogeologic zoning**



1. Hydrogeological regions; 2. Boundary of hydrogeological regions;
I - Greater Caucasian hydrogeological basin: I-1 - Greater Caucasian mountain - fold region;
I-2 - Gusar region; I-3 - Gobustan region and the adjacent part of the Near-Caspian lowland;
I-4 - Absheron region.
II - Kura depression hydrogeological basin: II-1 - Alazan-Agrichai region; II-2 - Adjinour-Jeiranchel region; II-3 - Gyanja-Gazakh region; II-4 - Mil-Garabakh region; II-5 - Shirvan region; II-6 - Mugan-Saliyan region; II-7 - South-Eastern Shirvan region.
III - Lesser Caucasian hydrogeological basin: III-1 - Lesser Caucasian mountain - fold region;
III-2 - Nakhchyvan region; III-3 - Jabrail region; III-4 - Mountain-Talysh region;
III-5 - Lyankyaran region.

2.2. Transboundary (shared) aquifers systems

Complex geological-hydrogeological conditions and natural peculiarities in Azerbaijan determine the existence of different types of groundwater aquifers (basins) with different hydrodynamic, hydrochemical and other characteristics. The transboundary aquifers mentioned above are not the only sources of fresh waters. Rather, these are the main sources of fresh groundwater in Azerbaijan. The

aquifers differ by their geologic formations, transmission and discharge of groundwater, and by hydrogeological structures in the neighbouring countries. The common link among the aquifers is that the groundwater meets the requirements of drinking water standards.

The largest transboundary aquifers with fresh waters are Gyanja-Gazakh, Mil-Garabakh, Alazan-Agrachai and Gusar-Divichi. More than 80% of the existing reserves of fresh groundwater in Azerbaijan are confined in these basins. However, the artesian basin of the Alazan-Agrichai inter-mountain basin (groundwater from the thick series of volcanogenic deposits of drift cones of the Greater Caucasus South slope) is equally divided between Georgia and Azerbaijan, whereas only the southwest part of the groundwater basin area in the Gyanja-Gazakh planes (groundwater aquifer formations of gravel-shingle and sandy deposits of the Quaternary and Upper Pliocene age) plains is adjacent to Armenia. The situation is quite different in the Gusar-Divichi piedmont plain (groundwater is confined in continental series formations) and in Mil-Garabakh plain (groundwater aquifer formations of gravel-shingle and sandy deposits of the Quaternary and Upper Pliocene age), where only the transit areas of the artesian basins are located in the territories of Russia and Iran respectively. The rest of the transboundary aquifers are in the same condition, that is, a detailed study of natural aquifer boundaries and State borders of Azerbaijan and neighboring countries is required to resolve the outstanding issues. All fresh water in the artesian aquifers mentioned here, originates from surface infiltration and as such are closely linked with surficial drainage patterns. For example, in the Alazan-Agrichai and Gusar-Divichi aquifers about 50% of the river flow is base flow, from a water balance point of view. Therefore, to avoid gross mistakes in water yield calculations it is very important to consider surface water and groundwater as an integrated hydrologic system.

3. PRESENT CONDITION

At first glance, it may seem that the problem associated with transboundary water resources is relatively new for Azerbaijan. This is because its independence is still very recent. Most of the water basins that are transboundary today, used to fall within state boundaries during the USSR era. In spite of this, transboundary water resources issues existed in that period as well. It is inaccurate to think that these issues have appeared only since the break up of the USSR. In the USSR, internal boundaries between "autonomous" republicsexistef. Even then, due to sever contamination of some water resources and a lack of plans for the regional use of water resources of the Kura and Araz rivers, their inflow from Georgia and Armenia was of great concern to Azerbaijan. Thus, the problem exists for some time and a number of solutions have been proposed by various scientists (1, 6, 15, 23, 25, 30 et al.). In our opinion, the present state of affairs as far as the sources of water supply is concerned, shouldn’t exist. Only, it is today an inter-state problem and it is much more difficult to solve because of the consensus required from all the interested countries. For this reason, the problem of transboundary water basins for the independent Azerbaijan seems to be new, serious and nearly unstudied. Considering that water resources of the transboundary aquifers have lately attracted more attention, it has become clear how hard a young, independent country must work to resolve the problem. World-wide experience in the investigation and resolution of transboundary aquifer problems (5, 20, 21, 22, 27, 28, 31, 32, 33 etc.) demonstrate that the solution of this problem has many aspects (scientific, legal, socio-economic, institutional, environmental) and requires

a complex solution. Undoubtedly, we think the main factor in the solution of these problems (just like in many other area of the inter-state relations) is "the human factor", determined by the level of good-neighbourly relations between states. Once again, this requires especial analysis.

In many countries, the aspects cited above became the main principle during the preparation of interstate and intrastate agreements regulating the utilization of water resources. Even today, we can find many positive examples of scientifically based approaches in countries in pursuit of "the" water policy (19, 22, 28, 32, 33, etc). For this reason, we shall briefly describe what has been done up to date, and how we can make this more successful in the future.

3.1. Scientific aspects

Hydrological investigations in Azerbaijan have an old history. Information from existing sources indicates that the water resources of the river basins were used for irrigated agriculture since more than a millenium. Archeological investigations showed that the oldest irrigation systems date back to the fourth century and were constructed similarly to the oldest systems in Mesopotamia, southwest Persia, Egypt, India and China. The first scientific hydrological investigations started in the 1860s in the Caucasian Department of the Russian Water Survey, when it became necessary to study the feasibility of supplemental irrigation in the Kura-Araz lowlands and the possibility of navigation in the Kura River. Then, in 1895, construction works on the irrigation systems started in the Mughan zone, where by 1919 four irrigation systems have been built. The total length of the channels was 209 km with a water discharge of 130 m^3/sec. (main sources - Kura River). Due to an urgent need for hydrological and meteorological investigations and data collection, the Azerbaijan Hydrometeorological Survey (later on the Azerbaijan Hydrometeorological Committee) was established in 1920. All hydrometeorological investigations are conducted within this organization today.

In 1930 a regional state hydrologic regime network was formed, based on individual hydrological stations. Up to now, the network has conducted systematic monitoring of quantitative and qualitative parameters for surficial water regime in the republic. At present 100 hydro-stations conduct monitoring of quantitative parameters and 50 hydro-stations conduct monitoring of qualitative parameters of rivers in Azerbaijan. Results of hydrologic peculiarities of the river basins are presented in annual reports and published in special bulletins. A wide range of hydrological investigations, including transboundary projects, were conducted by the Scientific-Research Institute of Water Problems, the Baku State University, the Institute of Geography of the Azerbaijan National Academy of Sciences and other institutions possessing many years of experience on hydrology of transboundary rivers. These reports contain information on the amount and availability of water resources of the rivers, the magnitude of their recent and prospective utilisation, the impact of industrialisation on the change of background indices of rivers and many other basic environmental issues in the river basins. But many issues associated with short-term and long-term prediction of river parameters and their regimes in the basins in terms of multifactor impact, as well as numerous ecological issues, require thorough investigation.

Before the 20th century, hydrogeological investigations in Azerbaijan were of episodic nature. Due to intensive urbanization, industrial and agricultural

developments since the first years of the last century, hydrogeologic investigations have been conducted regularly and systematically. The first investigations are associated with the search for sources of water supply, and then for the irrigation of lands in the city of Baku and in the adjacent populated areas. From 1939 through 1948, a regional state observatory "hydro-regime" network of wells to conduct monitoring of groundwater's regime in Azerbaijan was established and in operation. However, due to the fact that the equipment of the network has not been maintained nor updated since the early establishment, the monitoring is not conducted in real time, readings (parameters measurements) are done only 3 times per month. More intensive study of hydrogeological conditions of the republic started after the end of the World War II from 1945 to 2000. During that period, data on regime, water balance and the groundwater resources were systematized. A comprehensive hydrogeologic survey (1:200 000 and 1:50 000 scale) was conducted in all of the piedmont and low land zones. Reserves of groundwater (90% of the explored reserves of fresh groundwater level declined during 1970-1991) were inventoried. Moreover, for the last 20-30 years special attention was paid to hydrogeological studies, as they relate to contamination of fresh groundwater and their potential sources. The results of investigations were compiled in numerous reports of the Committee on Geology, the Geology Institute, and the Institute of Water Problems as well as in theses, monographs and papers (2, 3, 4, 7, 9, 10, 11, 12, 13, 14, 18, etc.). However, recent data show it is still necessary to more thoroughly investigate fresh groundwater aquifers in the republic (including the transboundary) and to re-assess their reserves as there exists an opinion that they are much higher than the reported reserves (Table 1).

3.2. Legal aspects

It is our opinion that the existing national legal base adopted in the republic is apropriate and meets the principal legal codes of developed countries. As a matter of fact, the "Water code of Azerbaijan" and the law "About Interiors of the Earth" were approved by a special session of legislators of the Azerbaijan Republic on December 26, 1997 and April 27, 1998 that lay down the principles for any negotiation on the subject matter of transboundary water resources. Unlike Armenia and Georgia, the supreme legislative body of Azerbaijan ratified all international conventions associated with the subject matter.
Exploitation reserves and possibilities for use of fresh and weakly mineralised groundwater fields

Ground waters deposits	Groundwater, th. m^3/d			
	Exploitation reserves		Used at present	
	Forecasted	Approved by Commission on reserves	Economic drinking needs	Irrigation, technical needs
I. Greater Caucasian hydrogeological basin				
Greater Caucasian mountain-fold region	1008,87	17,7	7,8	12,4
Gusar region	3470,72	1686,1	375,6	31,1

Gobustan region and the adjacent part of the Near-Caspian lowland (region of sporadic distribution of aquifers)	not estimated	not approved	2,5	1,9
Absheron region	241,92	0,3	0,1	0,4
II. Kura depression hydrogeological basin				
Alazan-Agrichai region	3822,0	2000,0	32,7	263,3
Adjinour-Jeiranchel region (region of sporadic distribution of aquifers)	not estimated	not approved	—	—
Gyanja-Gazakh region	4218,6	4218,6	91,3	751,3
Mil-Garabakh region	7909,92	2231,5	63,9	1212,3
Shirvan region	517,7	517,7	20,5	14,0
Mugan-Saliyan region	130,0	76,0	7,2	5,8
South-Eastern Shirvan region	the waters are high-mineralized and can not be used			
III. Lesser Caucasian hydrogeological basin				
Lesser Caucasian mountain-fold region (together with Mountain-Talysh region)	989,35	98,9	3,7	3,1
Nakhchyvan region	902,2	902,2	56,1	85,9
Jabrail region	344,0	234,6	occupied by Armenia	occupied by Armenia
Lyankyaran region	209,0	86,0	13,0	48,3
TOTAL in Republic	23764,28	12079,4	674,4	2429,8

However, there only exist temporary bilateral agreements between Azerbaijan Republic and Iran, Georgia, Russia and Turkey. Because of the military conflict between Azerbaijan and Armenia (20% of Azerbaijan territory is occupied by Armenia), there is no agreement with that country, not even a temporary one.

The poor use of existing international ecological agreements, as well as the weak implementation of the mechanisms defined in those agreements, are the main factors for the uncertainty about the legal aspects of transboundary water resources. As a matter of fact, binding requirements, declared in agreements of international agencies such as the UN, OSCE and EU, are lacking. Such requirements would oblige all member states, even in the absence of bilateral intergovernmental agreements to strictly observe basic principles of ecological co-existence among states, thus including the use and protection of transboundary water resources. International ecological agreements as the "Convention on the protection and use of transboundary water courses and international lakes", the "Convention on the conservation of European wildlife and natural habitats" and many other humanitarian agreements should be adapted by all member states.

Their ratification should be obligatory for any state wishing to adhere to the organisation. Up to now, inter-state agreements on the utilisation of transboundary water resources have not been developed at the level of municipalities. We think they might be used as a model, that could be adapted to the inter-state level at a later stage. The agreements developed and approved in the USA between different states (Arkansas River Compact, Colorado River Compact, The La Plata Compact, Republican River Compact, Rio Grande River Compact, South Platte Compact and Upper Colorado River Compact etc.) might be a good base. As we have seen, the legal aspect for regulation of water resources in Azerbaijan requires a thorough investigation.

3.3. Socio-economic aspects

Azerbaijan is one of the few countries where transboundary waters play a major role in water supply. More than 50% of the Kura river flow (85% of all existing resources of river basins in the republic counting inflow Araz River) are used for water supply purposes (9,7 km^3 for agricultural irrigation, 3,3 km^3 for industrial use and 0,4 km^3 for municipal water supply). Taking into account that about 4.5-5 km^3 get lost from water reservoirs, it becomes clear that about 70% of the Kura river water resources are allocated for other purposes. Water resources from the other transboundary rivers are used in the same way.

To emphasize the importance of the water resources of the transboundary aquifers in the socio-economic development of Azerbaijan, it should be mentioned that about 50% of the water supply of the city of Baku and the other two largest cities in the republic (Gyanja and Sumgayit) is provided by the groundwater of transboundary basins. About 70% of these waters are used for agricultural needs and industry. The local legislation allows the use of fresh groundwater for irrigation and industrial needs, but only when the water needs of the muncipalities are completely satisfied. An objective reason for this is the lack of sufficient resources to carry out the development and pursuance of a general program for rational utilization of water resources. For the same reason there is still no central water supply system in many small cities, villages and populated areas of the republic. A subjective reason could be the poor institutional controls by water authorities on the use of groundwater. In many cases, a complete analysis of the role of transboundary resources of the groundwater basins in the social-economic development of Azerbaijan is necessary and requires special investigations.

3.4. Institutional aspects

One of the main hurdles in the solution of the problem is the institutional aspect. There is no doubt that specific features of the management may play both positive and negative role in the solution of the problem.

During the USSR era, the exploration and assessment of groundwater resources and issuance of permits for water use were carried out by the Geology Committee, and for surface waters by the Committee on Hydrology and Meteorology of Azerbaijan. The Ministry of Melioration and Water Resources of Azerbaijan carried out the exploration of the surficial and groundwater. Water protection was the administered by the Committee on Natural Resources Protection. All scientific-research institutions worked on the solution of different problems and had access to production data and activity of all the above-mentioned organizations. At present,

and since the transition of Azerbaijan to a market economy, there is an adaptation of the management structure of the water resources in the leading countries of the world. The legislation has already fixed that the use of the water resources is a prerogative of the local authorities, though control on the right use is in the competences of the Committee on Melioration and Water Resources. At the same time, after some reorganization, all the functions of former committees on geology and hydrometeorology had are passed through to the re-established Ministry of Natural Conservation. It is quite natural that in this period, when the authorities are not very powerful the actual management of the water resources in the republic is carried out by the above mentioned ministries. Thus, the problem of management of water resources and transboundary basins of the republic remains urgent and requires a competent solution.

3.5. Environmental aspects

Environmental protection and maintenance ofsurface water and groundwater ecology is another urgent problem in the republic. The research results of various investigators (16, 19, 23, 26, 29, 30 etc.) show environmental conditions of the Kura and Araz rivers are relatively better that in the territories of Turkey and Iran. The Kura river in the Georgian Varsiya - Akhalkalaki region and the Araz beginning in the Gumru region of Armenia to Azerbaijan territory, are polluted. Wastewaters in Armenia and 36-40% of Georgia are discharged in the Kura river basin. In the Ararat valley, sewage from residential areas is transported by pipes to the Sadarak settlement. The annual amount of polluted waters coming from Armenia into the Araz river is about 2,6 km^3. The annual wastewater flow into the Araz includes in average 22-25 thousand ton biogenic elements, 10-12 thousand ton pesticide-detergents, around 60-70 thousands ton organic elements of alloxton type and thousands of tons phenols and heavy metals. There is no self-purification process in the river basins. Furthermore, physically, chemically and biologically altered and unsafe waters enter into Azerbaijan territory. Pollution of Kura River in the Georgian territory begins from Borjomi valley and continues till Khramchay. The annual amount of polluted waters entering from Georgian territory into the Kura river is about 4,2 km^3. Following information gathered by specialists (30), the wastewater flow into the Kura carries on average an annual chlorides load of 60-70 thousand ton, 9-11 thousand ton nitrogen compositions, 20-25 thousand ton pesticide-detergents, 120-160 thousands ton organic elements, 10 thousand ton phenols and 19-22 thousand tons metal salts.

The situation of the groundwater is just about the same. In many regions of the republic, intensive industrial activity has resulted in water table rise and salinisation of soils, contamination and/or decline of the groundwater level, subsidence and landslide processes, etc. Local authorities should address these problems urgently. The situation is worsened by poor financial support of non-commercial scientific research organizations. This made numerous scientific hydrogeologic developments associated with natural investigations impossible and resulted in the loss of control. However, in case of contamination of the transboundary aquifers, the problem becomes more urgent as it reaches the inter-state level. It is well known that the level of natural protection of the groundwater in the artesian basins is high. But the urgency of the problem may be illustrated by the example of the Alazan-Agrichai transboundary aquifer, its south-east part being located in the territory of Azerbaijan and the north-west part in the territory of Georgia. More than a million people of both countries live within this region. Their main occupation is agriculture. Moreover, a large Kakhetin-Filizchai (field of polymetallic ores) has been exploited

for more than 30 years in the area. Intensive contamination of the environment since the time the territory was part of the USSR has resulted in serious pollution of the water resources. Water samples from the surficial and groundwater sources in the territory of Georgia and Azerbaijan contain nitrates, heavy metals and some radioactive elements in amounts that exceed acceptable existing standards. At present, this is an international problem and it should be solved by the collective efforts of Azerbaijan and Georgia. The above-mentioned examples demonstrate the urgency for the protection of the water resources, and the regulation of the use of the transboundary aquifers.

4. CONCLUSION

The special geographical position and natural conditions of the Azerbaijan Republic have determined its dependence on the transboundary water resources from river basins and aquifers. The most effective way to solve the existing problems now is the conclusion of bilateral agreements. In the future, they will become the basis for the conclusion of a full-scale and multilateral agreement on the use of the transboundary water resources by all countries of the region. It should be mentioned that so far these issues have not been addressed at all.

After the disintegration of the USSR and the independence of the republic, the problem of transboundary water resources became most urgent. The difficulty of the situation is that the transformation of some inter-state boundaries goes together with complicated relations between some of the newly independent states in the region and by their different political courses. For this reason, Azerbaijan cannot find a unitary way to solve this problem, taking into account the different levels of interrelation with states of the region. The neutral states can assist in cases of very complex situations but countries with current conflicts must adhere to unitary international acts (agreements) that establish the basic principles of co-existence, and, possibly, regulate the use of transboundary water resources. Undoubtedly, proceeding from this stagnant situation, there may be other ways to resolve this problem. The succeed, it is necessary to study all aspects of the problem. In this matter, it is important for Azerbaijan, and in our opinion for some other states of the region as well, to work together to use their own resources to join numerous programs in the framework of UNESCO, UNECE, UNDP, WMO, etc. On the one hand, it will help to use their rich experience of highly qualified experts. On the other hand, it will result in a complete transparency of results. This is the shortest way to success because organisations like the UN, OSCE and others could act as arbiters. By all means, this will lead to the conclusion of a multilateral agreement between all countries of the region. To answer our initial question "What are the transboundary water basins for Azerbaijan: conflict or co-operation?", we can say that Azerbaijan is closer to co-operation than conflict. However, the good will of all the region's states is a indispensable starting point.

ACKNOWLEDGEMENTS

The assistance of Rafic Hanifazadeh and Shafa Pashayeva in the final preparation of this manuscript in sincerely acknowledged. Many thanks are also due to Prof. Behrouz Panahi and Dr. Vagif Ibragimov for access to the necessary database. Special thanks go to my colleague Dr. Zia Hosseinipour for his recommendations while preparing this paper and when editing it.

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THE CANCELLATION OF THE DONG-GANG DAM PROJECT: FROM CONFLICT TO CO-OPERTAION

He-young Kim[269]

ABSTRACT

By analyzing of the conflict that surrounded the Korean government's hydraulic project or the construction of the Young-wol dam, different theories and interpretations regarding the term 'development' can be identified according to different groups of people. Social players as defined by M. Thompson (1995) within the conflict show how arguments and interests from different stakeholders have contended and directed the invisible hand of power in the Korean hydropolitics (Ohlsson, 1995).
The emergence of Korean non-governmental organizations will be seen as a driving force challenging the existed realm of Korean water policy. The cancellation of the Dong-gang dam project is highlighted by the influence of NGOs, more specifically their socio-political impact upon the government's policy decision-making process. Since the social democratic movement in 1987, the green NGOs and the rising civil society in South Korea has challenged the status quo of the political regime.

1. BACKGROUND

The former South Korean government was under dominant authoritarian military regimes since the 1960s until the late 1980s. The military government had sough economic development and rapid industrialization of the country by focusing on the development of natural resources and heavy industrial activities. As a part of the regime's resources development policy, the government carried out massive hydraulic missions (Reisner, 1987) in the 70s and 80s. According to the report produced by the Korea Institute of Construction Technology (hereafter KICT, 2000), there are 708 irrigation dams, 62 municipal dams and 12 hydroelectric power dams built in South Korea since the late 1960s.

Geographically South Korea is covered with 70 percent of mountains and 30 percent of plains, the mountain slops are deep and short, the river catchments are short and narrow. As a consequence, floods can easily occur. Due to that specific environmental condition, the former government in the 1980s and 1990s had concentrated on flood control policy (Water Vision, 2020).

South Korea often experienced severe environmental disasters including flood, typhoon and landslide etc (Water Vision 2000). The recent flood event in 1990, which inundated the northeastern part of South Korea, called Kang-won province, brought with it an immediate response from the government (Hajer, 1995). As a consequence, one could notice the political willingness to establish a contingent flood control policy. The result was the construction of a flood control dam in Young-wol, the most severely flood affected area of the 1990's disaster. The proposal was, in the beginning, welcomed by the local residents who severely experienced the devastation of the flood.

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In January 1991, the Ministry of Construction and Transportation (hereafter MOCT) announced the Young-wol multipurpose dam construction, preventing future flood and water shortages in the regions (Cheung, 2001).

2. IDENTIFICATION OF THE PROBLEMS

2.1. Local Conflict On The Dam Project

After the MOCT's announcement, pros and cons arguments appeared government's within the local community. Most residents in Young-wol agreed to the government's proposal, while the residents in Jung-sun, the upper riparian of the river Dong-gang disagreed. The Jung-sun residents feared inundation once the dam completed (Cheung, 2001) and further losing of their homeland and displacement.
The dispute over the dam proposal included as well environmental issues. It was the Journal of Young-wol that raised the environmental issue for the first time (Cheung, 2001). The Journal pointed out the ecological concern that if the dam was built, it could bring an environmental destruction in physical as well as in ecological respect. The Journal argued that the terrestrial foundation of Young-wol is comprised of limestone. Traditionally the local ancestors used to say, "if the underground caves were exploded, Young-wol would collapse as a consequence".
However the impact of the catastrophic flood event in 1990 was much greater than the old ancestor's saying and the environmental notion failed to win over the local opinions.

The analysis of the local complaints and disputes over the dam project indicates that the local citizens were not well aware of environmental changes related to the dam construction. This in spite the fact that the Journal of Young-wol had stressed the environmental risk. The arguments from the local community of Young-wol tended to comply with the government's suggestion. The impact of the flood in 1990 was so catastrophic that the dam project seemed to guarantee and provide a much secured protection measure against future disasters.

When we analyse the nature of the arguments of local residents, they are rather ego-centered thus more emphasis on the life protection and environmental safety (Park, 2001).
According to the description of the social groups by M. Thompson (1988), one group which can be named, the fatalist or the mass governed, tend to be easily shifted and affected by both an internal or external change. However the way they regard 'nature', or 'environment' are quite dependent on the fatalistic view. In a circumstance of natural disaster for example, the social response to such an emblematic event is short sighted, ignorant and indifferent.
Park (2001) indicates several quotations of strong anthropocentric arguments made by the local residents in Young-wol towards the dam plan. According to her interview with several local residents, one of the interviewees states:

> " Those people whose stomachs are full and whose backs are warm can oppose the dam project. They are generally well off and often ruling class. Because they are not directly affected by the flood, they can say that they oppose to the project. Why? Because for them the environment is valued to be protected, but for us it could become a real threat. If they really want to preserve the nature, why don't they buy the lands and live here?"

> " People say the nature should be protected, but then what about us? Human beings have first priority of living to the nature. Human comes first than the nature. It is more important to protect the local community than the ecosystem and the environment. Environmental protection could be meaningful as long as the environment does not threat you, but our living environment could become a threat someday and already we have gone through such catastrophic event".

After the MOCT's announcement on the dam project, most local residents in Young-wol experienced the reduction of the local government's public spending in the region. It was due to the dam plan, once the region was inundated by the dam, it is pointless to put public investment. Road construction and the electric service had been gradually diminished (Jung, 2001) that the level of the public disadvantage the local community had to gone through became worse.
However soon after the dam project announcement, many local residents invested in cost-intensive agro-business such as flowers, vegetables etc to claim more compensation (Jung, 2001).

2.2. Green NGOs vis-à-vis the government

When the MOCT announced the construction site for the Young-wol dam in October 20th 1997, the Korean Federation for Environmental Movement (hereafter KFEM) organized an anti-dam demonstration in Young-wol on October 31st 1997.
The argument against the dam project stemmed from the KFEM, which shapes a fundamental difference from that of the Young-wol residents regarding the nature. What the ecologists and the green activists would argue for the anti-Young-wol dam deals with the intrinsic value of the environment and the importance of ecology, whilst the hierarchical entity of the government argues for the human superiority to the nature, which for them is seen as a part of materials that needs to be developed and exploited by the human technology and skills (Thompson, 1995).

The KFEM's activity in the anti-Young-wol dam campaign was supported by the local residents of Jung-sun. Later the campaign was developed into a nation-wide environmental campaign. Ninety-one percent of the public opinion in the poll[270] surveyed by the KFEM opposed the government's proposal (KFEM's homepage. 2000). As the Young-wol dam issue became a top environmental issue, number of international environmental organizations such as the Sierra club, the Green peace, the Friends of the Earth supported the campaign (Kim, 2001).
While the campaign rested on the public participation and Han Nara Dang, the MOCT and KOWACO argued for the legitimacy of the construction, and denied speculation about the environmental risk related to the project. According to the Korean Economy Newspaper (07/04/1999), President Kim Dea-Jung urged the MOCT and KOWACO to accelerate the speed of the project for the purpose to meet the future water demand and to regulate the flood control in the country. The president's speech in the National assembly was regarded as a strong governmental willingness to proceed the project despite the rising public opposition. Even more, Lee Jung Moo, the Secretary of the MOCT in the interview with KBS (Korean Broadcasting Station) in April 3 1999, said the importance of the Young-wol dam in terms of water saving for the future generation. He rejected the suggestion of small dam construction and emphasized the adequacy of the location of the dam even more strongly (HanKyorae Newspaper, 04/04/99)

[270] The public opinion poll was carried by the KFEM in March 1999 with 4,338 people being surveyed.

According to the dialogues between the government and the environmental NGOs on the dam project, the two institutions have a fundamental difference in the understanding of development. The government emphasised to enlarge the future and present water supply, whilst KFEM and the anti-dam campaigners propose water demand control as a futuristic water policy strategy. It seemed difficult to reach an agreement with these two contentious arguments because the fundamental philosophy structure of each institution different ideas towards development and conservation.

The continuous conflict between the anti-dam protesters and the government lasted almost for four years with the government finally announcing the cancellation of the Young-wol dam project in June 2000. President Kim Dae-Jung made a public speech about the cancellation of the hydraulic mission on the World Environment Day on 5th June 2000 (S. Park, 2001). The cancellation of the Young-wol dam is the first victory for the green NGOs and the anti-dam campaigners since the late 1970s (H. Y. Kim 2001). Many analysts observe the cancellation of the water project as a result of the development of civil society, NGOs and public influence on the policy realm (Lee, 2000). After the social democratic movement in 1987, rapid increase in number of civil society and NGOs took place and the social and political impact of these organizations became imminent.

2.3. Social Democratic Movement And Civil Society

The social democratization movement in 1987 was followed by a a rapid political institutional change, the so called the civilian democratic government's new settlement. The new civilian government under President Kim Young Sam in 1993 made attempts to a political purification since the former military government had been involved for a long time in political corruption scandals. The new government put as well a lot of efforts for more civilian participation in political decision-making process. These movements had in some extent speeded up the substantive social democratization process in the society. Such movement gradually encouraged the development of civil society and NGOs. As table 1 indicates, there had been a dramatic increase in number of Korean NGOs between the 1980s and 90s. According to Lee (2000) this sharp rise in the number of NGOs in the late 1980s is highly correlated to the purpose of political democratization.

***Table. 1*: Percentage Distribution of Funding Years of all Korean NGOs (Source: Lee 2000; Directory of Korean NGOs, 2000)**

Founding Years	For all Korean NGOs
Prior to 1960	5.7%
1960s	7.2%
1970s	9.0%
1980s	21.6%
1990s	56.5%

Table 1 shows a rapid growth in number of Korean NGOs since the 1980s. The number of NGOs in the 1990s dubbled in comparison with the 80s, and many analysts argue that the increase in number of the NGOs is a consequence of the democratic movement and the establishment of the civilian government in the 1990s.

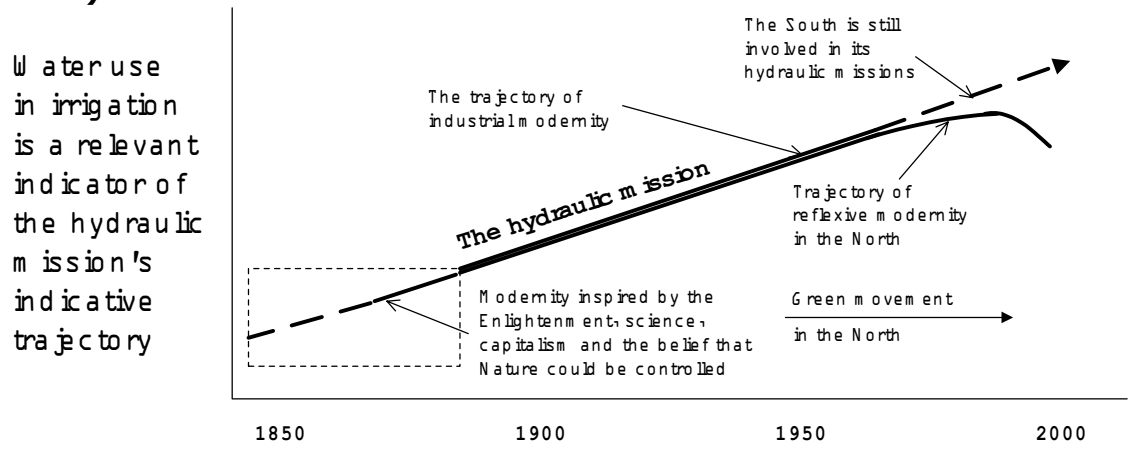
***Table. 2*: Frequency and Percentage Distribution of Korean NGOs in Specific (Source: Lee 2000; Directory of Korean NGOs, 2000)**

Issue	Frequency	Percentage	Issue	Frequency	Percentage
Civil Society	1013	25.2%	Education	235	5.8%
Social Service	743	18.5%	Local Self-Governing	222	5.5%
Civic Culture	634	15.8%	Labourer/Farmer /Fisher	217	5.4%
Economy	501	12.5%	Religion	107	2.7%
Environment	287	7.1%	International Society	44	1.1%
Others	20	0.5%	Subtotal	4,023	100.0%
Total (Including 1,517 academic association & 900 unidentified organizations)					6,440

Table 2 indicates that the environmental NGOs take one fifth of the whole number of NGOs in Korea. Korean environmental NGOs emerged in the mid 1990s and the major prominent green NGOs in present Korea is the Korean Federation for Environmental Movement, which has played a major role in the anti-Young-wol dam campaign. It was established in April 1993 and it became the biggest environmental NGO with its 85,000 members and 47 local branches working on various types of environmental issues (KFEM hompage, 2002).

What is important with regard to the emergence of the environmental NGOs in Korea is that the increasing number of green NGOs drive more environmental campaigns against excessive development plans and resources policy such as water development programme. The significant political impact brought by the rising number of environmental NGOs had introduced the green movement in North America and the western society in the late 1960s, which many people believe the state's hydraulic missions had been significantly affected by the rising force.
Figure 1 below shows past hydraulic missions, initiated by western states, which have been reduced in its speed and the frequency due to the intrusion of the green movements and its political interventions in the policy making process in the 1960s. North America and Europe have experienced the green movement as a new social phenomenon. Many developed countries realized that its social and political influence could not be easily ignored. As a result many politicians and engineers had to shift their old development-oriented policy regime into a more environmentally aware and ecologically favoured policy.

***Figure 1*: The hydraulic mission, industrial modernity, reflexive modernity explaining parallel discourses in the North and the South (Source: Allan, 2001)**



Whether the western analysis of the green movement and its political influence in the realm of water resources development policy is applicable to the Korean circumstance, we would need more periodical observation and evaluation. It was obvious that after the 1987's social democratic movement, things within Korean society were beginning to change. The emergence of a civil society with NGOs and interests groups have intruded the political sphere more rapidly than the past military era. They were allowed to maintain and further accessing and implementing the social and political identification and interests of the organization due to the less state's restriction under the civilian government. Now the government's decision-making process has allowed more public access and civil participation. The state of the triadic power (S. Park, 2001) has now been shifted by the emergence of civil society, interests groups and labour unions. The weight of the dominant power has been moved from the state and government control toward the realm of civil society and NGOs. In terms of the power impact diagram, the former Korean government has been the dominant policy maker with the least public participation and consensus, while the current political decision making structure in Korea has experienced much stronger voices and influence coming out from the civil society and various NGOs. Many sociologists regard such a trend as an emergence of a new pluralism being introduced in the realm of decision making process instead of single controlled decision making by the state.

3. CONCLUSION

It is important to notice that the social and political democratization has brought various types of social and political reform. Under the former military authoritarian regime, the Korean society would not have managed to support this new concept of environmentalism and ecological conservation, because of the strong dominated term 'development' being prioritized and patronized by the state.

The social democratic movement since the late 1980s paved a way to develop a civil society that nurtured the social empowerment and capacity building and challenged the government's strong regime. Many sociologists would argue that if the anti-Young-wol dam demonstration would have taken place in the 70s and 80s, the results would have been different.

Therefore the cancellation of the Young-wol dam reveals the importance of social and political reform in Korea since the late 1980s. In addition, the green NGOs and

environmental activists affected strongly the government and the authoritarian state If the anti-Young-wol dam campaign occured under the military regime, it would have been a rather silent conflict with strict government oppression.

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CONFLICT AND CO-OPERATION: MANAGING THE WATER OF THE RIO GRANDE AND THE COLORADO RIVER AT THE MEXICO-U.S. BORDER

Carlos F. Lascurain[271]

ABSTRACT

There is a long-standing regime of border co-operation between Mexico and the U.S. that was transformed during the twentieth century into a regime of international environmental management. This analysis reviewed the Mexico-U.S. Environmental Regime with particular focus on water resources. Despite the efforts already made by the Mexico-U.S. Environmental Regime towards a more efficient and effective allocation of the water resources and for a better water quality in the border region, various water and environmental problems are still on the agenda and remain unresolved. We have to understand that the conditions in which the regime operates are indeed complicated. Yet, the challenge for the regime is not only to manage the water resources based on the performance criteria of effectiveness, efficiency and equity, but also to implement both the norms and rules that give form to the regime and the appropriate environmental policies in an unfavourable milieu. It is important to make clear that the regime has failed to resolve some important water related and environmental problems. Despite the problems that are still present in the border region, the Mexico-U.S. Environmental Regime has largely performed well from 1960 to 1990. The analysis of this regime allows having a clearer view of the formation, the different transformations it has suffered and its performance. That is why this regime analysis makes an important contribution to the study of other international environmental regimes and other international river management institutions.

1. BEHAVIOURAL COMPLEX

The environmental consciousness within the Mexico-U.S. border region is growing at a rate unprecedented for the spread of any intellectual concept or the acceptance of new ways of defining the interaction of humanity and nature. This growth was reflected in the need to restructure the current international institutional arrangements for dealing with environmental protection, so as to achieve greater prominence, power, and coherence. For the last 40 years, the Mexico-U.S. border region has been exposed to a series of changes and adjustments concerning the international agreements governing the environment and natural resources of this area. In this sense, a long established regime of cross border environmental management has been transformed, so that it becomes a set of institutions providing a regime of multilevel governance. According to Sprouse and Mumme (1997: 2), the process of transformation of the Mexico-U.S. Environmental Regime might be better understood within three chronological and institutional phases. The first of these phases, the *traditional* phase, was built around the operations of the IBWC. Its main features were to establish control over the natural resources in the border area, particularly water, allocating usage rights, and addressing water related public health problems through the development of sewage and sanitation infrastructure on a largely ad hoc basis. The second, or *transitional* phase, associated with the La Paz Agreement, put into action a framework agreement for

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addressing a comprehensive range of environmental concerns, also using *ad hoc* and traditional diplomatic approaches. According to the research findings, this probably would be the most important phase because it marks the beginning of more open and inclusionist behavior of the regime, which led the way to other equally important projects such as the *post-NAFTA* phase. This *post-NAFTA* phase, closely related to the last one is associated with the development of BECC and the NADBank, and approaches environmental and water problems from an even more ordered bottom-up perspective including different sectors of the population. In general, these regime adaptations reflect that environmental regimes do not become static constructs even after they are fully articulated; rather, as Young (1982: 106) would argue, they undergo continuous transformations in response to their own political, economic and social settings. This is to say that regimes give rise to highly dynamic social practices that continually change over time. The case of the Mexico-U.S. Environmental Regime is a clear example of regime adaptability.

Within this context, an important finding concerning the interaction among different levels of governance that are present in the regime must be addressed. Even though in almost all modern states the international relations are the responsibility of the federal level of government, the participation of actors at sub-national levels concerning international negotiations in fields where these actors had policy responsibilities were very common; and so there were a lot of cross-border contacts of this kind in the border region. Yet, some of these contacts had been limited to non-political issues and were very informal in nature. The decentralization trends experienced at the time of the implementation of the La Paz Agreement in the mid-1980's, provided some sort of incentives, capacities and opportunities for stronger international activities involving other potential participatory levels once ignored. As a consequence of this development, a more systematic and strategic approach to the Mexico-U.S. cross border environmental co-operation evolved. Nevertheless, the regime still lacks smooth and better linkages between the different levels of the regime structure. In a sense, the regime has not been able to create a homogeneous identity that can accommodate the diverse institutional interests and transform them into practical and efficient solutions to environmental and water problems. Communication and co-operation among regime members is still a major problem that delays the implementation of qualified water projects. Some of the binational agreements, such as Border XXI, could be even more effective if their members were able to fix commitments to projects and funding. Unfortunately, many of their members still adjust their agendas according to regional, political and some times even political-party demands[272], rather than a truly environmental commitment.

The new method to approach environmental and water problems and to implement solutions to those problems gave rise to an interesting interaction of different levels of society. According to Paterson (1999: 795), environmental multilevel governance refers to a simultaneous shift of authority to international or transnational institutions, and down to local organization. For Hempel (1996) this regional governance emerges because the spatial scale of the state is inadequate in dealing with the scale of environmental problems. In the case of the Mexico-U.S.

[272] In the case of Mexico, some authors (for instance: Bruhn, 1997; Padgett, 1966 and Rivanuva, 1974) have indicated that most of the municipalities governed by Partido Revolucionario Institucional (P R I), have used public resources in order to benefit their party in some local and federal elections.

Environmental Regime, the state is simultaneously too small and too big to deal effectively with such problems, and thus practices of governance move towards regional levels and at the same time towards local levels. In this sense, the rise of the state and local governments as new actors in the Mexico-U.S. policy-making and the resulting pressure for regional participation and integration produced novel elements of interlacing and interlocking politics. Moreover, the interaction of borderisation and regionalisation triggered processes of regional adjustment and differentiation of intergovernmental and decision-making structures. It is this process of adjustment and homogenization that emerges as a precondition for the successful management of the multilevel system.

As a consequence, redistribution of responsibilities has been usually made downwards to sub-national governments. Change has often taken the form of greater sharing of tasks and a greater mix of financing and implementing responsibilities, leading to more interdependence. Exactly how responsibilities are distributed across levels of government, the degree and nature of autonomy, and the reasons for the changes that are taking place, all vary according to different types of inter-governmental systems. However, research findings suggest that inter-governmental relations may tend towards negotiation and collaboration depending on the country and the political and economic circumstances. It is difficult to generalize about trends in these relationships, but the growing interest in result-oriented management and inter-governmental partnerships is encouraging more consultation to agree on objectives, standards and cost-sharing arrangements.

2. THE PERFORMANCE

According to Young's (1997b) findings it would be a mistake to expect too much of individual regimes as devices for meeting the growing demand for governance in world affairs. Environmental regimes, such as the one on which we are focusing, are expected to experience different kinds of failures in their performance when dealing with transboundary and environmental issues. Hence, it would be natural to raise questions as Bernauer (1997) does in discussing regimes for river basins, about the effectiveness of their success in solving the problems that motivate their creators to establish them. To be effective, international environmental regimes must play a significant role in solving or at least managing the problems that led to their creation. But because regimes are not actors in their own right, they can succeed only by influencing the behavior of their members or actors operating under their members' jurisdiction (Young, 1999b). Concerning the case of the Mexico-U.S. Environmental Regime, we can conclude without hesitation that this regime does matter in the context of the border region. This is to say that the regime has created a situation in which the outcomes are greater in terms of benefit for the regime members than for detriment.

According to Young (1999a), one should never expect to be able to solve complex governance problems through application of simple devices. Hence, in order to understand this regime we need to engage in an analysis of regime performance, focusing in particular upon the principle of equity. The importance of this principle lies in the fact that it provides actors in a discourse with recognized starting points for a sequence of arguments designed to convince other parties of a particular interpretation of a social phenomenon (Hasenclever, Mayer and Rittberger, 1997:181). According to Ingram, Laney and Gillilan (1995), equity and fairness are key values associated with environmental or water management. This is mainly

because perceptions of inequity in the allocation of water of the Colorado River and Rio Grande have plagued Mexico and U.S. relations. For a long time the Mexico-U.S. border residents of both countries who share an aquifer or a river basin have encountered inequalities in access to, and costs of, water supply. Such unfair or inequitable difference is a matter of increasing controversy among border residents. Within this milieu, perceptions of unfairness would seem natural. In accordance with Ingram, Laney and Gillilan (1995: 211), what is true for water undoubtedly applies as well to other aspects of environmental quality where access to shared resources is very unevenly distributed. Free trade, for instance, although it may be expected to diminish wage and price differentials between the two countries, will not eliminate such disparities unless a greater public investment is made.

Far from being irrelevant, equity is developing into an important redeeming aspect of the Mexico-U.S. Environmental Regime (see Hasenclever, Mayer and Rittberger, 1997, 1998; Rae, 1981; Vogler 1995, 1996; Young 1980, 1982, 1989a, 1997, 1999a, 1999b). The growing inequality in the distribution of desired goods indicates that the formal equality of states must be made actual by recourse to notions of justice. Justice, as an augmentation of law, is also needed to protect those interests not ordinarily organized by traditional law, such as the well-being of future generations and the interests of the biosphere. Justice, seen as a concept of fairness, has a tempering role to play when the apportionment of goods (as in a river basin) occurs in the context of an almost infinite number of possible geographical, geological, topographical, economic, political, strategic, demographic, and scientific variables (Franck, 1995). In this sense, one of the main failures of the regime has been not introducing this concept as an element for its own practices.

For this research, the principle of equity is particularly important in terms of the critique of regime analysis coming from the neorealist tradition, which stresses the extent to which nations use international institutions for their own advantage. One main conclusion from the Lascurain´s work in 2001[273] is that Mexico and the U.S. did not benefit themselves entirely from the institutional arrangements. In fact, the statistical results in research work appear to reject neorealist arguments in which the U.S., in comparison with Mexico, was expected to take advantage of this binational relationship. When we look at the results related to each river, the findings suggest that, in the case of the Rio Grande, the U.S. have been allocated more water than Mexico. This confirms neorealist claims that institutions respond very poorly to the environmental problems and tend to benefit the hegemon, which in this case happens to be the U.S. This situation proves that the regime has been performing inequitably in allocating and distributing the water among the border citizens. On the Colorado River, the findings suggest that the city of San Luis has been allocated more water than Yuma. This is to say that the U.S., only in the case of this river, does not behave as the hegemon. On the contrary, this situation allows Mexico to develop power preponderance and to make advances in its relative capabilities, pressuring the U.S. to play a more equitable role within the regime. Theoretically, these findings verify that the neorealist assumptions are in a very vulnerable position, in the sense that there is no hegemonic domination of the U.S. Contrary to what we are likely to find in relation to the performance of the regime in the Rio Grande, in the Colorado River, the regime looks as if it was performing effectively due to the consideration and respect of the criterion of equity.

[273] Refer to Lascurain (2001). Ph.D. Thesis, University of Essex, England.

In the same way, when we look at the constantly increasing population, it is possible to conclude that the regime has accurately estimated the water demand in accordance to an increase in this variable. As well, it is possible to infer that the regime has also been able to guarantee the necessary water resources at least for the four decades on which this research is focusing. Hence, it is appropriate to say that the regime has had a successful performance in this matter. On the other hand, the inequalities of the socio-economic conditions among the population from one country to the other represent a difficult task for the regime's actors in redressing a severe mismatch between water availability and water demand. This difficulty ranges from a relative abundance in the cities of San Luis-Yuma (Colorado River) and in the cities located in the Upper Rio Grande to great scarcity in the arid areas located downstream of the cities Ojinaga-Presidio until the cities of Matamoros-Brownsville (Middle and Lower Rio Grande), and other areas such as the border between Sonora and Arizona and New Mexico. Moreover, these inequalities are reflected in the quality of the water resources in the region, in the sense that the waters in the border area are classified among the most seriously degraded in the whole of the territory of both countries. Without doubt, border surface waters and even groundwaters are often contaminated and/or over exploited. In comparison with the rest of the areas of both countries, this generates a preoccupying situation that automatically reduces the designated uses of the waters of these rivers for being unsuitable (OECD, 1998). To this end, the regime seems to be highly ineffectively since in the south most cities of the Rio Grande have been limited in terms of water availability.

Following from this, when we look at the regime performance in terms of water quality, it is possible to conclude that the regime performed in equitable terms, to the extent that the results suggest that Mexico and the U.S. practically have the same levels of DO in the Rio Grande. This situation, as I indicated earlier in this essay, confirms that the U.S. is unable to take advantage of the hegemonic role it traditionally plays, rather it would have to co-operate to maintain satisfactory levels of water quality on both sides of the border. It is also important to notice that this scenario may reject neorealist views in the sense that the U.S. would not be capable of using the Mexico-U.S. Environmental Regime for their own advantage. Concerning the Colorado River, we can find more or less a similar picture in the sense that Mexico and the U.S. have similar levels of DO. Despite the fact that these levels could be considered as harmful, the regime has been able to restrain the dominant role that the U.S. normally has. It simply has been limited by the entire politico-economic context of this area that frustrates a more favorable performance in favor of the U.S., as would be argued by neorealists.

Similarly, the regime has also been successful in allocating good water quality to the cities that are located on the lower reaches of the Rio Grande. In other words, that the water quality the lower riparian cities are receiving is not polluted but rather it tends to improve the levels of DO. This would mean without doubt a support for the neoliberal institutionalist approach since the delivery of the resource is done in an effective way, within the actual framework of the regime. Another important concluding point is that the regime has been able to improve the quality of the water throughout time. This would undoubtedly be an important finding that will certainly give support to future operations and will build up complementary environmental agreements in the border area. In relation to the economic variables, the regime behaves in different ways. For instance, there will not be better levels of water quality when improvements are made in the governmental

and services sectors. In fact, the regime appears to be highly ineffective when improvements are made in the governmental sector as well as in the manufacturing sector, to the extent that no improvements are detected in terms of water quality. However, the regime has been able to control the rapidly expanding factor of development in the border area, allowing only a decline of one thousandth of mg/L of DO.

With the above mentioned, this is not to suggest that the criterion of effectiveness is not important for this analysis. In fact, the criterion of effectiveness has been essential for the general evaluation of the regime in the sense that it has focused on how the regime promotes compliance and changes in the behavior in line with its norms and rules. In the end, it follows that the criterion of effectiveness is not entirely separable from the criterion of equity, since together they allow a better understanding of the environmental regimes. *If we look at an analysis of water supply and water quality, we can see that the Mexico-U.S. Environmental Regime has been reasonably successful, as judged by the tests of effectiveness and equity*. However, there are various areas in which the regime has failed to perform adequately. Concerning the legal framework that supports the Mexico-U.S. Environmental Regime, it was found that the polluter-pays principle does not carry much weight in the regime dynamics and victims of pollution are rarely in a position to obtain emission reductions from a polluter by threatening transboundary legal action (Bernauer, 1997: 185). In this sense, the regime has been ineffective simply because liability rules concerning transboundary freshwater remain weak and vulnerable.

Moreover, it was also found that current responses of the regime towards environmental problems have provided too little too slowly. Although federal agencies from Mexico and the U.S. have begun to take stronger initiatives throughout the regime infrastructure, environmental plans remain a compendium of current projects of disparate institutions. At the regional level, the border states of both countries have also begun to implement initiatives in this matter, notwithstanding the local level presents a different reality. Apparently, local citizens will never have the water and wastewater infrastructure they desired, unless they decide to create institutions that can plan, manage and pay for hydraulic improvements. In my opinion, the creation of stronger regional or even local institutions that can achieve the infrastructure goals within the limited means of the citizens of the border region promises to be a challenging task during the coming decades.

Looking at the conditions that encompass the Mexico-U.S. Environmental Regime one of the main problems it has to face is the disadvantageous economic position in which Mexico is standing in comparison with the U.S. economic supremacy. Poor communities, such as those we find along the Mexican side of the border, tend to lack the expertise, financial resources, and stability to undertake development, management and improvement of sophisticated water supply, wastewater treatment, or groundwater management projects. This situation simply means that country members have unequal economic capabilities to tackle environmental problems in the border region. The consequences of this situation are dramatically reflected in the quality and quantity of water the border population is likely to get. Yet, the participation of these poor and small communities, mainly on the Mexican side of the border, is essential in relation to the new practices of openness that the regime members agreed to put into action. As we can infer from analytical section

of the Ph.D. thesis of Lascurain (2001)[274], participation at the local level within the regime dynamics is essential not only for the proximity to the issue-area, which enables them to act quickly in solving problems, but also because of the effective operation and maintenance of water they are able to give, due to the knowledge about local conditions and their experience in formulating and enforcing operational rules and choices (Ostrom, Gardner and Walker, 1996). Even though the regime is not responsible for improving the social and economic development for the municipalities, the regime, in theory, is supposed to act as an enhancer of development and co-operation, something that it has not been able to do.

Despite the efforts already made by the Mexico-U.S. Environmental Regime towards a more efficient and effective allocation of the water resources and for a better water quality in the border region, various water and environmental problems are still present and unresolved in the agenda. We have to understand that the conditions in which the regime operates are indeed complicated. The challenge for the regime is not only to manage the water resources based on the performance criteria mentioned before, but also to implement both the norms and rules that give form to the regime and the appropriate environmental policies in an unfavorable milieu. It is important to make clear that the regime has failed to resolve some important water related and environmental problems. Supported by my findings, water and environmental conditions along the border region are if not better, at least less degraded thanks to the intervention of the regime. In other words, the environmental and water conditions within the border area are better off within the management of the regime than without it.

Other general findings about the contrasts that exist between Mexico and the U.S. can be seen not only in terms of economic modernity, but also in the consciousness that border population have about the invaluable price of water as well as in the way environmental policies are implemented. For many years Mexicans have been able to enjoy the water resources in the border region, paying very small amounts of money for it. It is also my belief that this kind of situation devalues the resource, which leads to unsuitable uses of the resource and this has severe consequences for the quality of the water. On the other hand, the population of the U.S. located along the Rio Grande has been entitled to higher amounts of water, yet they have to pay pertinent charges for its allocation. The problem of an appropriate environmental consciousness in the border population and mainly on the Mexican side, represents a vital issue that has to be considered by the regime members in order to put even more pressure on the federal, state and local governments to charge higher amounts of money for the use of water.

Contrary to the argument of Battler (1996) in which he suggests that new institutions such as the La Paz Agreement-Border XXI and the BECC-NADBank act as administrative focal points of more recent interest coalitions in their attempt to introduce new measures on a policy field strongly occupied by users and their administrative regulatory bodies. I support the idea that the new actors have apparently fulfilled the environmental necessities and the public demands effectively, due to the fact that more opinions were taken into account and more channels were introduced to the processes of policy-making and policy-implementation. The manner in which new institutions have adapted to the already existing schedules of the regime was clever. These new institutions were not only

[274] Refer to Chapter V and VI of Lascurain (2001)

concentrating their activities on issues never touched before by governmental agencies as such, but also they were opening spaces for other excluded and relegated actors in the border region in order to create and develop more effective and efficient policies. The consolidation of different focus oriented institutions in a single sphere of dynamics, working in a relatively harmonious way, represents per se an achievement that has to be recognized by all its members.

So far, the general performance of the regime could be considered as satisfactory, to the extent that much of the water supply and water quality problems, if not solved, at least have been contained. In a sense, I sustain the view that the operation of the regime has been directed towards the prevention of water-related or environmental problems, rather than the elimination of those problems. This, however, is not to belittle the work done by the regime. The presence of water and environmental institutions along the Mexican-American border has to take some credit. Firstly, for supplying the water of the border rivers, which according to the findings, this supply has not fulfilled the criterion of equity. In this respect, we have to consider that other entities located at other levels have also failed in achieving appropriate conditions in which to create some tangible changes. Secondly, these institutions have maintained effectively the levels of water quality over a period of nearly forty years. Then, I maintain that the participation of the La Paz Agreement, Border XXI, BECC and NADBank does not alter the effective performance of the regime; rather, these institutions are helping to reinforce the long history of environmental co-operation between Mexico and the U.S. Moreover, I believe that even though the situation is quite complex, the involvement of the regime in the environmental and hydraulic problematic in the border area contributes significantly to rebuilding of new and better ways to solve binational concerns.

3. THEORETICAL DEBATE

As Young (1999b) would argue, once we have concluded that the Mexico-U.S. Environmental Regime does matter in the context of the border region, there is nothing to be gained from perpetuating the debate between neoliberal institutionalists and neorealists about the false promise of international institutions. However, this debate seems to be particularly important when looking at the outcomes the regime is likely to produce. As we were able to see in this essay, the regime could not produce a set of outcomes that were in agreement exclusively with one of these theories. On the contrary, the regime appears to support and reject simultaneously both sets of theories. When regime outcomes tended to be focused on the asymmetries of power, neorealism accurately explained this kind of social phenomenon. In contrast, when outcomes focused on asymmetries of knowledge or information, neoliberal institutionalists' arguments were appropriate to understand these situations. Therefore, neither neorealism nor neoliberal institutionalism is able to explain the performance of the Mexico-U.S. Environmental Regime in a comprehensive way.

The importance in focusing on this debate is also because we were able to see that the regime does not conform to neorealist accounts of international relations. This is mainly because there is no clear separation of international and domestic as would be implied by the sovereignty thesis of neorealism. Instead, as Rosenau (1988) asserts, the policy of the information society consists of two worlds with overlapping membership; one an interactive, multi-centered world with a manifold of national and international community sector actors, and one a state-centered

world with public actors as its primary component. Mexico and the U.S. have created through negotiation a number of regions, such as the political-administrative cross-border regions in a multilevel system of governance, where the question of autonomy and sovereignty between the different levels has yet to be clarified (Veggeland, 2000). According to Veggeland (2000) we are able to find two kinds of border in this perspective. That is a Mexico-U.S. border of *states* and a border of *networks* with intricate relations, and which bases its power potential to govern on both *governmental institutions* (decision-making by Mexico and U.S. representatives) and *governance* (decision-making by networking partnerships). Similarly, as part of this theoretical debate, it is also possible to notice that there is no successful assertion of self-interest that neorealism would predict when looking at the performance of the regime in terms of the distribution of water supplies between Mexican and U.S. citizens. There are signs that the U.S. can no longer act as an hegemon throughout the Mexico-U.S. border region. There is, therefore, more equity in terms of water allocation than realists and neorealists would assume.

The point is so worthy of noting that, at the time of looking at the environmental performance of this regime, this theoretical debate is of great significance in the sense that it challenges the Thomas thesis (1992: 3-4) that the problem is that the world is organized on realist lines. She argues that Sovereignty, in theory, allows governments and non governmental actors on different levels, so that they can look after their areas of responsibility, complete their assigned tasks and realize the goals defining their reason to be (Veggeland, 2000). However, as was claimed by Thomas (1992), states have been portrayed in perpetual competition for power as the means of defense against external threats. Hence, the environmental issues have been disregarded and have changed to be more of an article for economic exploitation. In practice, this argument has been completely rejected by the performance of the Mexico-U.S. Environmental Regime in the understanding that formal sovereignty has been surrendered and partially replaced by a pooled sovereignty, in which actors are adjusted to the negotiations about internal and external relations. In the same way, Thomas' argument is also rejected despite the fact that the environment is, in spite of everything, at risk. The regime has been able to create a set of multiple interests rather than a single hierarchy of interests dominated either by security or power issues.

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THE SYR-DARYA BASIN
SECURITY PERCEPTION AND RESOURCE MANAGEMENT

Kai Wegerich[275]

1. INTRODUCTION

In the year 2001, the Central Asian states celebrated ten years of political independence. The main consequences of independence in terms of resource management was the transformation of Soviet administrative boundaries into national boundaries, and from integrated national water management approaches into transnational ones. The foregrounding of political independence allowed a backgrounding of historical and geographical interdependence. However, the collapse of integrated water, energy and food sectors of all the riparian states, created new and very serious risks and security challenges for the independent states.

The paper discusses how the new ideology of national security opposed to the former geopolitical security created different water resource problems between Kyrgyzstan upstream and Uzbekistan downstream. The paper presents two different security strategies, namely food and energy security and their consequences for integrated water management. It is argued that the proposed solutions addressing the national identified security threats, create regional insecurity.

2. INSTITUTIONS, PERCEPTIONS AND STRATEGIES

In this paper, institutions are defined as frameworks within which human beings interact. "Institutions are a set of rules, compliance procedures, and moral and ethical behavioural norms designed to constrain the behaviour of individuals." (North, 1981: pp.201-202, in Feeny 1988, p.171) Because institutions are influencing the perception and selection of strategies of the members of the institution. (Douglas and Wildavsky 1982) For this reason, the institutional structure, "plays the key role in the degree that the society and the economy will encourage the trials, experiments, and innovations that we can characterise as adaptively efficient". (North, 90, p.81) Institutions will also influence the perception of risks and security issues. Hence, a shift of the value system influences the perception and strategies of risks and security. It will be shown that the disintegration of the Soviet Union gave rise to 'new' perceptions of risks or probably similar perceptions as identified during the Soviet era. However the shift from administrational to national boundaries changed the scale, in which the 'new' strategies could be enacted. Because, institutions "determine the kinds of economic activity that will be profitable and viable" (North, 90, p.81), a shift within the value system or perception of the institutional boundaries might determine new 'profitable and viable' solutions. These solutions will not necessarily be the most efficient outcome or solution, however they might be "acceptable" within the new

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system. While the old institutional value system emphasised geopolitical security for Central Asia, the new value system focused on national security.

In his early works, North has argued that the main reason for change is minimisation of transaction costs and efficiency. However, as Feeny states institutional innovation does not take place in a perfectly competitive political area in which only efficiency-improving innovations are selected (compare Feeny 1988, p.165) Even North had to abandon the claim that institutional change is an attempt to increase efficiency. He argued that inefficient institutions stay unchanged if they have the necessary support, stating "rulers devised property rights in their own interests". (North, 90, p.7) Arguably, this could be true for different institutions on higher or lower spatial as well as hierarchical levels (Wegerich, 2002b). Hence, institutions which change the value system could be promoted. The case of Central Asia indicates that after the break-up new ideologies and values were promoted. These ideologies were not efficient, but were in the interest of the new ideologies of the states. The new ideology promoted national solutions, which manifested the political disintegration and lead to a disintegration of the integrated resource management systems. To fully understand the problems created through the disintegration of the resource management systems, one has to consider the historical background of water management in the region.

3. INTEGRATED RESOURCE MANAGEMENT

What already had started during the Russian occupation, continued during the Soviet period. Because of central control it was determined that the Central Asian rivers (Amu Darya and Syr Darya and their tributaries) should be managed according to basin boundaries.[276] This implied that the utilisation of the rivers did not correspond to the administrative boundaries and the interests of the administrative zones. The outside power forced the different interests of the administrative zones into one framework, which subordinated local interests to the interests of the outsider, the Central Authority in Moscow and to the greater interest of the Soviet Union. The Central Asian water authorities of each administrative zone were headed by the Ministry of Land Reclamation and Water Resources of the USSR (MLR&WR). "The ministries of the Central Asian republics were extensions of the ministry in Moscow. They were responsible to fulfil the centralised plans and norms. Their role in decision-making was limited to provide data to the centre." (Renger 1998, p.5) An SIC ICWC report states that that the subordination was two-fold, national and sectorial [irrigated agriculture]. (SIC ICWC 1999, p.13) The sectorial subordination implied that "the water management infrastructure was designed for a unified purpose and placed where it made sense geologically." (Lange 2001, p.1) The dams and reservoirs were build upstream in the mountains, while the main irrigation areas were downstream in the valleys and in the steppes. Hence. the water management constructions were built to control the flow and to enhance irrigation in the downstream regions. This implied that the dams had to be operated according to water requirements for irrigation during the summer and not for hydropower requirements during the winter.[277] The basin

[276] The exception is Afghanistan, which contributes according to recent estimates between 10 to 20 km³ to the annual water flow of the Amu Darya

[277] While this is the case for the Syr Darya it is different in the Amu Darya Basin. In Tajikistan the Vakhsh cascade is too small to significantly influence the flow. The live

framework approach had the benefit of total control over water and efficient water management for irrigation.

The Syr Darya is 3 019 km long and has a catchment area of 219 000 km^2. About 75.2% of the Syr Darya runoff originates in the Kyrgyz Republic. The Naryn is the main tributary of the Syr Darya and supplies about 30% of its total runoff. The Naryn-Syr Darya Cascade in Kyrgyzstan is based on different dams, the Toktogul Reservoir being the most upstream and the largest reservoir in the Syr Darya Basin. It has a gross storage capacity of 19.4 km^3 and a life storage of 14 km^3. During the Soviet Union, Toktogul was operated according to the requirements of the downstream irrigation regime. The summer reservoir releases averaged 8.1 km^3, or 75% of the inflow.

Already during the Russian empire, the irrigated areas were expanded and new virgin lands were developed. Under the virgin land policy of the Soviet Union the irrigated area in Central Asia continued to grow. The drive of the 'hydraulic mission' with its emphasis on large canals, pumping stations, and reservoirs helped to further control river flows and to expand the irrigation systems. In the 1970s, the Hunger steppe got further developed. Between 1971 to 1975 the area irrigated in the Hunger steppe increased by 115,000 ha of virgin lands. In addition, the Djizak steppe, south of the Hunger steppe, was developed. Both irrigation systems received water from the Syr Darya. Because of the Soviet policy to enhance irrigation productivity of the region, equal water distribution between the riparian administrative units was not considered. The policy of expanding the irrigated areas in the downstream regions further manifested the skewed distribution between water producing and water using countries.

***Table 1*: Water producing and water using countries**

Republics	water producing (km^3)	irrigated area (ha)
Uzbekistan	4.14	1,883,000
Kazakhstan	4.5	786,000
Kyrgyzstan	27.4	410,000
Tajikistan	1.1	271,000
Total	37.14	3,350,000

In the Soviet system there was no conflict between upstream and downstream interests. Upstream and downstream riparian units benefited through the regional approach and the use of water, energy and food as common pool resources. Due to the forced focus on irrigation, the upstream water management constructions, such as dams and reservoirs, did not produce hydroelectric power when it was needed mostly in the upstream regions, which is during the winter season. The dams released water during the summer when the downstream riparian administrative units needed water for agriculture. Because all the republics were unified in one country, energy was provided during the winter from the downstream regions, which are rich in oil and gas. As shown in Table 1, the upstream republics did not utilise the water for irrigation on their own territory. In the upstream regions the

storage capacity of the Nurek reservoir is 5 km^3. The Vakhsh Cascade has an installed capacity of almost 4,000 MW and in average year produces about 15,000 GW.

main focus in the agricultural sector was on livestock and not on food crops. Food security was provided in the integrated approach from the downstream regions.

With the independence and the shift from a single administrative unit to an autonomous state, the regional approach of water management was at risk. The international 'security and conflict community' assumed that Central Asia would have to deal with water disputes and water wars. Smith's statement reflects these thoughts, "nowhere in the world is the potential for conflict over the use of natural resources as strong as in Central Asia". (Smith 1995, p.351)

4. FROM INTEGRATION TO DISINTEGRATION

Soon after independence, the Central Asian governments initially agreed to continue with the water allocation of the Soviet Union. They agreed to manage the basin water on the basis of the International Water Law. This implies equitable, reasonable and mutually advantageous water resource use. (WB 1996, p.13) The independent republics acknowledged the joint water management of the water resources in the Almaty agreement of 1992. "Under the agreement the states retained their Soviet-period water allocations, refrained from projects infringements on other states and promised an open exchange of information. (O'Hara quoted in Horsman 2001, p. 3)

As Table 1 indicates, the current water allocation among the different riparian states in the Syr Darya basin is unequal. The allocation is a continuation of the old system. However, while the old system of water allocation continued, other regional approaches had disappeared, such as food and energy exchange. This had major consequences for upstream water demand. It is a fact that small changes in water policies upstream can disturb the balance of the current agreement, due to the upstream-downstream dependence on water. And independence did not bring small but large changes. After independence all the republics started a national strategy of energy and food security. The foregrounding of political independence allowed a backgrounding of historical and geographical interdependence. However, while downstream countries could divert water away from cash crop to food crop production (as happened in Uzbekistan and Turkmenistan), the small amount of allocated water in upstream countries does not allow any shifts. Any upstream shift in water demands for agriculture reduces the availability of water for downstream users. The following evaluation of Kyrgyzstan's agricultural reform will emphasise the increasing water demand of the upstream riparian.

5. FOOD SECURITY

On the territory of Kyrgyzstan 410,000 ha of land are irrigated. Prior independence, the land was managed by large state and collective farms. After the collapse of the Soviet Union, these farms were privatised and divided into small farms. While in 1990 450 state and collective farms existed, in 1996 the number of farms had increased to 40,000. The on-farm irrigation structures became inter-farm structures, which are not equipped to control the water use of small-scale farms. In addition to the problems of water distribution on the local level, small-scale subsisting farming changed the focus of the agricultural production from livestock to crop production. (Baumann 1999, p.26) According to FAO data, in the time period from 1992 to 2000 the area allocated to cotton, wheat, rice and vegetables

increased from 21,500 to 33,764; 284,400 to 443,688; 1,900 to 6,229 and 24,400 to 48,034 ha respectively. As a result of the increase in area the production increased as well from 52,400 to 87,884; 679,000 to 1,039,109; 3,500 to 18,991 and 438,600 to 824,000 respectively in the same period. (FAO data 25/04/2002) On the other hand, livestock, which was the primary focus of the state and collective farms, declined. The shift from livestock to food and cash crops lead to higher water demands in Kyrgyzstan. The agricultural sector became more important, since independence the agricultural sector dominates the Kyrgyz economy and accounts for 45 per cent of the GDP. (UNESCO 2000, p. 60) However, the water allocation for Kyrgyzstan did not increase. This could imply that Kyrgyzstan already infringed the current water allocations with its land reforms.

Chart 1: **Area harvested (in %)**

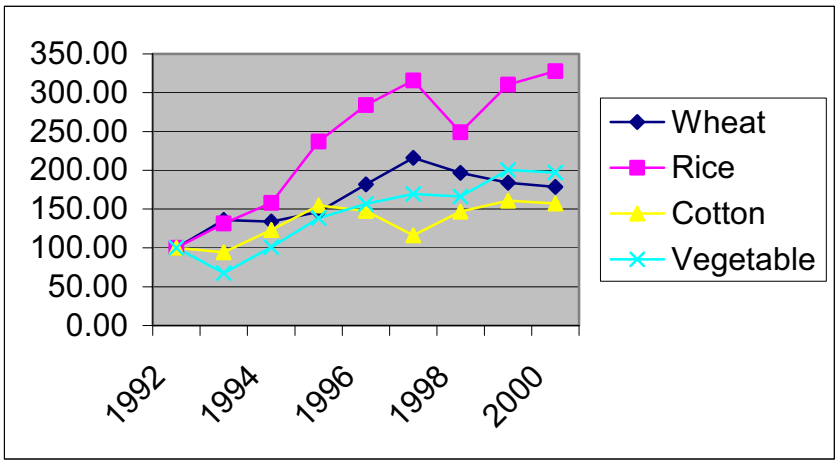
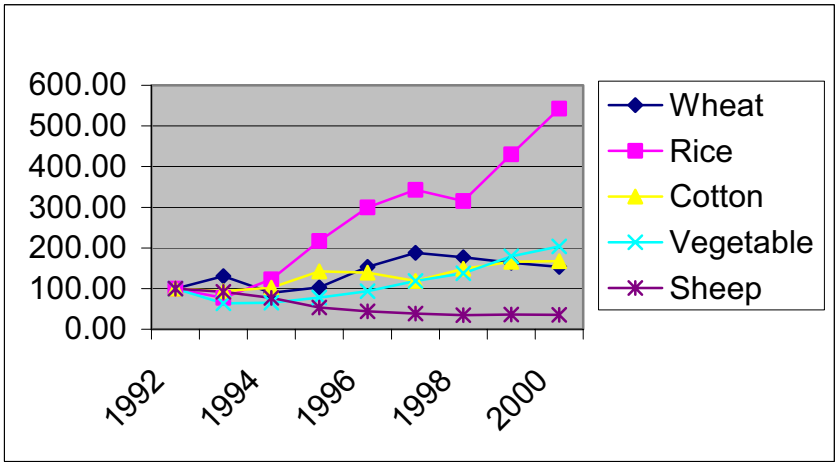


Chart 2: **Production (in %)**



Most authors focus on the allocation of water resources as the main cause for potential conflict between upstream and downstream riparian states. "The key source of tension between Kyrgyzstan and Tajikistan, and between Kazakhstan, Turkmenistan and Uzbekistan, is [water] allocation." (Horsman 2001, p. 5) Hence, a shift in water consumption and rising demands, as happened in Kyrgyzstan,

should have resulted in a conflict amongst the riparian states. However, the increase in water demand did not lead to state conflicts over water.
Conflicts in which water played a significant role were not based on allocation issues. On the contrary they were related to different uses of water, such as water releases from the Toktogul reservoir for hydro-power in winter. Conflict based on unequal water distribution did not occur. Water scarcity did not lead to interstate conflict. However, it seems likely that the rising demand for water in agriculture upstream did not have an impact because it was overshadowed by the water releases from the dams during the winter.

6. ENERGY SECURITY

After independence, the Soviet arrangements for water allocation ceased when Kazakhstan and Uzbekistan started to charge for oil and gas supplies to Kyrgyzstan. Kyrgyzstan began to release water during the winter, to produce energy for its population. Even though the use of water for energy production did not change the regional allocation of water, it changed the availability of water at certain periods. Economic sectors need water in different periods. Kyrgyzstan needs water for energy production during the winter and Uzbekistan for irrigation during the summer. Before 1991, the summer reservoir releases an average of 8.1 km^3, or 75% of the inflow into Toktogul. But, since 1991, the summer releases have averaged 6.0 km^3, only 46% of the inflow. (USAID 2002, p. 13)

Table 2: **Toktogul Reservoir Operation**

Water Year Oct.-Mar.	Reservoir Inflow (km^3)	Winter Outflow (km^3)	Summer Outflow (km^3)	Total Outflow (km^3)	Summer as % of Total Outflow
Avg.76-90	11,369	2,677	8,087	10,765	75.13
Avg. 91-00	12,819	7,216	6,048	13,264	45.60

(USAID 2002, Appendix C)

In the late 1990s, USAID pressured the upstream and downstream countries into a barter trade, which reinforced the Soviet arrangements on energy. According to an agreement from March 1998, Uzbekistan and Kazakhstan agreed to buy Kyrgyz electricity during the summer and sell gas, coal and oil to Kyrgyzstan in the winter. Even though it seems that the agreement reinforced the Soviet arrangements, the agreement still has disadvantages for Kyrgyzstan. Firstly, the price for hydro-power is lower than the prices of coal and gas, and secondly the agreement did not take into consideration the operation and maintenance of the upstream water management constructions. Kyrgyzstan, which provides the service of water delivery to the downstream countries, is responsible for the costs of the service, namely the costs of dams and reservoirs benefiting downstream irrigation.

However, since 2002 a new trend seems to be established, furthering independence between the countries and promoting a continuation of the disintegration of the water, energy and food sectors. According to various interstate protocols the agreed summer outflow of Toktogul is 6.5 km^3. The number is close to the achieved average. Hence, it would not be necessary to continue with the barter trade of energy and water. This would also release Uzbekistan from the pressure of taking responsibility of the operation and the maintenance costs of the upstream dams

and reservoirs. At present, it is also contested that the winter releases of the Toktogul reservoir are responsible for the water scarcity in the downstream regions. Water scarcity might be due to the weakness of the River Basin Organisation (BVO), which has not the capacity to enforce and control the water allocations to the riparian provinces. In the Amu Darya basin, the weakness of the BVO lead to over appropriation of water by the midstream riparian water users. (compare Wegerich 2002) In addition, new proposals in Uzbekistan suggest to build reservoirs, (Rezaksay Reservoir Project and Arnasay Reservoirs Project) which would reduce the need of interstate co-operation over water allocations across different sectors. (Abdullaev 2002) However, while these proposed solutions might solve the conflict between the energy and water sectors, it does not solve the problem of water allocation which arises from the policy of national food security.

7. CONCLUSION

The discussion of the new water management problems in the Syr Darya basin resulting from the collapse of the Soviet Union, emphasises that institutions do matter. Institutions determine the perception and strategies for resource use and management. In the past, conflicts between upstream and downstream states arose when one geopolitical perspective changed into national perspectives. One integrated solution turned into a few disintegrated solutions and a win-win situation for all the riparian states turned into multiple zero-sum situations.

The example of the Syr Darya Basin shows that a disintegrated framework, focusing on one sector and one riparian state alone, has not lead to stability and security for the whole basin. In the case of the riparian states of the Syr Darya, a more complex solidarity incorporating a regional perspective as well as the water, energy and agricultural sector is needed. The scope would be similar to that of the Soviet period. But the style would have to be different. The new integration would have to be based on the principle of economic efficiency and environmental sustainability.

The study showed that a complex and comprehensive integrated water management can disintegrate when the wider assumptions and ideologies which lead to integrated management disintegrate. Hence, the shift in leading assumptions and strategies can determine water resource use and management. The integration of basin water management will fail if the assumptions and strategies focus on national instead of basin boundaries and security.

ACKNOWLEDGEMENTS

I would like to thank Prof. Tony Allan, Ton Laennerts and Stuart Gunn for their helpful comments and suggestions.

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WATER ALLOCATION AMONG MULTIPLE STAKEHOLDERS: A CASE STUDY OF WAIAHOLE WATER PROJECT, HAWAII

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ABSTRACT

This paper identifies seven critical elements that ought to be an integral part of a scheme or framework of water resource allocation. Using a case study approach, it documents, analyses and explains how the exclusion of these key variables could result in a pattern of allocation which seriously compromises efficiency, equity, and sustainability of water use. Based on this analysis, a strong case is made for designing, developing, and implementing an innovative, holistic decision-making framework for water allocation incorporating these seven critical components.

1. INTRODUCTION

Recent years have seen a sharp increase in the demand for water in Hawaii. Many factors account for this growth. These include population growth, expansion in the visitor industry and increasing water demands in the urban and industrial sectors, among others. The increase in water demand has intensified and accelerated the competition for the state's water resources. This rapidly changing configuration of water demand has resulted in a number of conflicts with respect to the allocation of water among its competing multiple users.

This paper is a study of the allocation of the Waiahole Ditch waters on Oahu, the major economic and population centre and visitor destination of Hawaii. The Waiahole ditch and tunnel system was built in 1916 by the Oahu Sugar Company for transporting water from the wet, windward side to the arid leeward plain of Oahu for irrigating its extensive sugar plantation spread over some 4,000 acres. For almost 80 years, approximately 27 mgd of water was being diverted through this 25-mile tunnel for the exclusive use of Oahu Sugar Company. The closing down of sugar operation at the end of 1995 freed this water for alternate uses.

2. THE PROBLEM

The central issue in the Waiahole ditch controversy boils down to the question of how best to reallocate this water among competing and often conflicting demands. The state of Hawaii Commission on Water Resource Management (herein after called the Water Commission) became responsible for the reallocation of the surplus 27 mgd of water among uses and users claiming a share in it. There are many stakeholders to this water bonanza. These included, on the leeward side, large landowners (Bishop, Castle, Campbell and Robinson Estates), and big resort-, golf-course-, and housing-developers. On the windward side, the claimants included small farmers, community associations, neighbourhood boards, Native Hawaiian Associations and assorted environmental groups.

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The Water Commission was created by the Hawaii State Legislature in 1987 to administer the Water Code of Hawaii. The broad mission of the Water Commission is to protect and enhance Hawaii's water resources through judicious and responsible management. The Commission consists of six members (commissioners). Two are ex-officio members and the other four are political appointees of the governor. Although autonomous, it is administratively housed in the Water Resource Management Division in the state Department of Land and Natural Resources (DLNR) and the Director of DLNR also serves as the chairman of the Commission. As the agency entrusted with the management of the state's water resources, the Water Commission assumed the responsibility for reallocating the surplus Waiahole water. The two major competing water users, as noted above, are the urban developers of leeward and central Oahu, on the one hand, and a coalition of farmers and environmentalists of windward Oahu, on the other. The urban developers have a close affiliation with Hawaii's big corporations and they stand to gain enormously if substantial quantities of water are made available to them at throw-away prices.

The state Water Commission after over three years of deliberations announced in Dec. 1997 its decision with respect to the reallocation of 27 mgd of Waiahole water among the contending parties as follows: 14.03mgd for the leeward side and 12.97 mgd for the windward side. The 14.03 mgd of water allocated to the leeward side included 12.22 mgd for agricultural uses and 1.29 mgd for former Oahu Sugar Company (OSC) sugarcane lands currently used for diversified agriculture (nearly 4,000 acres at 2,500 gd/acre), and 2.2 mgd for Castle Corporation's agricultural lands. The windward allocation by the Commission included a release into the windward streams a total of 12. 97 mgd, out of which 6.77 mgd remained water available for offstream leeward uses. The amount of water released to windward streams was significantly lower than was requested by the windward parties.

3. ANALYSIS AND CRITIQUE

There is no mention in the Water Commission's report of the specific criteria it used to reallocate water among the different uses and users. Absent from the Commission's report were explicit and clear discussions of:
Water rights issues
Impact on sustainable water use
Impact on water quality
Impact on in-stream uses
Economic impacts
Impact on water conservation
Impact on watersheds

The exclusion by the Commission of these criteria for water allocation poses troubling questions as to whether the projected increases in water demand for the different sectors of Hawaii's economy have been considered in the allocation of water. The interpretation and application of the legal doctrine used by the Commission has now been found to be flawed by the State Supreme Court. With Hawaii's population showing rapid increase, the impact of any proposed allocation on sustainable water use merits detailed investigation. With growing concern in Hawaii on water quality, especially from non-point sources, the Commission should have carefully considered the potential impact of the proposed allocation on water

quality. Although the damage to in-stream uses in windward Oahu due to the age-old diversion of Waiahole water has been well documented, there is no evidence of the Commission factoring this into its deliberations. An egregious omission is the lack of analysis of short-and long-term economic impacts likely to result from the proposed water allocation. Also, any proposal for water allocation should carefully consider the potential for water conservation, in light of diminishing supplies and expanding population. Finally, consideration of the impact on the watershed as a whole is crucial in any water allocation decision and the Commission's report barely examines this aspect. What follows is a further examination of each of the above issues focusing on its centrality in the context of water allocation decisions involving multiple stakeholders.

4. WATER RIGHTS ISSUES

A group of water users challenged in the State Supreme Court the Commission's allocation of water among different users, shortly after the final allocation was announced in December 1997. Of particular concern to the plaintiffs was the large quantity of water allocated to agriculture on the leeward side. It was argued that the amount allotted for agricultural use by the leeward landowners was excessive and this could well have been the result of the Water Commission using an arbitrary water per acre need for diversified agriculture as the allocational basis. A second major concern had to do with the Water Commission's rationale and approach toward the allocation of water for in-stream uses. The State Supreme Court took strong exception to the Commission's allocation. The Court ruled that "without any proper findings as to the actual requirements for in-stream purposes, or the reasonableness of offstream diversions relative to these requirements, the Commission effectively assigned to windward stream the water remaining after it had approved the bulk of the offstream use permits" (Supreme Court of the State of Hawaii, 2000).

The State Supreme Court concluded that the Water Commission had overly narrowly applied the Public Trust Doctrine, the basic legal principle governing natural resources, including water, in its deliberations and decisions, to the detriment of many parties. The Court urged the Commission to take into account issues of intergenerational equity, ecological and environmental impacts, Native Hawaiian Water Rights, and other related concerns in its efforts to reapportion the Waiahole water. The State Supreme Court therefore revoked several of the Water Commission's decisions and remanded it to revisit and revise its earlier decisions consistent with the Court's decision (Supreme Court of the State of Hawaii, 2000).

5. IMPACT ON SUSTAINABLE WATER USE

It is estimated that the demand for water in Hawaii will increase by about 206 mgd in 2010 from the current level of consumption. The demand for domestic water use alone will be 116 mgd in 2010, representing an increase of 30 mgd (35%) over the water consumption in 1990 (Malla & Gopalakrishnan, 1997). The commercial-industrial sector of Hawaii is another important consumer of the state's water supply, with a clear potential for significant additional water demand in the years to come. This is evidenced by the fact that commercial and industrial water use increased by a dramatic 60% during 1985-1990 in the state of Hawaii (Malla &

Gopalakrishnan, 1999). The visitor industry water consumption is also expected to go up markedly (Gopalakrishnan & Cox, 2003).

Oahu's sustainable yield estimate for groundwater was revised to 465 mgd from 495 mgd by the Water Commission in 1991. The demand projections estimate that Oahu will be approaching the sustainable yield limits for the island within the next 20 years. Nevertheless, the water withdrawal in two of the main aquifer systems is already 85% or more of the sustainable yield (85% in Pearl Harbour and 88% in Honolulu) (Malla & Gopalakrishnan, 1995).

Thus, it becomes imperative to undertake a careful review and analysis of the potential impacts of any proposed water allocation on sustainable water use in the state of Hawaii. Regretfully, no attempt was made by the Commission to examine this aspect.

6. IMPACT ON WATER QUALITY

Approximately 85% of the drinking water in Hawaii comes from public supplies with a groundwater source (Hagemann & Fukunaga, 1995). No other state in the nation is so heavily dependent on groundwater for its rapidly growing water needs (see Malla & Gopalakrishnan, 1997). Given this extraordinary situation, the case for preserving the quality of Hawaii's groundwater supplies becomes compelling.

There have been many instances of water contamination in Hawaii from non-point sources, in recent years, virtually all of them from agricultural chemicals (Lau, 1987). Given the preponderance of water allocation for agricultural use, the Water Commission should have used due diligence in assessing potential water quality impacts from the use of agricultural chemicals in diversified agriculture. The potential for surface water pollution from residential, industrial and urban developments triggered by the reallocation of water should also have been carefully examined by the Water Commission. This is all the more important in the case of Hawaii's fragile tropical environment which is so vital for sustaining the visitor industry, especially its growing segment of eco-tourism. Unfortunately, the Water Commission made no attempt to examine and assess potential water quality impacts.

7. IMPACT ON IN-STREAM USES

The windward farmers contend that a return of water is crucial for the restoration of shrunken streams and the replenishment of stream-fed estuaries where fish breed. It has been maintained that the stream ecosystem and the traditional taro and rice farming in the Waiahole-Waikane areas dried up 80 years ago when the ditch was constructed to divert water to central Oahu.

Monitoring of increased stream flow has shown that a variety of freshwater fish, O'opu, has made a comeback and benefited the Kaneohe Bay where the stream empties (Matsunaga, 1995). Kaneohe Bay once had 70 mgd of freshwater flowing into it by way of stream, 50% of which no longer enters the bay. Therefore, it stands to reason that the availability of water in windward streams, among other things, will improve the habitat for near-shore fisheries, provide opportunities for

aquaculture, improve stream habitat, and increase valuable wetland habitat for the endangered birds (Reppun, 1994 a).

8. POTENTIAL ECONOMIC IMPACTS

Two possible scenarios of water allocation have been put forward, one proposing retaining water for the leeward side, while the other suggesting returning the water to the windward streams.

8.1. Leeward Oahu

The interests on the leeward side include Amfac (former owner of the Waiahole Water Company), large landowners — the Bishop, Campbell and Robinson Estates — and their neighbours who are supported by the resort, residential and golf course developers, as well as the state Departments of Land and Natural Resources and Agriculture.

It has been argued that water should be retained on the leeward side for diversified agriculture and urban development. The windward side receives heavy rainfall compared with dry central Oahu. Land requesting water in central Oahu totals 9,000 acres (Paty, 1994). Over 4,000 acres of land can be put into diversified agriculture consistent with the current state policy. Crops such as tomato, bell pepper, potato, herbs, wonbok, and more can be grown to meet local demands (substituting imports) and also for export. It is estimated that diversified agriculture can generate one job per twenty acres against one for thirty acres in sugarcane (Paty, 1994), helping to absorb jobs displaced by sugar workers. Thus, there is a potential to create about 450 jobs on the leeward side.

Water can also be used in urban areas for landscaping, industrial operations, golf course irrigation, and fire protection. Some advocating more water for the leeward side argue that any water allocation decision should be based on General Plans for the island of Oahu. Leeward Oahu is envisioned to grow significantly in the Oahu General Plan, while the plans for windward Oahu call for virtually no growth and emphasise its rural character (Davidson & Callies, 1995).

8.2. Windward Oahu

Those supporting water restoration to the windward side include the Waiahole-Waikane Community Association, the Kahuluu Neighbourhood Board and Ka Lahui Hawaii, a Native Hawaiian group (Matsunaga, 1995). However, it was suggested by the Water Commission that the freed water maybe enough to meet the demands of both sides of the Koolau mountains (Wagner, 1994).

On restoration of water to the windward side, it has been claimed that about 180 acres of land can be re-established under rice crop and 400 acres under taro cultivation. Currently, taro is being cultivated on 10-15 acres (Barayuga, 1994). It has also been suggested that 1,500 additional acres can be made productive provided the water is brought back (Reppun, 1994 b).

The windward farmers argue that thousands of acres of central Oahu land are vacant and therefore do not need water. Besides, there are possibilities of developing alternate sources in leeward/central Oahu, including millions of gallons

of treated sewage effluent for irrigation. Since a substantial amount of taxpayer money is involved in treating the effluent, it seems only logical to make use of this water for irrigation. Another alternative is the underground pumping of water.
The windward farmers say that the increased flow of water has facilitated the cultivation of taro crop. There are now more commercial bait fish and shrimp. The future water requirements for agricultural and aquacultural uses in windward Oahu are projected to reach 34.70 mgd in the years ahead.

9. WATER CONSERVATION

Given the escalating demand for and shrinking supplies of both surface and groundwater supplies in Hawaii, the potential for conservation should be a key factor in any proposal involving water reallocation. It appears that the Oahu Sugar Company has not been able to fully utilise for many years the 27 mgd it had contracted for. Instead, it was routinely dumping as much as 18 mgd of water in dry gulches, pastures and ditches, a practice seriously compromising efficient water use and water conservation (Vickers, 1994). Also, the potential for using treated effluent for the purpose of recharging the Pearl Harbour aquifer should be carefully examined (Environment Hawaii, 1994). It is also estimated that 25 mgd of treated sewage effluent can be made available for possible irrigation purposes in leeward Oahu.

10. IMPACT ON WATERSHEDS

Any scheme involving a major reallocation of water should carefully consider and document the impact of the proposed diversion on the watershed as a whole, as opposed to its impact on the immediate vicinity. The emphasis today in the context of water allocation and transfer is on the macro impacts on the area served by the whole watershed instead of the micro impacts on specific areas immediately affected. The hydrology of the watershed should be at least as important as the economic impact in charting the course of water reallocation. This is especially important since sustainable water use would dictate a rate of depletion no higher than the rate of replenishment. Also, an examination of the impacts on ecology, the environment and aesthetics of the watershed, along with the consideration of irreversibility, should be part of the calculus of decision-making.

11. CONCLUSIONS

This case study has shown how imperative it is to have explicit and well-defined criteria in place in order to equitably allocate a public good, such as water resources, among myriad competing demands. Adherence to these criteria should ensure access and availability of water to the different sectors, including the disenfranchised minority groups (in this case the Native Hawaiians), thus meeting the fundamental tenet of allocational justice of a public good.

The analysis demonstrates the need for reforming outmoded water institutions, often affiliated with state or federal bureaucracies, which lack genuine autonomy and independence in objective decision-making. The flawed decision by the Water Commission, to a large measure, may be the result of its being administratively housed in the state Department of Land and Natural Resources. As a result, the Commission was seriously constrained in a genuinely autonomous decision-making,

especially given the long and overarching history of the politics of water in Hawaii (Gopalakrishnan, Malla & Khaleghi, 1996). This situation is all-too-common in other settings, as well. This further points to the need to have an allocational system guided by well-defined criteria that will ensure independent decision-making through institutional reform, a decidedly achievable goal.

Arbitrary allocation of water by bureaucratic agencies has been widely recognised as the principal cause of conflicts among stakeholders. In most instances, the absence of a framework or system based on well-defined criteria, and the consequent lack of accountability have been the main source of such arbitrary action. The upshot has been the proliferation of conflicts among uses and users involving long-drawn-out negotiations and other conflict resolution mechanisms with prohibitive transactions costs. Often the results have been disappointing both in national and international settings. The proposed 7-point framework has the potential for rational water allocation and a substantial reduction in costly water use conflicts and litigation. This is one of the major conclusions of this study that has special relevance to water policy formulation in developed as well as developing countries.

In summary, this paper argues that a decision-making framework incorporating well-defined procedures to gauge the multiple economic and institutional impacts of water allocation has to be developed and implemented in order to ensure efficiency, equity, and sustainability, while at the same time protecting stakeholder interests. Such a framework should assist local, national, and international water agencies in deciding on future water allocations among competing water uses and users.

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CONFLICTS FACING THE PROPOSED WATER RESOURCES POLICY OF SRI LANKA

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ABSTRACT

In 1995, the Sri Lankan Government adopted a Strategic Framework and Action Plan for Comprehensive Water Resources Management with the assistance of the Asian Development Bank. The actions included the establishment of a national water resources council, formulation of a water policy, and preparation of a water law. In the year 2000, the Cabinet of the Government of Sri Lanka approved a comprehensive policy, a legal, and an institutional reform package, prepared in the framework of this project. However, public concern and protest regarding the proposed National Water Resources Policy and Institutional Arrangements and Water Resources Act forced the government to temporarily stop its implementation and take steps to reformulate prior to bringing it before the parliament for approval. The issues regarding the ownership of water, granting right to use water through entitlements and suspected implicit measures to price water were major issues for the objections. For Sri Lankans, water is not something that should be turned into an economic commodity to be bought and sold. The government should conduct public consultations and awareness campaigns of the draft national water policy and draft laws during their reformulation. Policy makers should interact not only with water resources experts and water administrators but also with the public during the reformulation effort to avoid conflicts in the future and come up with an acceptable water policy for all in Sri Lanka.

1. INTRODUCTION

The Government of Sri Lanka, with support from the Asian Development Bank (ADB), initiated an Institutional Strengthening for Comprehensive Water Resources Management (ISCWRM) project in Sri Lanka in 1995. This project was in line with current emphasis on water policy and institutional development and on the need for a comprehensive, water-sector approach to sustainable development. The ISCWRM project was under the guidance of the Water Resources Council in Sri Lanka establish under the project. This Council is not a legal entity, though the Cabinet endorses its mandate and the nation's President appoints its members. It is composed of secretaries (senior executive officers) of six of the major ministries responsible for water management and by an equal number of non-government representatives, including water users, NGOs, and the academic community.

The Council was, in turn, supported by a technical Secretariat (Water Resources Secretariat) set up in the framework of the project. The Council and its supporting groups are responsible for implementing the project and promoting improved co-ordination among the country's many water sector agencies. The Comprehensive Water Resources Management project was supposed to address the entire water sector in Sri Lanka, including irrigation, water supply, hydropower, and environmental aspects. It consists of a five-point action plan:

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1) Development of a National Water Policy. Currently Sri Lanka has no national water policy.

2) Preparation of a National Water Act. The project goal is to prepare national legislation and regulations and to amend the large number of current water-related acts.

3) Institutional development, including specification of water sector functions and strengthening the environment of sector agencies to carry out these functions.

4) Preparation of a system of integrated river basin planning, including development and communication of planning guidelines and development of terms of reference for an integrated river basin planning study.

5) Development of a co-ordinated water sector information system, including public information.

The Cabinet of the Sri Lankan Government, in March 2000, approved the National Water Resources Policy formulated under the project. The policy was expected to address both resource management and service delivery aspects, linking water to national development goals and protection of the environment. The WRS and the Water Resources Council, with the help of the ADB, the Government of the Netherlands and the Food and Agriculture Organisation (FAO) drafted the policy document.

However, nation-wide huge protest campaigns against the draft policy blaming it for having many detrimental impacts on (a) public water rights, (b) water prices and (c) social and physical environment, prevented its submission to the Parliament for the final approval. The major dissent was concerning the issue 'water entitlements' to both surface and ground water resources, which was suspected to lead to multinationals obtaining the rights to the country's water and result in a threat to the country's agriculture, power generation and people's access to drinking water. The government initiated steps to reformulate the draft policy, but continued with its plans to establish some of the institutional arrangements set out in the policy on an interim basis. The paper presents the drafted policy in summary and several main reasons why the public protested against it.

2. WATER IN SRI LANKA

Sri Lanka is a tropical island situated in the Indian Ocean covering a land area of 65 610 km^2 out of which 2 905 km^2 correspond to large inland waters. Sri Lanka is flat in the coastal areas, and has mountains towards the centre of the island. The country may be divided into two climatic regions, the wet zone, which covers one third of the island, and the dry zone. Its population is over 19 million with an average population density of about 290 persons per km^2. The population increased with 1.2% per annum in 1999.
There are 103 river basins in the island. The overall annual average precipitation is more than 2,000 mm, but the monsoon climate and national geography create substantial variability in the amount of water that is available both spatially and temporally. Per capita water availability of 2400 m^3 as available today in Sri Lanka does not indicate a crisis situation at first glance. It is estimated that at a population threshold of 23 million people by 2025 based on current trends, per

capita availability would by 1900 m^3, still above the minimum levels for adequacy of 1700 m^3 set by the FAO. Though water appears to be plentiful in aggregate terms it gives a misleading picture due to the high degree of spatial and temporal variation. Besides, economic development, population pressure and growing demands for food production, electric power, and adequate water for domestic, industrial and commercial use and sanitation services are placing increasing pressure on water resources. In addition, current uses of water also include the maintenance of carrying capacities for mitigation of impacts from effluent discharges from domestic and industrial pollutants. It also serves as a medium for maintenance of an environment for aquatic biota and reproduction of aquatic species associated with wetlands. Future projections show that expected demand far outstrips supply, particularly in the country's dry zone where most of the irrigation schemes are located.

The available water resources have been subject to competing uses without concern for its equitable distribution among users. There is no incentive for conserving water although many are deprived of basic requirements of water for different purposes in terms of volume and acceptable quality. There have been frequent water shortages arising from climatic changes and inefficient systems adopted in water use, in the light of rising economic, social and environmental demands.

The need for an improved legal and institutional framework for water resources management in Sri Lanka was pointed out in many legal and policy studies. A draft Water Act even was prepared in 1980, but was never submitted to Parliament. Understanding this need, the Government of Sri Lanka requested the assistance of the ADB and the Food and Agriculture Organisation of the United Nations (FAO) to formulate respectively a national water resources management policy and implementing legislation. Simultaneously, it set up Water Resources Council (WRC) and the Council's technical a Water Resources Secretariat (WRS) to oversee and carry out the process.

3. NATIONAL WATER RESOURCES POLICY

The National Water Resources Policy is a statement of the government's intentions regarding management of the country's inland water. The formulated Water Resources Policy consists of the following component statements (Sri Lanka Water Resources Council & Secretariat. 1999):

Water Resources Policy Foundation
Water Rights and Allocation Policy
Water Resources Demand Management Policy
Groundwater Management Policy
Water resources Information Management Policy
Institutional structure for Water Resources Management

The government expects additional components of the Water Resources Policy to be developed and approved in the future. The anticipated components include:
River basin Planning and Management
Drought Management and Flood Control
Water Resource Development and Financing
Water Quality Management

In addition, irrigation, industrial, urban, power and environmental authorities should develop sectorial water policies and procedures.

A summary of the formulated Water Resources Policy is presented below.

Water Resources Policy Foundation	
Policy Objectives	To ensure the use of water resources in an effective, efficient and equitable manner, consistent with the social, economic and environmental needs of present and future generations. Further objectives include: ☐ promoting the efficient use and productive use of scarce water resources. ☐ maintaining equitable distribution of water among all users. ☐ improving the quality of water and securing other environmental benefits. ☐ facilitating public and private investment in the water sector through greater security of water rights and availability. ☐ promoting a co-ordinated approach to water and other natural resource management. ☐ providing a co-ordinated institutional structure in the water resources sector which is capable of carrying out important resource management functions.
Scope	Applies to all fresh and brackish water. It does not apply to marine water.
Policy Principles	All surface and groundwater is owned by the state and managed by the government in partnership with water users on behalf of all Sri Lankans. Water will be managed in a sustainable manner, recognising efficiency, equity and environmental objectives.
Sectorial Emphasis	The special role of the irrigation sector is recognised. Some key policy provisions, such as granting water entitlements to existing users, increasing the security of water allocation through monitoring and enforcement, the provision for government to pay the water management cost share for irrigation entitlement holders until they are able to do so and an open and transparent approach to all aspects of water resource decision making will help to safeguard the interests of irrigation water users in balance with other sectorial water users. The importance of hydropower sector is also recognised.

Strategies	The policy takes an integrated approach covering all aspects of water resources management. Co-ordination will also be ensured with other natural resources and with other national policies. The policy will be implemented largely through planning at the national, multi-basin and basin/aquifer levels and through project and operational planning. Basin and aquifer plans will be implemented in a progressive manner through declared, priority basins. A permanent National Water Resources Authority (NWRA), Water Resources Council (WRC) and Water Resources Tribunal (WRT) will be formed to carryout selected water resources management functions and to co-ordinate and guide the activities of other agencies which will also continue to play a role in this field.

Water Rights and Allocation Policy	
The objectives are as follows: to promote the wise use of water resources through secure and orderly allocation of water, equitable access to water by all users, preservation of water supply for environmental, social and cultural priorities and voluntary transfer to higher valued uses.	
Entitlements	The right to use water will be granted through water entitlements with the exemption of small-scale users and individual users, who are supplied through group schemes. Entitlements will be granted for a fixed period of time, based on the specific water use. User compliance with the terms of their entitlements will be monitored and enforced.
Environmental and Social Water Requirements	Environmental, social and cultural water uses will be protected by reserving minimum flows and storage volumes. The water reservationswill be made before water entitlements are issued.
Water Allocation Priorities	Water will be reserved to protect small-scale users, other social and cultural purposes and environmental values. Water entitlements will be issued to existing water users and to the extent that further water is available to new applications.
River Basin and Groundwater Plans	River basin plans will be developed to guide the allocation of water. Planning will be carried out in specified river basins and aquifers. Plans will be implemented through the issuing of water entitlements and through the actions of various government agencies responsible for water and other resources.
Transfers	Voluntary transfers of water entitlements between entitlements holders or from entitlement holders to those seeking to acquire water use rights will be allowed. Transfers will be subjected to approval under approved guidelines in order to protect third parties and environmental values.
Sub-sectorial allocation	Policy outlines a system of bulk allocation of water to large users and group schemes. Existing arrangements will be

	used or new arrangements developed to allocate water within group schemes to individual water users.

Water Resources Demand Management Policy	
Its aims are to promote the efficient use of water resources and maximise the value of the resource to society.	
Transferable Water Entitlements	Establishment of transferable water entitlements will promote water conservation and improved water allocation.
Water Management Cost Sharing	Basin water resource management costs will be shared with water users in a transparent manner. Information on the value of water in different types of use will be reflected in basin plans. Government will pay the current share of water management costs for the irrigation sector through a transparent subsidy, in recognition of the low level of returns in this sector. As returns for irrigated agriculture will grow in the future, as irrigation system control and maintenance will be improved and as water delivery will be made more reliable, it is expected that the irrigation sector will better be able to share in the cost of water resource management.
Regulatory Control	Unauthorised use will be controlled through water entitlements. Agreements may also be developed to specify more general water conservation activities.
Water Saving Technology	Water saving technology and research will be promoted. e.g., Installation of water measuring devices.
Education and Awareness	Implementation of public education and awareness programmes, training of water resource managers, etc., to conserve water.
Capital Investment, Operation and Maintenance	Water conservation through capacity building, proper financial accounting, asset management and rehabilitation of schemes will be used to promote water use efficiency.
Information and Demand Management Performance	Information on water resources demand will be used in planning. Achievements in meeting demand management targets will be made public.

Groundwater Management Policy	
Its aim is to promote the sustainable development and management of groundwater resources in Sri Lanka.	
Sustainable Management of Groundwater	All important features of aquifers will be considered in groundwater planning and management. A long-term perspective will be used in its management.
Co-ordination of	Surface water and groundwater are closely related. They will be

Surface and Groundwater Management	managed integrally.
Management of Small-Scale Groundwater Use	Small users will be exempted from the requirements to hold entitlements, but local governments will be encouraged to register small wells and to apply guidelines on well density in groundwater management areas.
Groundwater Information Management	Data collection and information management will be strengthened.
Groundwater quality	Groundwater quality and other environmental objectives will be pursued in co-ordination with national and provincial environmental agencies.
Awareness and Participation	Greater awareness will be promoted through co-operative programmes. Stakeholders will be encouraged to participate in planning and monitoring activities.
Strategic Approach	Action plans will be developed and implemented by appropriate national and other government agencies in a co-ordinated manner.

Water resources Information Management Policy	
The objective of this policy is to improve quality, accessibility and efficiency of data and information management in order to support integrated water resource management and the widespread use of such data and information.	
Data Management	Water resources data collected by national government agencies are property of the state.
Data Co-ordination and Sharing	Data and information exchange and sharing will be ensured through agreements between data collection agencies and the NWRA. These agreements will specify data collection and management standards, data and information access and pricing and compilation of data sets by the NWRA.
Data and Information Access	Data and information will be made available to water agencies through data sharing arrangements and to the public through both active awareness and educational programmes and in response to requests. Consistent pricing of water data and processed water information will be encouraged.
Institutional Structure for Water Resources Management	
A new and permanent National Water Resources Authority (NWRA), a permanent Water Resources Council (WRC) and a Water Resources Tribunal (WRT) will be established at the national level. These bodies will be responsible for overall co-ordination of water resource management and for a number of specified functions.	

Functions of the NWRA	Preparation of national water resources policy Long-term national and river basin planning, including co-ordination of local input Co-ordination and collection of water resource data and information management, water monitoring and commissioning of research Water allocation through the issuing of water entitlements Advice to government regarding drought and flood management Policy and monitoring regarding riverine activities Public information and awareness
Reporting relationship and structure	The NWRA, WRC and WRT will be neutral with respect to sectorial interests and in a strong and authoritative position in the government. These bodies will be parallel in terms of reporting directly to the chief executive of the government. The NWRA, WRC and WRT will together form the water sector apex body and as such and in their areas of responsibility, they will be considered to have a higher level of authority than other national water agencies.
Delegation and contracting	The NWRA will delegate to, or work in partnership with various national and other government agencies in order to carry out technical and decentralised functions. Where the NWRA lacks technical capacity or staff, it may also contract tasks to other government agencies or private or non-government groups.
Water Resources Council	The WRC will advice the Minister on water resources issues and on the resolution of inter-provincial and interagency water disputes. It will co-ordinate activities in water resource management at the national level and will review and endorse draft policies and national and river basin plans.
Water Resources Tribunal	The WRT will be an independent appeal tribunal, which will resolve issues relating to the administration of water entitlements by the NWRA.
Relationship of NWRA, WRC and WRT to other national agencies	The NWRA, WRC and WRT will together form the water sector apex body responsible for co-ordination, planning, regulation and monitoring national water resources and resolution of disputes in the water sector.
Provincial and River Basin Water resources administration	River basin and major aquifer planning will be co-ordinated and technically supported by the NWRA and partner agencies.
Groundwater administration	All surface water and inter connected groundwater will be planned and managed in an integrated manner and in accordance with the Groundwater Policy.
Water Quality administration	The NWRA will fully co-ordinate its activities with the Central Environmental Authority and provincial environment agencies. Water quality issues will be considered along with water quantity in the river and groundwater planning process.

Watershed Management	The NWRA will not be responsible for planning and managing all natural resources such as land, forests, soil, etc. However, since water cannot be separated from other above resources the NWRA will work in close co-ordination with other resource managers.

4. CONFLICTS OVER THE FORMULATED WATER RESOURCES POLICY

An earlier attempt by the Government of Sri Lanka in the 1980s to introduce a Water Tax to the farmers was withdrawn due to public pressure. Again, pressure mounted against the recently proposed water policy. Several demonstrations were held to protest against many proposals in the policy demanding the withdrawal of them. Though the government insisted, saying that many of the protestors are misinformed about the new policy, and that it is yet to be submitted to the parliament for approval.

The preparation of the policy only in English and not in native languages adversely impacted on its accessibility to the general public. Besides, the content of the policy document was kept a secret until the Cabinet of the Government of Sri Lanka approved it. A transparent process was not adopted as stated in the ISCWRM project throughout the development of the Water Resources Policy. If people's right to know were respected, and encouraged them to express their opinion on critical issues a strong protest again the policy would have been avoided.

5. OWNERSHIP OF WATER

The proposed policy states "all surface and groundwater are owned by the state and managed by the government in partnership with water users on behalf of all Sri Lankans." This policy seemed suspect to the public as a result of ongoing natural resource privatisation in the country as promoted by international financial institutions. Arguments were brought up regarding the right to use water by commons if it becomes government property.

People believe that all water in the water cycle, whether on land, underground or in surface channels, or falling on, flowing through or infiltrating such systems, should be treated as part of the commons. The water required to meet basic human needs and to maintain environmental sustainability must be guaranteed as a right. The national government should act as the custodian of the nation's water resources, and its powers in this regard should be exercised as a public trust.

6. THREAT OF PRIVATIZATION

A major recommendation of the policy is that "all the water resources shall vest with the government". This proposal makes people think that once the policy is implemented every user of water will have to obtain water entitlement by paying a price for it. They suspect that as a step towards transferring the ownership of the water resources to private companies for making profits. Even at present in Sri Lanka, there are instances where, more and more water is being taken out of the hands of small communities and siphoned off for bigger causes. Human and environmental consequences of such short-sighted management can be substantial.

Hitherto in the history of Sri Lanka, water was always regarded as a common property of people. It was meant to be freely available not only for human beings, but for all beings including the animals and plant life. People accept that the State only as the guardian of water resources and argue that it has no authority to intervene or change the course of nature.

According to the proposed policy, voluntary transfers of water entitlements will be allowed between entitlements holders or from entitlement holders to those seeking to acquire water use rights. This policy is queried as to how it would promote water conservation and improves water allocation within the country and it is suspected to be a step towards privatisation. The proposed policy of transferable water entitlements will adversely affect the poor, given the extensive indebtedness among those communities, and their inability to satisfy even basic needs. People suspect that the commercial exploitation of the common water resource by those without long-term interest in either equity or the environment will be an outcome of this policy.

7. WATER PRICING

Although the government denies that the proposed Water Resources Policy involves the imposition of a water pricing mechanism, people argue that a careful reading of it shows otherwise. They doubt that the proposed policy will protect the rights of large companies with water entitlements and small users will be charged higher prices for water, electricity and other resources that use water.

People fear that if water marketing starts, rich people will obtain water, but poor people, more than half of the population, will have no water because they do not have money. Making water a commodity and fixing a market price as proposed is considered as a deprivation of the gift of water or taking away of life of the urban and rural poor, farmers and the animals and plants as well.

Access to water is essential for the cultivation of rice, which is the staple food of Sri Lankans. National policy makers and international financial institutions argue that rice paddy farmers waste water and thus must be forced to pay for it. If the amount of water taken up by plants is measured against that which drains away and evaporates, an average efficiency level of about 30 percent is obtained. But the other 70 percent is not really lost. Large amounts of it flow back into the system and are used again downstream. The issue is then how to improve of the irrigation systems to make them efficient enough to re-use the water.

Even though the policy claims to be an instrument for integrated management, its mechanisms seem to be based upon one criterion only, the 'willingness to pay'. Poor farmers of Sri Lanka are unable to live 'today', it is unavoidable that they are severely tempted to trade their water allocations for a mere pittance.

8. IMPACTS ON CULTURE

The entire culture and history of Sri Lanka has been built on water. In fact, water has been central to Sri Lanka's evolution as a nation. More than 2500 years ago, people built irrigation reservoirs and cultivated the land around them. They treated water with great respect and value. Sri Lankans believe that this policy risks to destroy the traditional way of life in rural Sri Lanka.

The agriculture, and more particularly the paddy cultivation, will be seriously affected, if water is issued as a commodity on the market. People are aware of the danger they face even now because the World Bank, in a document 'Non-plantation Sector Alternatives' of 1996, has advised the government that paddy cultivation in Sri Lanka is a non-profitable venture and recommended the diversification of agriculture into cash crops instead of paddy.

9. PERMITS

The proposed Water Resources Act will render several existing legislation of the country redundant. The State Land Ordinance of 1947 may be one such legislation. The ordinance provides the regulation and control of public water and streams through a system of permits while defining public and private water and water uses for which no permit is required. The use of water under the Irrigation Ordinance is expressly exempted from permit requirement. Water is allocated for power generation purposes too without any permit requirement at present.

The proposed water policy states that the State Lands Ordinance is 'outdated and far too limited' and proposes a water allocation strategy via water entitlements. The right to use water, which is granted through water entitlements will be for fixed periods of time, based on the specific water use. Though the proposed policy states that small users are exempted from the requirement to hold entitlements, it contrasts suggesting that local governments should register small wells, springs etc., within their areas. This, people suspect to be an implicit step towards issuing permits for a fee. It seems a threat to the general public, that fears to be asked to register their small dug wells.

10. VIEW OF WATER RESOURCES SECRETARIAT

WRS, the institution responsible for drafting the policy and the government states that the idea of the proposed Water Resources Policy is not to exploit the poor or destroy their way of life but to help them. According to WRS one of the fundamental principals of this water policy, is to look after the poor people, their interests and their fair share of water and therefore, it has taken enough precautions to make sure that they are given their entitlements.

However, the idea of water entitlements and the privatisation of consumer water

supplies is an alien concept for many in Sri Lanka where free water has been taken for granted.

11. CONCLUSIONS

Although Sri Lanka does not have to face a water resource management crisis at present, there are growing indications of stress in the water sector and competition among water users. Besides, water resources in the country are not adequately protected. The legal and organisational framework is fragmented and the institutional capacity is poor. There is no comprehensive water resources policy for the country at present.

Therefore, a National Water Resources Policy for the country is undoubtedly vital for the proper management, conservation and protection of water in Sri Lanka. Understanding its importance, the government has taken steps to reformulate the initially proposed policy that was not brought forward the Sri Lankan parliament for approval due to public protests. Sri Lankans staged huge protests claiming that the proposed policy makes water an economic commodity and arguing that water is not a resource that can be given an economic value easily, because it is a basic right of the people. Policy makers should get the public involved in the reformulation process to make this second attempt a success. The work done up to date in the reformulation of the policy, still without much public participation, should be made public. Suspicion among the public could be avoided by conducting public consultations and island-wide awareness programmes of the draft national water policy and draft laws. That will make the government's continued commitment towards the development of a National Water Resources Policy for Sri Lanka a success.

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TRANSBOUNDARY WATER MANAGEMENT IN MEXICO-USA BORDER: POLICY AND DECISION-MAKING CHALLENGES

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ABSTRACT

Although water conflicts may not always be as conspicuous or dramatic as wars over religious, ethnic or sovereignty issues, they may have serious repercussions on the security interests of the developed and the developing countries, especially in arid regions. For over a century, the United States and Mexico, otherwise divided by history, culture, wealth, and a host of past antagonisms, have managed to find diplomatic, co-operative solutions to some of the most basic controversies in international affairs: the allocation of transboundary water, the division of disputes territories, and the management of a range of problems arising from contiguous development along their common boundary, which has an annual rainfall of less than seven inches. It is important to recognise that some successes in water-related problems have been achieved throughout the obligations assumed by the Governments of the United Sates and Mexico under the 1944 Water Treaty. This Treaty was signed at a historically propitious moment in response of essentially locative and territorial defensive, because its primary mandate was to protect the two countries´ respective national interests. For more than a century, this regime accomplished its mission using centralised and issue-oriented approach to problems. Nevertheless, this approach is becoming less appropriate as the border region evolves into a highly bilaterally-related urbanised and industrialised region which needs the participation of institutions rather than those in the water sector in order to achieve effective co-operative basin management. In this scenario one question still seeks answer: how can obstacles and conflicts be overcome? Since there is no simple answer to this complex problem, one of the alternatives is transboundary co-operation, understood as a process of network building that encompasses a variety of actions and different levels. The paper will discuss Water Treaties in the border region of Mexico and the United States, analyse the existing water management bilateral Commission, and recommend the direction for the future.

1. INTRODUCTION

Water scarcity, understood as lack of secure, uninterrupted and long-term availability of adequate amounts of fresh water of required quality on regular basis, and multiply needs (Elhance, 1999) by itself does not necessary lead to acute interstate conflict. It is important to note that environment, especially water, is but one variable in a series of political, economic and social factors that can bring about turmoil in international relations.

It is when water-shared resources are perceived as being overexploited by others at a cost to oneself, that states may become prone to conflict (Elhance, 1999). Scarcity can be an important force behind changes in the politics and economics governing resources use among international actors. Environmental problems, such as water pollution or water scarcity, can cause powerful actors to strengthen political and economical measures, on the believe that irreversible, environmental

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degradation becomes an independent variable that even if national governments remove the original political, economic, and cultural causes of degradation, it may lead to social disruption (Homer-Dixon, 1993).

Although water conflicts may not always be as conspicuous or dramatic as wars over religious, ethnic or sovereignty matters, they may have serious repercussions for the security interests of the developed and the developing countries, especially in the arid and semi-arid regions. The potential for conflict over water is predicted to be specially high in the arid and semi-arid regions of the developing countries, where rapidly growing water population needs are expected to put increasing pressures on the already scarce and overexploited freshwater supplies (Elhance, 1999).

Such situation suggests that water resources are under increasing competition world-wide in order to satisfy populations water demand for agriculture, industry, domestic and hydropower needs. As a consequence, water systems resilience has dropped, as the systems are less able to absorb shocks caused by increased demand and decreased supply. Reservoirs now a day are under stress due to the constraints placed on them. The increasing competition over water, among users, is a fact that would inevitable becomes a reality for almost any country. Water has become a major bone of contention both among different users and regions in almost any state or country across international borders.

Some countries, like Mexico, depend on groundwater resources for economic development. Groundwater constitutes a large part of this nation's total water use. Specifically, the National Water Commission in Mexico *(Comisión Nacional del Agua, CNA)* has estimated groundwater use around 23.9km/y of the total national water use of 73.1Km/y, in such way that maintaining the quality if groundwater resources is essential to current and future uses by agriculture, public and domestic water supplies (Steel and Barrios, 1997). The success of many ongoing economic development programs in the semi-arid Mexican regions is contingent upon the availability of adequate amounts of water. Not even industries in Northern Mexico are "dry industries" they have become a strategic development spot which have attracted an increasing number of people that in order to raise their incomes have moved to that Northern part of the country. Such increase in population has placed greater stress on groundwater resources. The stress placed over water resources is clear if we notice that cities in this semi-arid region like Juárez, Chihuahua, twin-city of El Paso, Texas, obtains 100% of its water supply from the Hueco Bolson aquifer, the main water supplier in the region (Bath and Petit 1999).

As water demand is placed on groundwater resources, scarcity becomes the main problem. If, like in El Paso-Juárez region, the groundwater resource is shared by two cities placed in different countries, the hydrological induced interdependence gradually compels the states to commit at least with the possibility of co-operation in order to maintain their water-shared resource. "Co-operation" in a scenario where water security depends on transboundary watershed resources, is less than easy. Asymmetrical relations among nations have been one of the main subjects of many works in the field of international relations. When water is the main subject in an asymmetrical international relation, like the one Mexico and the USA confront since 1906, the scenario becomes complex. If water, as Aaron Wolf has point out is "likely to be the most pressing concern of the next century", any negotiation

involving such resource would become mainly important for riparian international relations.
The ever-increasing competition for the use of limited supplies of freshwater between this neighbouring countries could lead to the development of serious political tension between them (Utagawa, 1999)."National sovereignty, is the most important political consideration at state level, and nearly all nations-states jealously guard their sovereign powers to manage activities within their own border. Thus, not surprisingly, the overall discussions on the management of international rivers and lakes have often been not smooth because of national sovereignty questions" (Biswas, 1999). Water related problems between the United States and Mexico give a perfect example of this. Because much of the 3,140-Kilometer (Km) boundary between Mexico and the United States passes through regions of water scarcity, there has been intense competition over obtaining an adequate supply of water for municipal, residential, industrial, and agricultural use (Ingram, 2000). Water users in the twin cities located in the semiarid region of the U.S.-Mexican borderlands, during the past decades, have placed increasing demands on water availability because of the population growth rate. In both the United Sates and Mexico, historical trends have shown faster growth in the border region than in the nations as a hole.

In 1900, one in 18 U.S. residents lived in a border state; by 1995, about one in five U.S. resident lived in a border state. Also in 1990, one Mexican in 10 lived in a border state; by 1995, that figure became one in six. By 1995, almost 10.6 million people lived in the counties and *municipios* adjacent to the international boundary, with 5.8 million on the U.S. side and 4.8 million on the Mexican side. These population trends portend serious problems for border communities in terms of sustainable use, availability and negative environmental impacts on water. Nowhere is the problem more acute than in the El Paso-Ciudad Juárez region, located in an arid region with annual rainfall of less tan seven inches (Border Environment Research Reports, 1999).

It is now well understood that the major source of water for both El Paso and Ciudad Juárez, the Hueco Bolson aquifer, will be exhausted early in the twentieth-first century. Some authors like Charles Turner, professor of Civil Engineering at the University of Texas, proposed in 1992 that the sustainable limit of water usage in the region of El Paso-Ciudad Juárez may have already been surpassed, with very little cushion for the present population, and virtually no room for future growth. In spite of that, the region continues to have rampant growth. Obviously the aquifer have limits and these limits have been strained in recent years by several factors as unsustainable use of groundwater, rapid population increase and the potential contamination (fecal coliform bacteria and nitrate-nitrogen from poorly treated sewage) of the groundwater (Utz, 1999).

El Paso Water Utilities has already begun using less groundwater to meet their supply needs and to extend the life of the aquifer. In 1994, 41% of El Paso's water supply came from the Hueco Bolson, 16% from the Mesilla Bolson, while 43% came from the areas surface water, the Rio Grande/Bravo. By 1996, El Paso had reduced its use of the Hueco Bolson to 35%, the Mesilla Bolson to 15%, and increased its used of the Rio Grande/Bravo to 59% (Scmidt, 1999). This aquifer is shared by two countries, and it is the key source of water for the city of El Paso, Ciudad Juarez, and military installations and smaller cities in New Mexico, Texas, and Mexico (Chávez, 2000). The Hueco Bolson extends south from the New Mexico/Texas state

line to the Sierra de Juárez to the west, and to the *Sierra El Presidio* and *Sierra Guadalupe* to the south, it is approximately 9,000 feet deep and consists primarily of stilt and gravel in the upper levels, and clay and stilt in the lower portion. It contains an estimated nine million acre-feet of fresh water and as much as 3.4 million acre-feet of saline water (International Boundary and Water Commission, 1998).
The Hueco Bolson has an annual recharge rate of about 6,000 acre-feet. This figure represents only about five percent of the total amount of water pumped out each year from the aquifer. Accordingly, the water level in this aquifer has been declining by 1.5 to 7 m annually. At the current rates of pumping, it is estimated that economically recoverable fresh water from this aquifer will be exhausted by 2030. There are two factors that can complicate groundwater issue in this area. First, the fact that available groundwater lies beneath land across the New Mexico border, fact that could affect the decision on whether El Paso can transport groundwater across the state line. Second, Ciudad Juárez gets 100% of its water supply from the Hueco Bolson aquifer. Unless Ciudad Juárez finds an alternative to the Hueco Bolson, it will run out of water. Juárez will then have to resort to the Rio Grande/Bravo (which is not in such a good health) as a source. Mexico will have to appeal to the United Sates for more surface water from the Rio Grande/Bravo (currently Juárez has annual allotment of 59, 985 Acres Feet- an acre-foot is the volume of water that would cover one acre of land to a depth of one foot, or about 326 gallons-of water from the river).

It would appear that there are two grounds for such appeal. First, under the terms of NAFTA and the Environmental Side Agreement, both governments obligated themselves to the concept of *sustainable development*. While not a binding commitment, Mexico, which consumes far less water per capita than the United States in the Cd. Juarez-El Paso region, could invoke the treaty obligation under NAFTA. In Cd. Juarez water use was 350 litters per person a day in 2000 versus 606 litters per person a day in the same year in the El Paso (Turner and Ibañez, 2002).

Groundwater resources are vital for the continuing economic development of the US-Mexico border. This region is changing rapidly in terms of population and water needs, and we must analyse the potential of water-related problems which may cause open conflicts, could constrain development and which could impede the improvement in the quality of life of people. Water policies today must address rational water management based on policies which contribute to poverty alleviation and equitable development. Thus, the complex set of water resources management mechanisms in the basin should be considered a most relevant issue, specially in Mexico where international water policy formulation and implementation have basically received lip service in the recent past.

Water allocation under the jurisdiction of the International Boundary and Water Commission (IBWC) and the 1906 and 1944 Water Treaties between Mexico and the United States should receive special attention to prevent problems which are international in nature and how this potential conflict can be transformed into a situation where co-operation potential can emerge. The IBWC may well represent the finest example of functional co-operation transboundary resources management between highly dissimilar countries.

2. TRANSBOUNDARY CO-OPERATION ALTERNATIVES: WATER TREATIES AND INSTITUTIONS

For over a Century, the United States and Mexico, otherwise divided by history, culture, wealth, and a host of past antagonisms, have managed to find diplomatic, co-operative solutions to some of the most basic controversies in international affairs: the allocation of transboundary water, the division of disputes territories, and the management of a range of problems arising from contiguous development along their common boundary (Mumme, 1993). Although the larger binational relationship has often been defined by mutual suspicion and asymmetry in political and economic terms, in the past century these countries have peacefully agreed on the apportionment of critical water resources and joint solutions water allocation problems.

The primary purpose of the binational 1944 Treaty between Mexico and the United States for the Utilisation of Waters of the Colorado and Tijuana Rivers and of the Rio Grande (from now on called Water Treaty) is to allocate and manage the US and Mexico surface boundary waters, specially the Rio Bravo (as it is call in Mexico) /Rio Grande (call like this in U.S.). Historically, the US-Mexico boundary waters have been managed through the Treaty of Peace and Friendship of 1848 and the Convention between the United States and Mexico for the Equitable Distribution of the Waters of the Rio Bravo/Rio Grande in 1906 and the 1944 Water Treaty.

The Water Treaty signed at Washington on 3 February 1944 allocated water along the U.S.-Mexico border based on a negotiation formula. The 1944 Treaty allotted in Article 4 the waters of the Rio Grande/Bravo between Fort Quitman, Texas and the Gulf of Mexico to the two countries. The 1944 Treaty specifies that in the event of extraordinary drought or serious accident to the hydraulic systems on the measured Mexican tributaries, making it difficult for Mexico to make available the run-off of 350,000 acre-feet (431,721,000 cubic meters) annually, allotted in subparagraph (c) of paragraph B of Article 4 to the United States as the minimum contribution from the aforesaid Mexican tributaries, any deficiencies existing at the end of the aforesaid five-year cycle shall be made up in the following five-year cycle with water from the said measured tributaries. Whenever the conservation capacities assigned to the United States in at least two of the major international reservoirs, including the highest major reservoir, are filled with waters belonging to the United States, a cycle of five years shall be Considered as terminated and all debits fully paid, where upon a new five-year cycle shall commence.

The 1944 Water Treaty provides for the non-navigational use and allocation of the Rio Grande (Articles 4-9, 18, 19, 21 and 26), the Colorado (Articles 10-15, and 27), and future agreements on the Tijuana Rivers (Article 16). The 1944 Treaty does not expressly make provision for water quality, but Article 3 does grant the IBWC the authority to give "preferential attention to the solution of all border sanitation problems". In practice, the Parties have broadly defined Article 3, and treated sanitation and salinity problems under its scope. This Treaty does not cover groundwater, even where it is related to the surface water. The allocation formulae for the Rio Grande and the Colorado Rivers contain ambiguous language. In particular, Articles 4, 9 (Rio Grande) and 10 (Colorado) allow for reductions in

quantity of water delivered in the event of "extraordinary drought" or "serious accident".

This Treaty apportioned the waters of the Rio Bravo (called in the U.S. Rio Grande) and established the IBWC in Article 2, creating an institutional mechanism for the implementation of the treaty. Article 25 sets out the procedures for the IBWC, based on the 1889 Convention and supplemental rules and procedure adopted by the IBWC with the approval of the Governments.

3. INTERNATIONAL BOUNDARY AND WATER COMMISSION (IBWC)

The IBWC is integrated by one "Engineer Commissioner" representing each government, who also leads the country Section. The Sections activities include all aspects of water resources management such as allocating water from the Rio Bravo, Colorado River, and other minor rivers and associated tributaries; overseeing groundwater utilisation in the Colorado River basin; and monitoring the salinity levels of the Colorado River as it enters Mexico. Although the IBCW has operated efficiently and effectively within the areas mentioned before, it has not responded to some other problems as hazardous-waste disposal and transport, air pollution, water pollution, and over-pumping of groundwater (Moore, 2000). There are few expressed compliance mechanisms in the 1944 Treaty, which is not unusual in watercourse agreements. Article 24 allows for ongoing monitoring and information exchange yet makes no provision for public access to information or justice. Unlike the 1909 Boundary Waters Treaty between the U.S. and Canada, the 1944 Water Treaty does not have a provision for non-discrimination. Article 17 expressly states that neither Party shall have claim for damage caused by discharge of flood waters, and Article 20 obligates governments to assume responsibility for claims arising from incidents in their own territories.

Article 24 of the 1944 Water Treaty contains the general powers of the IBWC pertaining to compliance system mechanisms. The IBWC has the power to invoke the national courts to support the enforcement of the treaty provisions; and to settle disputes subject to the approval of the two governments. The IBWC is required to furnish information to the Parties, but not the public. Article 24 requires the IBWC and each Section to construct, operate and maintain gauging stations to compile hydrographic data, which is to be exchanged between the two Sections, recently updated by Minute No. 289. Article 24 requires the Commission to submit annual reports to the two Governments, and at any other time on matters within its charge.

Over the course of 100 years, the two governments have used amendments known as "minutes" to address new issues and settle disputes. The minutes are mostly clarifications of technical details in an unclear language. The IBWC forwards its decisions in the form of "Minutes" which are subject to the approval of the two Governments and which are substantive agreements. The flexibility of this procedure has allowed the IBWC to respond to changing conditions without the need to re-negotiate the treaty. This evolving practice is one of the strengths of the U.S.– Mexico treaty. For several decades after the signing of the 1944 Treaty of International Waters, surface water issues along the border were managed trough the IBWC/CILA framework. However, by the 1980s the environmental problems, as

well as the world wide discussion of environmental issues, led to attempts by both the U.S. and Mexican governments to address these problems. The political difficulty of achieving treaty-level agreement binationally, and within Mexico and the United states isolates the IBWC from political pressure in both countries, and its narrow jurisdiction and limited water management mission reinforce both political insulation and dependence in the Mexican case from the central government (Mumme and Moore, 1999).
The political limitations bearing on the Commission derive from different sources in each country. In the United States, a strong federalism and powerful national Congress have been the basic arenas in which agreements related to the United States-Mexico affairs have been forged. For the Mexican national section, border states have little influence in the affairs of the Mexican section, which is above all responsive to the Mexican *Secretaria de Relaciones Exteriores* (SRE, Foreign Affairs Ministry) and presidential control. From a decision-making standpoint, IBCW dependence on SRE for policy authority restricts its realm of discretion and reinforces its role as a technical advisory agency to the Mexican Government. Unfortunately this role now a day is not enough to confront the emergency of environmental problems and a wide range of water-related issues which show clearly the embedded limitations on the Commissions capacity to innovate in the face of emerging demand for policy action and participation in water-related decisions in the border area.

The IBWC original mandate remains the allocation of treaty water resolution of disputes concerning the location of the boundary water resources. In the new context of heightened environmental concerns along the border, the IBWC´s traditional approach to water management has been hard pressed. Much of the difficulty seems to arise from the inherent tension between a management approach that is historically oriented toward the distribution of water resources along the border and growing pressures which have trust the Commission into a more visible and contentious regulatory role in addressing transboundary water problems (Mumme, 1993). For centuries rivers and wells have been the source of water in the border region. With the turn of the century, the growing urban centers along the Rio Grande/Bravo, where the river becomes the international boundary, started increasingly to depend on groundwater.

This situation was not specifically addressed in the 1944 Treaty and further opportunities for functional expansion outside current treaty authority are limited. Nevertheless transboundary groundwater had been addressed through the Minutes. Under Minute 242, signed in 1973, IBWC was given authority to regulate groundwater in the San Luis-Yuma section of the Lower Rio Colorado River Basin. Minute 242 also authorised the IWBC to enter into discussions, aimed at reaching a comprehensive international agreement apportioning and regulating groundwater aquifers along the United States-Mexico border. Its is interesting to note that since 1973 (Minute 242), despite some discussion, there has been little real progress toward such an agreement.

To the contrary, both nations have intensified withdrawals in a quiet pumping war on each other in a race to claim the larger share of this scarce resource (Mumme, 1993). The barriers to a groundwater treaty are numerous and growing. First, any effort to apportion groundwater will diminish the stock of water available to the border and basin states, particularly in the Rio Grande/Bravo and Colorado River basins. Transboundary groundwater is a common pool resource. As with most

common pool problems, individual beneficiaries have limited incentives to relinquish short-term benefits for long-term gain. Any groundwater treaty, indeed any treaty addressing any water-related environmental problems along the border, harbours the potential for opening up long settles distributive issues among the various basin states. The states themselves, as well as the two countries, have a very large stake in avoiding this. Taken as a whole, it is simply politically expedient to pump the water faster than the neighbour. Second, in recent years, water scarcity has become even more of a critical issue in the West than it was due to demographic trends, policy changes, and drought (Mumme, 1993). However, groundwater and IBWC role in current water-related problems are an important unfinished business to be dealt with if damaging conflict between the two countries is to be avoided.

4. CONCLUDING REMARKS

As we gathered the political, demographic, economical, and environmental characteristics of the border region between Mexico and the United States, we realise that complexity is always present. The asymmetrical interdependence between these two countries, forces both countries to considered each other when water problems is the issue. There are matters, such as drought that has compelled both sides of the border to co-operate in order to prevent the depletion of key transboundary water resources in this arid region, which present an annual rainfall of less than seven inches. Water resources has been historically the main issues in dispute between the growing population of the twin cities that has flourished along the border. Nonetheless, there lies a set of potential policy implications that could be very important for the future water situation: integrative approaches that embrace the importance of the institutional reform induced by the NAFTA, and the Environmental side agreement debate in the development of a cross-border social partnership. But more extensive research and more refined analytical tolls are required as well a regional consensus building by increasing opportunities for regional well-being. Business-as-usual policy is unlikely to contribute significantly to formulating new water policies which could lead to rational transboundary water management.

The recent Mexican Government policies, explicitly or implicitly, consider that the economic activities and employment opportunities will increase the most in the border regions. On the basis of current trends, it is clear that the growth in the border region cannot be maintained, because of water, energy and environmental constraints. For over 70 years, Mexico has been under one party rule. In December 2000, for the first time a President from a different party was elected. The election of President Fox has sent a shock wave through the entrenched political-institutional-bureaucratic systems of the country. One hopes that new Administration will radically improve the water management practices of the recent decades, so that it addresses more effectively the water-energy environment issues promptly. Nowhere will this bridge-building be more important, than in the border region of the country.

Nevertheless, co-operation is the one issues that can contribute to this building-bridges in the border. It is important to recognise that while some successes have been achieved through Water Treaties and the IBWC, it is like other institutions, a social artefact captive to the vicissitudes of time. As a transboundary resources management agency, the Commision´s jurisdiction and functions were formed at a

historically propitious moment in response to contextually specific circumstances. The authorities that established the Commission could not have anticipated all changes that have come to bear on its mandate (Mumme, 1993).

In the past, institutions like the IBWC, bilateral in nature, managed water-related problems along the border, following top-down and highly centralised decision-making procedures. The dominant regime was essentially locative and territorial defensive, because its primary mandate was to protect the two countries´ respective national interests. For more than a century, this regime accomplished its mission efficiently using centralised and issue-oriented approach to problems. Nevertheless, this approach became less appropriate as the border region evolved into a highly urbanised and industrialised region which needs public participation and empowered of other institutions in order to achieve effective co-operative basin management.

In this scenario one question still seeks answer: how can obstacles and conflicts be overcome? Since there is not a simple answer to this complex problem, one of the alternatives is transboundary co-operation, understood as a process of network building that encompasses a variety of actions and different levels of sophistication depending on the degree of interdependence and trust among the participating parties.

Hence, the process through which transborder co-operation is reflecting the perceptions, beliefs, and priorities of the people and groups involved (Herzog, 2000). In Mexico´s case there is a chance that this could be contemplated due to some international organisational relations that create a cross-border collaborative network. There is the IBWC, and at the implementation of the North American Trade Agreement (NAFTA) the Border Environment Co-operation Commission (BECC), the North American Development Bank, and the Commission for Environmental Co-operation. These institutions are not responsible for water-related problems only, but they are responsible for developing environmental binational and participatory processes and for socially, financially and environmentally sound projects which in turn could reflect capacity, degree of autonomy of co-operation bodies and specific binational water-related interests and priorities (Herzog, 2000)

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GRASSROOT PARTICIPATION AND MANAGEMENT FOR RURAL WATER-RELATED ENVIROMMENTAL PROBLEMS IN EBO ITUMBONUSO, INI LOCAL GOVERNMENT AREA, AKWA IBOM STATE, NIGERIA

Uwem Robert OTU [281]

ABSTRACT

Grassroot participation in the management of rural water-related environmental problems aimed at providing sustainable and safe water for drinking, farming and other domestic and public uses is hereby discussed. The scheme integrates the rural water stakeholders comprising the association of Women, Men, Youths, Traditional rulers, Religious leaders, Peer groups and the Parliamentarians (politicians) into a neatly-woven sphere for the containment and abatement of water-related environmental problems that includes flooding of riverline communities, silting of rivers and water bodies from overlying farmlands, pollution of water bodies from refuse dumps and animal grazing activities, erosional hazards, and outbreaks of diseases such as Typhoid fever, Polio, Diahorrhea, Dysentery and Cholera. It x-rays the participatory approach to include sustained public awareness and education programmes hinged on a values-based approach using TV, Radio, Newsletter, Magazines, and Illustrative Drama as well as the creation of a water sanitation agency, a training scheme to develop manpower as well as a knowledge enhancement programme with detailed drafting of a curriculum for the primary and secondary schools and the setting up of water use and rights groups in these schools. The direct participation of the CBO - the "Itu Mbonuso Youth Co-operative Multipurpose Society" and the NGO- the "Ikono-Ini Youth Consultative Assembly"-IIYCA towards the successful execution of the "GRASSROOT PROJECT" within International, Federal and State Agencies outlines and standards is herein described.

Keywords

CBO; grassroot participation; NGO; water management.

1. INTRODUCTION

In the remote village community of Ebo ltumbonuso, lni local Government Area of Akwa lbom State, Nigeria, everything about life around here revolves round tradition and superstition- the gods must be responsible for every stroke of success while the witches and wizard are held liable for the people's imaginary or real failures.

Thus when in the rainy season (June) of 1999 the farmers hadn't noticed rain and crops were dying coupled with a stupendous outbreak of such water-related disease like typhoid fever, dysentery, cholera, diahorrhea, polio and malaria, all these in quick succession it wasn't far-fetched to assume that the witches and wizards were at work to upstage Ebo. Worse still, the dry season brought with it a gradual drying up of the only source of drinking water in the village - the "Ubuche Stream".

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Ebo Itumbonuso is my village. It is strategically located on a hilly topography. Her people are good farmers who raise livestock to feed on her green and rich vegetation while planting paddy rice in the fields and cocoa in the big farm settlements downhill. By December when we were in the village for the annual celebrations of Christmas, which is a big event here, we witnessed a harvest of sorrows as death had visited the land and sparing nothing in its trail. The NGO- the "Ikono-Ini Youth Consultative Assembly"-IIYCA and the CBO - the "Itu Mbonuso Youth Co-operative Multipurpose Society" devised a set of programmes and activities to rid our community off this malaise which was principally caused by ignorance, fear, anxiety and danger.

Our focus was on Women (Grand Mothers and Mothers) who play great roles in water related issues within the context of our culture and tradition (Efo, 2000). Women here are considered to be the main actors in the sustenance of family health by catering for, managing and protecting water. The complimentary role of Men, Youth, Traditional rulers, Religious leaders, Peer groups and the Parliamentarians (politician), was neatly woven into a sphere of teamwork approach integrating the focal points of a credible and sustained values-based public awareness and education campaigns using the local media - television, radio, magazines, newsletters and illustrative drama to create awareness on the dangers of water pollution and a dirty environment (Otu, 2002).

2. SCOPE

This paper is based on a real life, real-time experience gained from a totally polluted environment affecting the health, and social, economic and political status of the people of this area. Initially, the villagers were unrepentant and lackadaisical about their negative environmental attitude such as indiscriminate refuse dumping, drinking unboiled stream water, farming uphill on slopes, washing clothes, food crops and tubers, and other human discharges into the water bodies understandably due to myths, superstition and traditional injunctions. This attitude gradually changed under a co-ordinated program of persuasion and lectures involving the CBO's, CDA's, NGO's and GOVERNMENT AGENCIES. The medium of approach hinged on public education, information and motivation.

3. METHODOLOGY

In fashioning an effective grassroot participatory approach in the management of our water-related environmental problems, we considered the following features as an integral component to the success of the project. These were political, technical and non-technical.

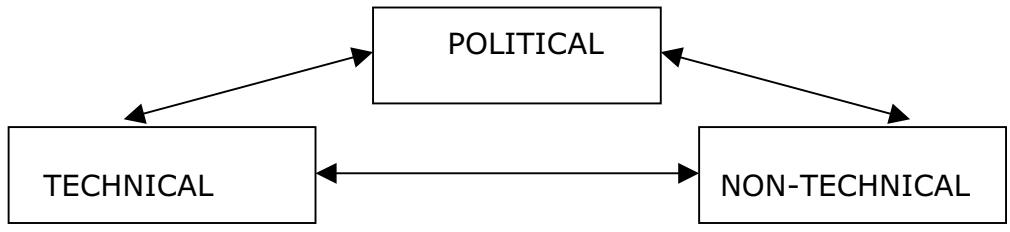


Figure 1: **Features of Approach**

The political aspects of the framework consider close collaboration between the peoples representatives at the village council, clubs, associations, peer groups, church hierarchy and pressure groups. They were closely made to tap from the NGO's, CDA's and CBA's. Thus, collectively the political cadre provided the legislative backup to enforce rules and regulations covering the project.
The technical includes generation, collection, transportation, local reuse/recycling, disposal and management of source pollutants. This particular framework centered basically on the ways and means of reducing and managing refuse and waste right from the source to minimize it's effects on water and the environment when disposed off carelessly.

The non-technical includes institutional and attitudinal aspects. Institutional involves institutional structure, institutional arrangement, organizational procedures and capacity of responsible institutions. Attitudinal considers changes in the people's attitude towards the environment.

This was hinged on formal and informal environmental awareness and education. The overall success of the scheme to reduce waste disposed to water bodies incidentally too reducing pollution of water bodies in "Ebo Itumbonuso" was carried along with the following conceptions.

3.1. Sustainability

Sustainability means ensuring that achievements of the plan last for the benefits of the present and future generations. In sustainability, we look at the technical sustainability and financial sustainability. Financial sustainability focuses on functionality and effectiveness. In other words, we looked at these questions: will the identified plan or action work? And for how long?

Technical sustainability answers health and safety regulations.

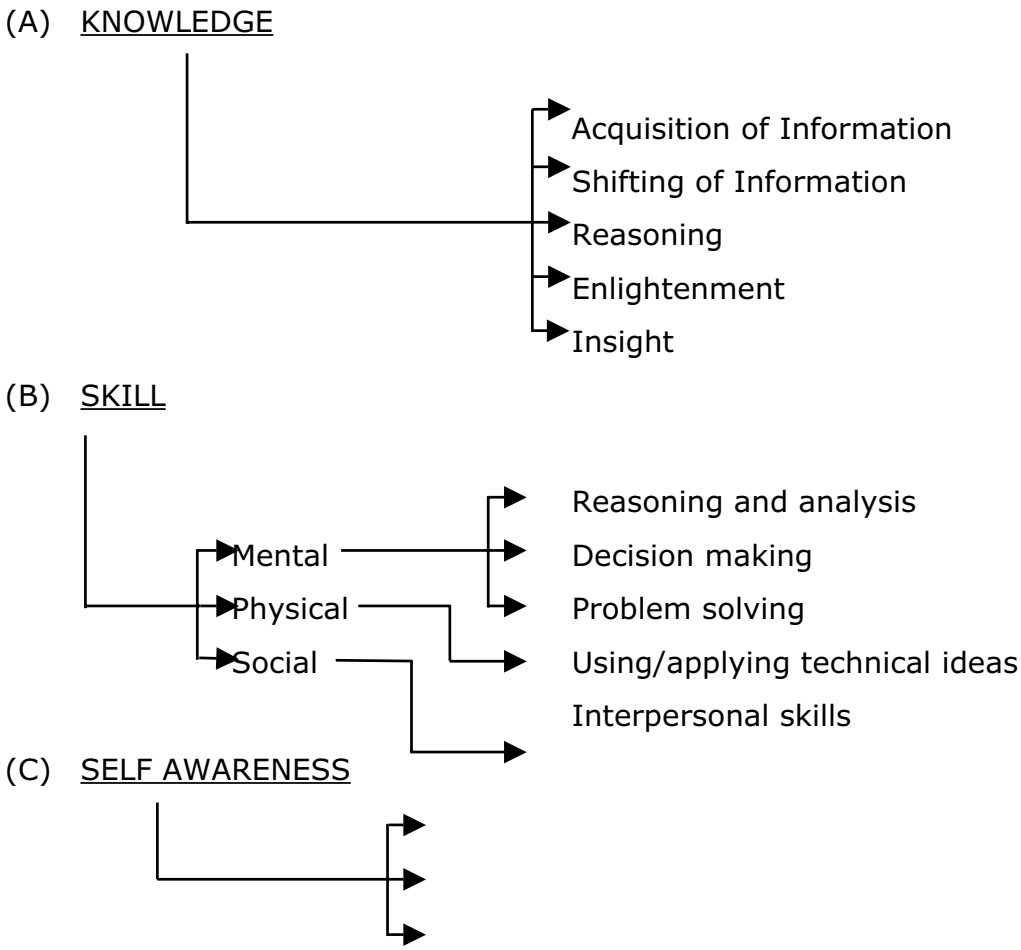
Equally, the following programmes and activities were focused on in the effective implementation of an action plan for management of Ebo ltumbonuso water-related environmental problems:

Aggressive education and awareness of the need for waste reduction,
Encourage community and private sector participation in waste reduction at source,
Initiate integrated management of waste and promote the development and identification of markets/outlets for recovered waste products,
Review, strengthen and update periodically existing laws and regulations for the environmentally sound management of solid waste,
Ensure compliance with existing laws and regulations on waste management through effective monitoring and enforcement,
Provide, upgrade and maintain infrastructures needed for the collection, transportation, treatment and disposal of waste,
Encourage community and private sector participation in the commercialization and privatization of waste,
Foster co-operation among all tires of government, the private sector, CBO's, CDA's and NGO's in the effective management of waste.

3.2. Strategies

The only impediment in the near future will be adequate funds to ensure that these objectives are pursued to fruition namely:
Encourage and mobilize all stakeholders including CDO's, CBA's and NGO's to ensure wastes minimization, reuse, recycling and recovery strategies,
Develop an infrastructural capacity building process involving women directly in the sound environmental management of waste,
Mandate the organized private sector to adopt waste reduction techniques,
Encourage and fund existing though limited research into waste related pollution control technologies as well as new means of effectively dealing with the falling standards of health and agriculture within the community,
Adopt the polluter-pay-principle in the management of waste,
Carry out periodic evaluation of progress achieved in the implementation of the objectives listed herein.

Deliberate efforts were made to involve as much as possible every societal player in the water business especially to involve women in the blueprint design of activities to enhance their living conditions and to boost their self-ability through dialogue. The scheme incorporated developing literacy skills, creating lasting awareness on major issues of development activities in the fight against poverty, disease, ignorance, environmental degradation, uphill farming, promoting self image and economic development, thus enhancing the earning capabilities of the women and their active participatory role in these projects. The use of illustrative situational drama was also applied to create increased understanding and awareness of water issues and the nature and root causes of water problems. These skills gained enabled participants to apply their energies and talents to solve water problems. This conceptual framework for the empowerment process is illustrated below in figure 2.



Self-Search "What/who am I"

Self-discovering "What am I capable of"

Self-development "I will not fold my arms"

(D) VISIBLE TOOLS OF POWER

- Socio-economic activity
- Income (Permanent/Continuous improving base
- Self-reliance

(E) POSITIVE SELF-CONTENT ⟶ (The "I am" and "I can" and "I will")

(F) FULL INVOLVEMENT/FULL CONTROL

- Autonomy: Full Participation

Notation: (A) – (F) = EMPOWERMENT PROCESS

Figure 2: **Poverty Alleviation and Waste Reduction Empowerment Scheme For Ebo ItuMbonuso.**

In order to sustain the empowerment process, links with outside agencies forming part of the institutional framework was designed. The approach is designed to facilitate and encourage local initiatives while maintaining common vision in line with the international strategy for an integrated water resource management (iwrm). See figure 3.

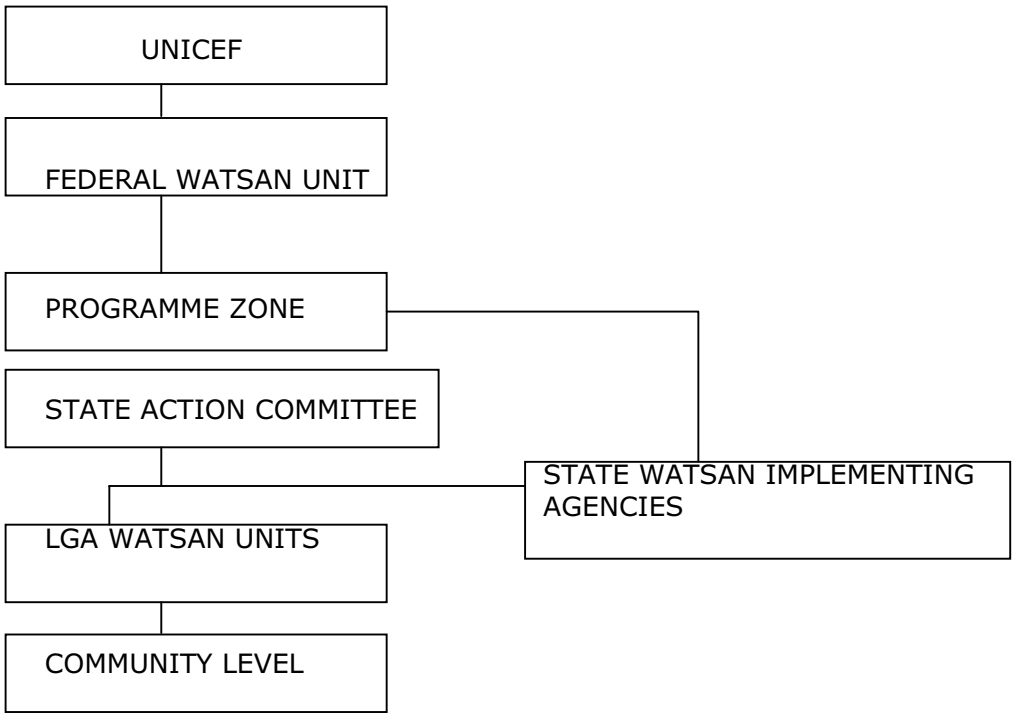


Figure 3: **Institutional Framework for Dealing with Ebo ItuMbonuso Water-related Environmental Problems.**

4. CONCLUSION

Overall, the incidence of water-related environmental problems here particularly typhoid fever, cholera and dysentery has reduced by 75% in 3 years based on data collected from the Local health center. Equally, there has been an increased awareness on the need to preserve the environment as even the Primary Schools within the village have started their Water clubs as part of efforts to protect the scare water resources of the Community. Currently, the Local Government Authority in the area has adopted our approach as a model for implementation.

ACKNOWLEDGEMENT

My sincere thanks goes to, Obong and Mrs O. R. Akpan and Professor Egboka who paved the way for this project.

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WATER PROVISION: FROM CONFLICT TO CO-OPERATION

James Mwami[282]

1. INTRODUCTION

The Pastoral System of the 'Bahima people' in Western Uganda was based on annual migrations that were driven by the seasonal availability of grass and water and the prevalence of cattle diseases.

This way of life was disrupted in the early 1960s by the establishment of government ranches, which covered 77 km^2, under the Land Use Investigation Unit (LUIU). In addition, the creation of the Ankole Ranching Scheme (ARS) between 1963 and 1975 covered a further 640 km^2, while the gazetting of Lake Mburo in 1964 added an area of 650 Km^2. As a consequence, the pastoralists and their herds were squeezed into smaller and smaller areas.

The breakdown of the political system in the second half of the 1970s led to the collapse of ARS and LUIU and the deterioration of law enforcement. As a result, the pastoralists started illegally re-occupying the lands from which they had been previously ousted. The traditional owners of the land had become landless squatters.

Following the victory of the National Resistance Army (NRA) in 1986, NRA officials allowed former residents to return to the park. When the pastoralists did return, though, in 1987, this migration was accompanied by the destruction of both headquarters and life they encountered. As a consequence, the park has subsequently been reduced in size from 650km^2 to 260km^2.

The 'Integrated Pastoral Development Project (IPDP) of Mbarara' aims at enabling 1000 settler families to become self-sufficient within a period of 6 years. The Mbarara Local Government (MLG) and the 'Gessellschaft for Technische Zusammenarbeit (GTZ)' are in charge of the project implementation for the Ugandan and German sides respectively.

The ultimate objective of the project is to have settled communities with sufficient water for both production (livestock) and domestic use. To achieve this aim, a gender-sensitive, participatory extension concept has been applied.

2. EXTENSION APPROACH

Experiences with self-help and worldwide extension approaches show that focusing on both the needs of the target groups and on self-help efforts as much as possible is a prerequisite for any successful outcome. This implies close co-operation between the staff and the target group, as priority needs can only be identified

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during intensive communication between both groups. To be successful, the participation of the target group is needed during the identification, planning and implementation stages of the project.

In the case of the Bahima settlers, it was necessary to focus on women as a group in particular, as settlement caused the loss of their central income. That is why a gender-sensitive approach was planned from the early stages of the project. Furthermore, a well-adapted step-by-step approach has been used to progressively enhance the technical knowledge of selected contact farmers.

3. SUSTAINABILITY OF IMPACTS ON TARGET GROUP LEVEL

It was made clear from the beginning that extension efforts would comprise support for the settlers with the aim that additional services would be necessary after 2003 (the likely end date of the project). Further, the support is limited by what the target group cannot afford or what they do not know (principle of subsidiarity).

Therefore the following principles were applied:

* material support for self-help project is limited to investments which do not need regular replacement.
* any maintenance of investments has to be done exclusively by the target group.
* advice on plant production, animal husbandry and health care is geared towards enabling farmers to grow their preferred plants and treat their animals by themselves by the end of the project term.

Community self-help and extension projects can only be successful if their support activities are closely geared towards the needs as perceived by the target groups. Therefore, an assessment of these needs is a vital first step, before any measures can be taken, as it is important that the target group knows the approximate frame for support. The second step involves decisions on the priorities of the project, accompanied by a time-schedule and financial framework. In the case of our case study, both meetings were arranged by a multi-disciplinary group of project officials that consisted of specialists in the field of water and sanitation facilities, gender issues, plant production, forestry, animal husbandry and health-care.

The table below indicates the costs of some valley tanks excavated in 1998/99.

Table 1: **Particulars of Valley Tanks implementation by GTZ-IPDP**

LOCATION	CAPACITY (M^3)	NO. OF FAMILIES	NO. OF CATTLE	COST (Ug. Shs.)	
				COMMUNITY CONTRIBUTION	PROJECT CONTRIBUTION
S.7	10,000	48	1,200	2,500,000=	5,500,000=
S.13	7,700	14	800	3,000,000=	6,000,000=
S.16	12,000	36	1,800	3,500,000=	6,500,000=
S.18	12,000	25	1,400	4,000,000=	7,000,000=
S.17	7,000	23	900	3,000,000=	6,000,000=
S.14	11,600	17	1,800	3,500,000=	6,000,000=
S.26	9,000	24	1,100	3,200,000=	6,500,000=
S.37	8,000	30	850	3,250,000=	7,500,000=
S.23	10,000	26	1,100	3,550,000=	7,250,000=

N.B: The exchange rate as of November 2001 was 1 US$ = 1,700 Ug. Shs.

4. OUTCOME OF NEEDS ASSESSMENT

In about 90 per cent of all cases, water has emerged as a top priority. As the Bahima settlers are a nomadic community, development of water activities must include water for livestock and domestic use.

The design of the valley tanks (the most appropriate technology for the area) must cater for the daily consumption of both animals and people. The design must also include auxiliary structures to protect the water, delivery and watering systems for the animals.

5. ACHIEVEMENTS TO-DATE

The potential for community based self-help activities, such as water development, has become a function of social cohesion among the families that are living in a particular ranch.
Some of the project's achievements are outlined here:

* 14 valley tanks have been completed with the aim of securing water supply for livestock and household purposes.
* 16 feeder roads have been rehabilitated and 2 new ones have been constructed in the area with the intention of improving access to the settlement as well as to external trading centres and markets; the total length of these roads is about 60 Km.
* One school building is currently under construction.
* Latrine platforms have improved sanitation with regard to food production.
* 10 contact farmers have planted wood lots.
* 13 contact farmers have planted agro-forestry trees.
* 11 have planted live fences.
* A total of 7 tree nurseries have been established.

* 13 women groups have been formed of which 6 are very active, 3 are slow and 4 are idle.
* No systematic follow-up and monitoring of the income generation from various activities is carried out, although there are indications for increased income in most active groups.
* A high level of cost sharing has been achieved with the beneficiaries of the infrastructure programme.

6. CONCLUSION

Over 70 per cent of the settlers have been involved in at least two other activities other than cattle rearing. About 50 per cent (about 500 families) of the families now have sufficient food, supplied from their own gardens as well as a surplus from which they earn an additional income. About 80 per cent of the originally settled people remain in the area and receive income from mixed farming, which is regarded as sufficient by Uganda standards.

All these developments have been sparked off by the construction of the fourteen valley tanks in the area, with capacities ranging from 6,000 m^3 to 12,000 m^3. On average, each of these tanks serves about 20 families and 100 heads of cattle.

To ensure a lasting water supply for the population, it is important that all users develop a cultural identification with the water project as well as one that will enable them to cope with the newly emerging social-cultural risks. This will increase security for all the water users.

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INTERNATIONAL COOPERATION AS AN INSTRUMENT FOR IMPROVING TRANSBOUNDARY WATER RESOURCES MANAGEMENT: the CASE OF UKRAINE

Viacheslav MANUKALO[283]

1. INTRODUCTION

The international (transboundary) level of water-related activity usually has very significant importance in sustainable water resources management and water protection for a country with watersheds that are shared at regional and national levels. Such activity commonly provides a basis for adequate and shared water management and water protection practice.

The 1997 UN Watercourses Convention should be regarded as an instrument to facilitate river basin management. In addition, principles established with respect to limiting transboundary impacts (1992 UNECE Helsinki Transboundary Watercourses Convention), encouraging public participation (1998 Aarhus Convention), and water and health (1999 Protocol on Water and Health) may supplement the principles set out in the 1997 UN Watercourses Convention.

Implementation of the Water Framework Directive of the European Parliament and Council of Ministers of October 23 2000, establishing a framework for Community action in the area of water policy, calls for cooperation and coordination in water-related activities, from the regional level through the transboundary to the international level, on any given watershed.

Ukraine shares many transboundary river basins with neighboring countries: the Republic of Belarus (Western Bug, Dnypro, Pryp'at Rivers), the Russian Federation (Dnypro, Desna, Siversky, Donets Rivers), the Republic of Moldova (Danube, Dnister, Siret Rivers), Romania (Danube, Tysza, Prut Rivers), Hungary (Tysza river), the Slovak Republic (Latoritsa, Uhg Rivers), and Poland (Western Bug River). The areas of these states featuring developed industry and agriculture and with large populations are situated within these transboundary river basins.

The water resources that originate within the Ukraine at present amount to 52,400 km^3 (only 25 percent from the total water resources of the country), while 209,800 km^3 of surface runoff comes from behind the Ukraine. Transboundary rivers and their numerous tributaries are used extensively for navigation, fishing, and drinking water supply, and to satisfy the demands of agriculture and industry. They also allow hydropower production and are used for recreation, as well as for disposal of wastewater.

River floods and the inundations accompanying them are characteristic of transboundary rivers. In particular, the natural conditions in mountain river basins (for instance, those of the Tysza, Prut, Siret, and Dnister Rivers) lead easily to flood runoff formation. In past years a number of accidental water pollution events have been reported on transboundary rivers.

The recent process of political and economic change in the countries of Central and Eastern Europe, including the new independent states of the Former Soviet Union, has posed new and compelling challenges to the development of national policy and international cooperation in the field of transboundary water

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management and protection. All the above factors affect the potential for the Ukraine and neighboring countries to cooperate in integrated water management, preventing pollution and the negative consequences of river flooding.

During the last decade the following fundamental water-related agreements have been put in place in the European region:

- the 1991 Convention on Environmental Impact Assessment in a Transboundary Context
- the 1992 Convention on the Transboundary Effects of Industrial Accidents
- the 1992 Convention of the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention)
- the 1992 Convention on the Protection of the Black Sea against Pollution
- the 1994 Danube River Protection Convention
- the 1998 Convention on Access to Information and Public Participation in Decision Making
- the 2000 Directive of the European Parliament and of the Council which established a framework for Community action in the field of water policy (European Water Framework Directive).

These agreements form a good basis for the development of national and international activities in transboundary water management. Providing sustainable transboundary water management is no easy task, however, especially in countries with economies in transition that face economic, social, and ecological problems. International cooperation in this field is needed in order to manage river basins effectively, and to use individual countries' financial resources most economically.

2. PRESENT STATE OF COOPERATION

Since its independence, Ukraine has gained experience of the international cooperation required for the management of transboundary river basins (Manukalo, 2001). Ukraine has established many links with its neighbors, as well as with other countries in Europe and elsewhere, and with a number of international organizations dealing with water-related activity. Ukraine has acceded to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes of July 1999. Priorities for improving transboundary waters include:

- developing water quantity and quality monitoring systems
- reducing pollution by building treatment facilities
- better identification of the problems facing different rivers and waters with the use of modern technology
- improving assessment systems and databases to assist decision makers
- developing financial mechanisms to help different water bodies meet protection goals.

As a riparian state with many neighboring countries, Ukraine is strengthening bilateral and multilateral cooperation in water management and protection in the following river basins: Danube (including its tributaries Tisza, Prut, Seret, Latoritsa, and Uzh), Dnypro, Dniester, Southern Bug and Western Bug, Siversky, and Donets, as well as in the corresponding zones of the Black and Azov Seas.

The bilateral cooperation on transboundary rivers between Ukraine and the Republic of Belarus, the Russian Federation, the Republic of Moldova, Romania,

Hungary, the Slovak Republic, and Poland is regulated by the intergovernmental agreements between the countries. Within the framework of these agreements the Joint Commissions on Transboundary Waters have been created, headed by the government representatives of each country. Ukrainian representation on these Commissions is headed by Deputies of the Chairman of the State Committee of Ukraine for Water Management.

Initially, agreements mainly addressed flood control questions; at the second stage they dealt with surface water management; subsequently they covered water quality issues and problems of complex water resources management, including that of groundwater.

Additionally, working groups have been created to address individual issues and dimensions, such as hydrometeorology, hydrogeology, protection of water from contamination, flood protection, regulation of river runoff, and so on.

The activities of these various commissions and groups reflect an annual cycle of programs of work. The representatives of commissions and groups gather annually at working meetings, where the plans of work are coordinated and issues of mutual interest are identified.

In the working groups on hydrometeorology, Ukraine is represented by representatives of the State Hydrometeorological Service. The main tasks of these working groups are:

- coordination of work on the creation of hydrological and meteorological observation networks
- shared investigation and analysis of the condition of the technical infrastructure of the observation networks
- organizing common observation programs on water levels and discharges in the transboundary sections of the rivers
- exchanging operational and status information
- exchanging forecasts during the flood formation season; giving warnings on unfavorable hydrological and meteorological conditions that might spread into neighboring areas
- sharing scientific and technical achievements.

International cooperation on water management within the Dnypro and Danube basins is especially important for Ukraine. The Dnypro basin provides about 80 percent of the total water resources used by Ukraine – altogether 32 million Ukrainians and two-thirds of the national economy depend upon it. Therefore, the poor state of the basin environment must be addressed, and environmental rehabilitation of the Dnypro basin is one of the priorities for both socioeconomic development and environmental policy for Ukraine and neighboring countries.

Ukraine, the Russian Federation, and the Republic of Belarus have joint conventions and programs addressing the rehabilitation and sustainable use of the Dnypro ecosystem, considering water supply quality, environmental hazards to the population, the impact of economic activity, and protection of water against pollution and overexploitation. These countries coordinate their national water management and water protection policies. Their national hydrometeorological services also cooperate very actively in the area of operational and scientific hydrology.

Scientific–technical cooperation in the area of hydrology and water resources study between Ukraine and the Danube countries has continued over many years. It has a multidisciplinary character, and embraces a spectrum of the problems

posed by scientific and practical hydrology. Cooperation in the Danube basin is regulated by the existing conventions, commissions and fora, programs, and agreements:

- Danube Commission on Navigation
- Declaration on Cooperation in the field of water-related issues
- Convention on Cooperation in the Protection and Sustainable Use of the Danube River
- Convention on the Protection and Use of Transboundary Watercourses and International Lakes
- Forum of directors of national hydrological services
- Operational Hydrological Program of the World Meteorological Organization (Hydrology and Water Resources Programme; World Hydrological Cycle Observing System WHYCOS–Danube HYCOS)
- Regional cooperation by the Danube countries within the framework of the International Hydrological Program of UNESCO
- International Association for Danube Research
- Transboundary Commissions
- Bilateral and multilateral agreements on flood forecasting and water management on transboundary rivers.

Being aware of the need for an effective system of flood warning in the basin of the Tisza (the largest tributary of the Danube), Ukraine, Hungary, and Romania have cooperated for many years in exchanging hydrometeorological information. These countries also exchange forecast information during the flood formation period, and issue warnings of unfavorable hydrological and meteorological conditions that might spread into neighboring areas. Such cooperation promotes coordinated actions to help ensure that a flood passes safely, and assists in the defense of territory from flooding.

Examples of successful cooperation of this kind between Ukraine, Hungary, and Romania is provided by the interaction between their hydrometeorological and hydrological services during the formation and passing of the extreme floods of December 1995, November 1998, and March 2001. These coordinated actions allowed plenty of time to organize preventive measures against flood damage. In Ukraine, for example, these measures alone prevented damage to the national economy amounting to tens of millions of dollars in value.

The above-mentioned floods, and the pollution accident in 2000 within the Tysza river basin, have focused public attention in the Danube countries on flood safety and pollution protection within the Danube river basin. Since riverine floods and pollution accidents can affect large areas with intense economic activity and high densities of population, it is necessary to improve international coordinated hydrological forecasting and warning systems for flood control, and comprehensive water management generally, within the Danube transboundary river basins.

A modern real-time water flow monitoring, forecasting, and warning system should be set up to meet the national and regional water development needs of Ukraine and neighboring countries. Without a basin-wide technical information system it will be difficult to implement the key principles of international law – equitable utilization and "no harm."

The present socioeconomic situation in Ukraine and neighboring countries creates complicated conditions for effective cooperation on transboundary rivers, since these nations face economic restructuring problems. This makes it very

important to obtain technical and financial assistance from developed countries and international organizations when planning and implementing joint projects.

In recent years, Ukraine has obtained technical assistance with improved water management from the European Union within the framework of the TASIS Programme, initiated by the EU for new independent states of the former Soviet Union and Mongolia. It fosters the development of harmonious and prosperous economic and political links between the EU and these partner countries.

Ukraine receives assistance from the TASIS Programme for the Danube river basin. In 2000, the project on "Accident Emergency Warning System and Monitoring, Laboratory, and Information Management for Ukraine and the Republic of Moldova" came to an end. Another four separate projects for Ukraine and the Republic of Moldova have been implemented with a large Tasis grant. The first project focuses on new technology for reducing pollution from wood-processing enterprises in the Tizsa river basin. The second addresses international water management in Ukraine. The third aims at developing cooperation on wetlands and the Danube lakes between the Rebublic of Moldova and Ukraine. The fourth should improve monitoring and emergency systems in the Danube river basin.

The Tasis project for the West Bug, Latoritsa, and Uzh on transboundary analysis and monitoring system was ended in 2001. It involved Ukraine, the Republic of Belarus, Poland and the Slovak Republic.

The Ukrainian–Danish–Slovakian project on the development of flood management within the Tisza and Latoritsa basins has been implemented since 1999. In the framework of this project Ukraine should obtain fourteen automatic hydrological stations from Denmark and a modern model for flood forecasting. During 1999 and 2000 Ukrainian specialists received training in Denmark.

In 1999 the GEF project for the Dnypro river basin also started. The project involves Ukraine, the Russian Federation, and the Republic of Belarus and focuses on the remediation of serious environmental effects of pollution, the sustainable use of resources, and the protection of biodiversity.

The WMO Danube–HYCOS project is currently under preparation. The main objectives of this project are:

- To improve the national hydrological systems and establish an operational and reliable system in the Danube basin for the collection, transmission, processing, storage, and dissemination of hydrological and water resources data, and information concerning related environmental parameters.
- To provide a framework for more efficient regional cooperation in hydrological forecasting and water resources management.
- To foster international cooperation in capacity building, including training and technology transfer.

The implementation of the project should allow the optimal use, at national level, of recent scientific and technological advances in water resources management and water pollution control.

3. CONCLUSIONS AND RECOMMENDATIONS

Within international river basins, where water is both an asset and a potential danger to several countries, international cooperation is a very important instrument for improving water resources management, protecting water and the environment, and preventing the negative consequences of flooding at national and international levels. This cooperation allows each participating country to make the

best use of financial resources – an important factor given the economic problems facing Ukraine and other Eastern European countries.

Ukraine is actively developing international cooperation in water-related activities with neighboring countries, and with international organizations and institutions. This cooperation helps Ukraine to improve the management of internal waters and ensures consistency in the protection and use of both internal and transboundary waters. To further respond to its international obligations, Ukraine has drawn up general and specific policy and action plans and sought foreign technical assistance.

Different national authorities (Ministry of Environment and Natural Resources of Ukraine, State Committee for Water Management, State Hydrometeorological Service) are involved in international cooperation in the field of water management. Unfortunately, in some cases there is insufficient coordination between these authorities. Establishment of a special unit for managing international technical assistance could improve the efficiency of this assistance and promote the development of capacity building, training of Ukrainian personal, and technology transfer.

The highest priority tasks for Ukraine and its neighboring countries are creating the transboundary integrated water monitoring system for providing reliable, consistent, and timely data and forecasts to support the decision-making processes related to hydrological forecasting, water resources management, and environmental protection. The creation of Early Flood Forecasting and Pollution Accidents Systems in the transboundary river basins represents the best course of action with regard to flood control, flood risk management, and environmental protection.

Environmental protection within individual countries requires international cooperation and the sharing of data and information. In the field of water quality, effective monitoring calls for updating of water quality standards, improvement and harmonization of systems for collecting information, standardization of laboratory procedures, and international laboratory intercalibration.

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THE ALBUFEIRA AGREEMENT: THE NEW SPANISH – PORTUGUESE TRANSBOUNDARY WATERS AGREEMENT

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ABSTRACT

The physical and hydrographical features of the Iberian Peninsula determine the fact that Spain and Portugal share a substantial part of their water resources, that is to say those included in the hydrographical basins of the Miño, Límia, Douro, Tagus and Guadiana Rivers. This means that water use is one of the most important subjects in the relations between the two countries, although this was not the case until the decade of the 1960s when the first specific agreements relative to the development of the hydropower resources of the border water stretches were reached. The 1964 (Douro) and the 1968 Agreements (for the remaining rivers) are good examples of the co-operation possibilities between countries in this field. The fact that the aforementioned Agreements have been totally developed, as well as the appearance of new questions on the international scene, particularly the Helsinki Agreement, and the political, economic and social evolution of both countries illustrated the need to reach a new agreement. Conversations were initiated in 1993 and concluded in 1997 with the signing of the Albufeira Agreement. This Agreement is based on the wealth of experience accumulated by both countries and it establishes a framework for the exploitation and protection of water resources, acknowledging each Part's right to manage the waters within its territory. The Pact, which is applied to all the basins, deals with situations derived from extreme phenomena, such as droughts and floods in the same way as the problems derived from accidental pollution incidents. Likewise, the co-operation organisms for the application and the development of the conventional framework are established in it.

1. INTRODUCTION

The main hydrographical feature of the Iberian Peninsula, located at the South-eastern end of Europe is its isolation from the rest of the European system. In Fig 1 the general characteristics of the Iberian Peninsula and the relative importance of the transborder basins are indicated.

The surface area of the basins shared by both countries covers a little over 45% of the mainland territory and their importance is much greater in the case of Portugal, where they reach 64% of its surface area, although the Portuguese part of each basin never exceeds 20% of each. Both countries have significantly different water management systems. It might even be said when simplifying the matter that whereas in Spain water management is reasonably decentralised, in Portugal it is more often centralised. In both cases water is in the public domain, that is to say, it is an asset belonging to the State, which may only be used privately when holding an authorisation from the corresponding management organisms.

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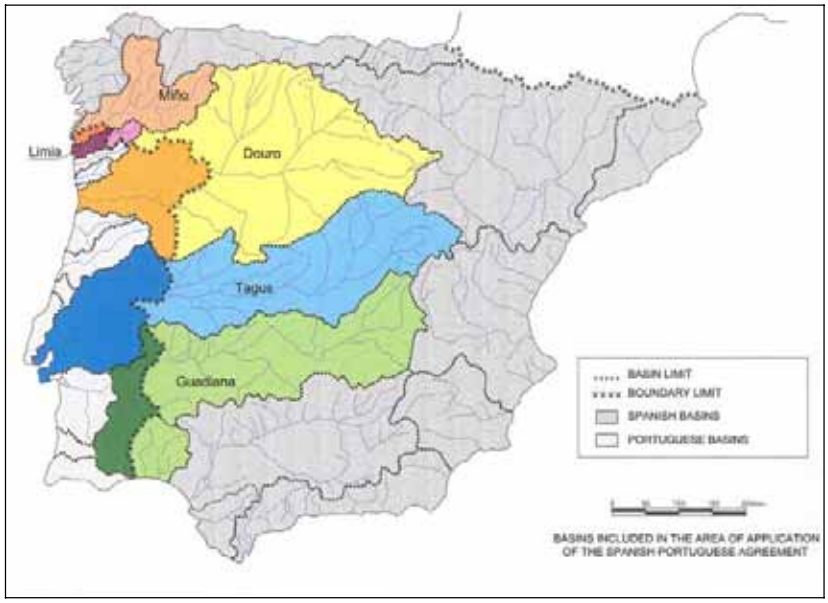

Figure 1: **Map of the Spanish-Potuguese basins.**

The administration authority for water is developed by the Ministry of the Environment, although water management in Spain is entrusted to the Hydrographic Confederations, independently managed public bodies. The Confederations, acting in the territory of one or several hydrographical basins, were created in 1926 and are made up by both representatives of the water users of the basin and the different public administrations working in the territory or the sectors of the corresponding activities.

The first document concerning the Spanish – Portuguese relations on the subject of water is the Limit Treaty of the 29th of September 1864, completed by the Change of Notes in September of 1912. In the first case, it was shown that the water resources existing in the border stretches had to be used for mutual benefit and no country could appropriate them exclusively for itself, excluding all others. The 1912 document included a set of simple rules for the industrial use of water in the border stretches, assigning each country with half of the running flow and establishing that a technical project for the water use had to be presented. To ensure the fulfilment of these conditions a sort of International Committee, formed by a technical delegate from each of the Parties, was established. The 1912 agreement has not been formally repealed, therefore today it still forms a subsidiary legal element. The next point to quote is the agreement of the 11th of August 1927, which regulated the hydroelectrical use of the international stretch of the Douro River, which became largely ineffective after the signing of the 1964 agreement.

Although they are generally dealt with together, the 1964 and 1968 Agreements respond to different layouts and philosophies. In the first place, the enormous hydropower potential of the international stretch of the Douro River was essential for the industrialisation of both countries and particularly for Spain. On the other hand, the advances in the electricity industry and the construction of dams that took place during the second half of the 20th century meant that the reference framework designed by the 1927 Agreement was insufficient to reach these targets. In the second case, the need to contemplate the expansion of irrigation necessary

for the growing urbanisation process and the modification in the population's eating habits was obvious.

In Table 1 the assignment of stretches to the countries carried out in the 1964 and 1968 Agreements is shown.

River stretch	Assignment
Miño	Shared hydropower exploitation
Limia	Portugal
Douro upper stretch	Portugal
Douro lower stretch	Spain
Tagus	Spain
Guadiana	Portugal
Chanza	Spain
Guadiana lower strech	Without assignment
Erjas	Without assignment

Table 1: **Assignment of stretches according to the Agreements.**

The model designed by the 1964 and 1968 Agreements suddenly entered a crisis in the year 1993. The certain political dimension of the water crisis put this question on the agenda of the Spanish – Portuguese ministerial summit in Palma de Mallorca (Spain), held in autumn 1993. At the following Ministerial Summit held in Oporto (Portugal) in November 1994, the contents of the new Agreement were studied in greater depth. The result of the Summit materialised in the so-called "Oporto Declaration" that formed a commission, at the highest level for the negotiations.

After ten formal negotiation meetings and in addition to many other technical and legal meetings, the "Agreement on co-operation for the protection and sustainable exploitation of the waters from the Spanish – Portuguese hydrographic basins" was signed ad referendum in the Portuguese city of Albufeira (known as the "Albufeira Agreement"). The Pact came into effect on the 17th of January 2000, this being the date of the last notification between the Parties communicating the fulfilment of the respective internal procedures. The Agreement's formal layout is relatively simple, being made up of a Preamble, a text with 35 articles, distributed into six Parties, two Annexes and an Additional Protocol with its Annex.

2. THE ALBUFEIRA AGREEMENT: PRINCIPLES OF CO-OPERATION

The Preamble summarises the Pact's intentional policy, synthesising the foundations of the agreement. Its contents are provisions that affect all the articles and are fundamental when interpreting the treaty in question. In this sense, we can emphasise the following as essential inspirational principles: the search for a balance between the use and the protection of the water within a framework of sustainable development and the co-ordination of the efforts to be carried out between both countries for water management.

The balance between the aspects relative to the use of the water and its protection the Preamble refers to are likewise held under the heading of definitions where that of "transborder impact" appears, immediately followed by that of "sustainable exploitation". More important than this is the criteria held in article 2, as it establishes that the aim of the Agreement is to define "a framework for co-operation.... for the protection of the waters ..... and for sustainable exploitation".

The introduction of sustainability criteria means that the analysis of the situations performed by the Parties must be carried out from the exploitation point of view, always taking for granted that this is sustainable and no significant impacts must be produced (be they internal or transborder). The assignment of potential impacts must analyse the lack of adaptation of the actions to the sustainability, referring to irreversibility in the medium term, going beyond merely particular or temporary situations.

The hydrographic basins of the following rivers enter into the Agreement's scope of application: Miño, Limia, Douro, Tagus and Guadiana. The fact that we are talking about a single Agreement and not one for each river, as is more normal in an international context, is based on the tradition existing in the previous Pacts, but which is sensible, as it is dealing with topics with similar allowing a better application of the means and a greater specialisation of the delegates.

In accordance with the latest theories on water management, the activities to be considered are all those developed in the hydrographic basin although, for the purpose of its practical application, greater importance must be given to those that are carried out in areas where the effects on the water conditions are greater and on those activities that are susceptible to causing transborder impacts. It cannot be forgotten that the Agreement is set out as a pact for co-operation and for this reason its methods are established consisting of the exchange of information, consultations and activities within the instituted organs and the adoption of joint activities.

The exchange of information is shown in the widest way possible, concentrating on those aspects necessary for water management. Annex I fixes the substantial elements on which the exchange of information is going to be concentrated, although it does not limit them. It is important to state that this exchange of information does not only include information on numerical aspects, but also on legislation and administrative practices to attempt to find similar situations between the countries and use similar tools and that are, at all times, comparable.

The information is not just reduced to the public administrations; it is extended to the public in general in line with that foreseen in the Aarhus Convection on access to environmental information and to the principles that the European Union has in practice on this aspect.

The Commission itself must be informed by the corresponding hydraulic administrations about the performance of the actions foreseen in the Agreement and subsequently, on the agreements of the Commission itself. It should be noted that, as we will see, the Commission is not an executing organ meaning that this information is relevant. Currently, work is being carried out to define a common format for this Report to allow a comparison of the data supplied by each country.

These annual Reports make up an essential element of what we could call the Agreement's "guarantee regime". These, together with the evaluation that the Commission makes of them, must form a fundamental instrument for the decision makers and in turn, a privileged and contrasted source of information for public opinion.

3. TREATMENT OF TRANSBORDER IMPACTS

This is a particularly important topic, especially for the country that is located downstream. The solution found refers to the practising of the international legislation signed by both countries, in particular the Helsinki Agreement. Its placing in the text, under the heading referring to co-operation between the Parties is not accidental, since it is considered that prevention and mitigation of the transborder impacts is one of the essential aspects on which this co-operation must be based. In any case, the starting point is the principle of good will by the Parties, the observance of which is correlative. Not causing significant damage – and acting with care in the case that damage could occur – and not using the consultation mechanism as a means to obstruct possible actions make up two sides of the same coin. The fact that the Agreement affects the entire hydrographic basin means that these behaviour principles show a more balanced nature than if the effects only referred to the water flows where the upstream or downstream positions are determining.

Article 8 fixes the processes for information, notification and consultation referring to actions that could potentially cause transborder impacts, while in article 9 the procedure for the evaluation of the damages is detailed. Both articles are complemented by Annex II, which fixes the projects or activities – including future extensions - which must be subject to impact evaluation. However, this list is only to be used as a guideline, therefore either Part may unilaterally ask for consultations on any project or activity.

Although the first phase of consultations referred to in article 8 is carried out within the Commission, that is to say in a deliberating organ with a technical nature, a lack of agreement must be substantiated in accordance with the general procedure for the solution of controversies – arbitration, fixed in article 26 of the Agreement itself. Although this is not stated, it seems logical that before reaching a solution by arbitration, the topic must be considered within the Conference of the Parties.

The distinction the Agreement makes between projects and activities is particularly interesting, although a greater conceptual accuracy of the terms with a differentiated treatment of both topics (Crucho de Almeida, 1999) would have been more desirable. It is important, insofar as it represents an advance over other agreements with the same characteristics. Next to the fact that a continuous follow up of specific projects or activities is established when the transborder impacts may be delayed or not enough certainties are found to exclude them, is the possibility to initiate actions, adapting their performance to the results that could be obtained through this follow up in a similar manner to the effect of the complementary measures that the Directive Framework sets out. The Agreement produces clauses that generate actions related to public health, public safety or general interest. This circumstance is compensated by the repair and damages compensation if responsibilities may be derived from this action.

4. WATER MANAGEMENT: EXTREME PHENOMENA

The articles devoted to dealing with water management may be grouped under three wide headings: those corresponding to the quality of the resources and the prevention and control of pollution; those referring to the use of the water (of which the flow regime would form a part, although this is analysed separately); and the questions related to extreme phenomena or exceptional situations.

In the first case, the idea is to establish the basis for the fulfilment within the bilateral scope of the demands of community law and particularly, those of the Directive Framework on Water. In this sense, an identification of the water masses that could be susceptible to reciprocal alteration must be carried out with the aim of co-ordinating the quality targets that these water masses must fulfil to obtain or maintain their good conditions. The measures necessary to reach these good conditions must be carried out in the corresponding national plan reporting to the Commission on the progresses that have occurred.

Situations in which the transborder water masses are the object of special protection, must be adopted by mutual agreement. Although it is based on the application of community legislation, the levels of freedom for its adoption are highly restricted.

In relation to the measures for the prevention and control of pollution, emphasis is placed on the co-ordination of the procedures and measures adopted by both countries and on the fact that they must not differ (other than on highly exceptional questions) from what has been foreseen in community legislation.

"Sustainable use" of water is one of the fundamental foundations of the Agreement. Obviously, the principles of sustainable management of the resources are established, such as rational use, water saving measures, use of economic instruments, etc., all of which being actions that we will see in greater detail when dealing with the situations of drought and water scarcity.

The Agreement mentiones that the exploitation of the resources must be carried out within the area of the hydrographic basin (Spain has been doing this since 1926). Exceptions to this rule are regulated by this Agreement and refer to the water transfers between basins. The water transfers may be a necessary operation to correct water deficiencies, but it must be contemplated as an exceptional operation and in any event, its performance presupposes the fulfilment of the Agreement both *ex ante* (environmental impact) and *ex post* (flow regime).

The regulation that each country will independently carry out the operation of its hydraulic infrastructures without any other limits than the fulfilment of the substantial obligations of the Pact is fixed. This regulation makes sense as both countries and particularly Spain, in the past have made an important effort to regulate the flows not included in the joint management, which if carried out could lead to a sub-optimum use of them with the possibility of a net loss of the usable resources. Additionally, one has to take into account the fact that private agents operate in many of these infrastructures.

In any event, the exchange of information about the operational processes, requirements, filling and emptying programmes etc. and the co-ordination of actions in specific cases (which have been carried out throughout this period) are a more effective solution, at least in the medium term, while the administrative and management structures differ in both countries.

The incidents of accidental pollution are a situation in which the position of the two countries is more balanced. Due to its very nature, an *in vigilando* obligation is tried to be imposed, (already existing in community legislation), but one specified for installations and activities of common interest that are, in some way or other, referred to in the list in Annex II. In the case that a pollution incident occurs, careful action is necessary to avoid or minimise its effects, the lack of which could bring into play the provisions contained in articles 8 and 9. In any event, information about the incident, its scope, actions that are being carried out, and the results obtained are essential.

Under the heading devoted to water management, special attention should be paid to topics relative to the treatment of extreme phenomena, habitual in Iberian hydrology. Action measures are set out orientated towards the method of action in these extreme situations, particularly during droughts as this is a phenomena that lasts for a long time and that constitutes a case of declaration of exception.

A flood situation does not require a legal definition, only the perception by either of the Parties (and not only for the Part that is potentially affected) that this situation exists. The transmission of information must be carried out in real time or, if this were not to be possible, in the nearest possible way to this. In addition to this, the information should be passed directly between the part generating the data and the part that must use it.

Taking this criterion into account, the Commission approved, at its 3rd meeting held in Evora in April 2002, a Protocol for the transmission of information in flood situations that must be operational in the hydrological year 2002-2003. For the establishment of this Protocol the important experience accumulated by both hydraulic administrations in past flood management has been taken into account. For the future, new studies are planned, particularly those referring to the operation of the infrastructures for flood lamination. It should be pointed out that these studies comprehend the analysis of possible reservoir operation strategies in flood situations with the idea that these are known and the results evaluated by the technical teams from both countries, but this does not mean any type of joint management.

The declaration of a situation of drought or lack of resources[286] must be made by the affected party without the other party being able to allege anything against it, in accordance with the spatial heterogeneity with which it is presented. Therefore, it

[286] The Agreement does not indicate the difference between the two situations although we can consider that drought corresponds to a temporary situation determined by hydro-meteorological causes, while scarcity of resources has a structural nature. In the following, both situations will be treated in the same way since for the resolution of the problems of scarcity of resources it is necessary to contemplate, as well as the demand management measures that are proposed during droughts, a reorganisation of uses or a contribution of external resources that are not contemplated in the Agreement. It must not be confused with the situation of exception that is fixed in the Additional Protocol.

is a situation of a subjective type that cannot be confused with the declaration of exception, even when both, drought and exception, show the signs of an extreme phenomena. However, this subjectivity must be limited by the definition of certain indicators that are currently being worked on.

The Directive Framework of the European Union requires the existence of indicators of a drought situation since this is a situation where the fulfilment of the environmental targets may be relaxed. Although the indicators from both the Agreement and the Directive do not have to be the same because they respond to different hypothetical cases, it would seem logical that finally common values are reached (including if possible, those corresponding to the exception criteria) with the aim of simplifying the treatment of the topics.

Once a situation of drought has been declared, the Parties must begin to co-ordinate a set of measures, listed in the Agreement, all of them aimed at carrying out a stricter management of the demand and to start up of water saving measures and resources protection, therefore the control over sewage discharge must be made stricter to avoid increasing the situation of stress in which the water medium is found.

Insofar as the fact that situations of drought in the Spanish-Portuguese basins have a significant probability of occurrence, it could be desirable for the set of determinations foreseen in article 19, that is to say: indicators, demand management regulations, restrictions plans, etc., to be incorporated into the actual national planning instruments as a different stage from that of average conditions that are contemplated in the Basin Plans, both in Spain and in Portugal.

The Commission is a fundamental element for the follow up of a drought situation as well as for the evaluation and the actions taken on, therefore it must be informed, in as short a time as possible, of the start up of the measures adopted as well as the efficiency of their results.

5. THE FLOW REGIME

This is possibly the most outstanding aspect of the Agreement. It is specifically regulated in article 19 and in the Additional Protocol. Essentially, it attempts to fix some guaranteed flows (obviously for Spain, the country that is upstream) at certain points. The fact of fixing a certain amount of water makes this Agreement unique[287]. It also fixes some minimum flows to be reached in the stretches of water downstream, to act as a control element with respect to the suitable use of the guaranteed flows and as a contribution by this part to the maintenance of the conditions of the river regime.

Taking into account the fact that the Pact must be considered to be naturally balanced, we must analyse the nature of the benefits that are derived by each Part.

[287] The commitment to deliver prefixed volumes appears in the Treaty of Mexico-USA (1944), in the one signed between Egypt and the Sudan (1957) that regulates the flow that must reach Assuan and in the Protocol between Turkey and Syria (1997) referring to the waters of the Euphrates. The agreement between Greece and Bulgaria (1995) on the Mestos River could be added to this short list, although here it refers to the guarantee of a given percentage of the circulating flow without fixing total amounts.

In the case of Spain, it involves the possibility, at least theoretically, of being able to extend, in the future, the uses without other limitations than the fulfilment of the established agreements. But this legal security requires greater strictness, owing to the service priority that the guaranteed flows have, when fixing these new uses, which will also have a great cost, either due to the performance of additional regulations or due to the implantation of saving measures. In the last resort, greater use of the resources will mean a more fragile system, increasing the risk of having to empty the reservoirs just to fulfil the Agreement's conditions. But when faced with future potential risks, the balance could be positive when the uncertainties that could weigh on the development of the Hydrological Plans disappear.

Portugal holds a more favourable position with respect to water resources but, in any event, its water security depends partially on the water coming from Spain, probably more in terms of quality than in quantity, and to be able to plan its development it is essential to fix some amounts with sufficient guarantees. This is more important in the case of the Guadiana as the possibility of new demands, both agricultural, tourist and residential are greater.

These flows try to ensure the uses of the water that are carried out today – the permanence of which the Agreement ensures - and those which could be carried out in the future, in a sustainable manner in each of the basins considered, but also, the hydrological and environmental functions of the rivers. The general criteria to fix the flow regime are specified in the Additional Protocol to the Pact and they are the following:

The natural characteristics of each hydrographic basin.
Those which guarantee good conditions of the water, in accordance with its ecological characteristics.
Those which guarantee the present and future uses within the framework of sustainable development.
Those which are derived from the availability of the existing infrastructures, particularly those with a large regulation capacity.
The respect for the 1964 and 1968 flow regimes.

This last criterion is particularly important since consolidated concessions along the border stretches cannot be changed. However, this cannot be understood as being unchangeable[288] since the development itself of the Agreement, and even the appearance of new methods of water management, could require their gradual adaptation to the new reality taking into account the Agreement themselve has a limited period of validity and that it cannot be understood to be extended tacitly by the implementation of the Albufeira Agreement.

The flow regime, established provisionally in the Additional Protocol, is detailed in Fig 2 and it is different for each river [289] in terms of its hydrological characteristics

[288] If this were a determining criterion, the appropriateness of the Albufeira Agreement itself must be questioned.
[289] They are not established for the Limia given that the consumption in Spain is not relevant and it is also not possible to carry out a significant regulation in the Spanish part of the basin, therefore it may be considered that the water flows entering Portugal correspond to natural flows.

but also with regard to the rest of the determinants. It represents a fraction of the average supply; this value having been determined with the aim of taking into account the hydrological variability of the Mainland Rivers and to have a safety margin available that allows future demands to be catered for. This value has been criticised in Portugal, but it ensures some specific values, which are minimum values, improving the situation existing in previous Pacts. It is well founded and its fulfilment is feasible, although not free, for the upstream part (Serra, 1999).

Using the annual supply to characterise a flow regime may not be enough in systems with an important inter-annual variation or in highly regulated rivers, particularly when thinking about maintaining the ecological functions that have some kind of seasonal variability. This subject was debated in depth during the discussions on the Agreement and maybe a new reflection on their appropriateness could be necessary when the final flow regime is studied, but finally the idea of using a single variable, the fulfilment of which is easy to compare by any interested person or body was opted for.

In the case of monthly guaranteed flows, their quantification would involve greater levels of subjectivity, causing a wide debate about the possible exceptions and a potential source of mistrust about the fulfilment of the conventional conditions. In addition to this, the adoption of these monthly flows would introduce serious inflexibilities into the operation of the existing hydropower stations that could give rise to a complete rethinking of the 1964 and 1968 Agreements when, paradoxically, one of the conditions of the flow regime is their maintenance. Therefore, the Agreement itself has mechanisms that allow the ecological function to be covered without it being essential to resort to a monthly distribution of flows.

Flow regime (Minimum flow)

Basin	Gauging Station	Minimum Flow (mcm/year)	START of exception period	END of exception period
Miño	Salto de Freira	3.700	$P^{(R)}$ up to 1st July < 70% $P^{(M)}$	following month to December if $P^{(R)} > P^{(M)}$
Douro	Miranda dam P. Saucelle + Águeda G.S. Crestuma dam	3.500 3.800 5.000	$P^{(R)}$ up to 1st June < 65% $P^{(M)}$	following month to December if $P^{(R)} > P^{(M)}$
Tagus	Salto de cedillo Ponte de Muge G.S.	2.700 4.000	$P^{(R)}$ up to 1st April>60% $P^{(M)}$ or $P^{(R)}$ up to 1st April < 70% $P^{(M)}$ and $P^{(R)}$ previous year < 80% $P^{(M)}$	following month to December if $P^{(R)} > P^{(M)}$
Guadiana	Badajoz dam Pomarao G.S.	600-300 2 m^3/s daily	according to rainfall and state of reference reservoirs	following month to December if volume in ref. reservoirs > 3.150 mcm

$P^{(R)}$ is the accumulated reference rainfall in the basin from the beginning of hydrological year to the date indicated.
$P^{(M)}$ is the mean accumulated rainfall in the basin in the same period.

Flow regime (detail of minimum flow in the GUADIANA)

a) Total annual flow in Badajoz dam (mcm/year):

Volume in reference reservoirs (mcm)	% Accumulated rainfall above the mean as at 1st March	
	> 65 %	< 65 %
> 4.000	600	400
between 3.150 and 4.000	500	300
between 2.650 and 3.150	400	Exception
< 2.650	Exception	Exception

b) Mean daily flow in Badajoz dam and in Pomarao: 2 m^3/sec in all cases

This regime will not be applied until the Alqueva reservoir begins to be filled.

The REFERENCE RESERVOIRS of the Guadiana basin are:

La Serena	3.219 mcm	García Sola	554 mcm
Zújar	309 mcm	Orellana	808 mcm
Cíjara	1.505 mcm	Alange	852 mcm

Figure 2: **Flow regime in the agreement**

The idea that a strict fulfilment of the flow regime would be possible is further removed from reality, that is to say, the flow regime being in force during a short period of time, when there are some hydrological conditions or of favourable running conditions and keeping a null flow for the rest of the hydrological year. This is not possible, in the first place, because the Agreement presupposes that a sustainable use of the water is being attempted and this is not the case in this situation. Secondly because the actual 1968 Agreement already introduced the need to maintain some minimum flows in periods of low water. Finally, and no less important, is the installation of the production structure itself in the last Spanish stretches and in the border stretches, meaning that this situation of null flow, maintained for long periods, is incompatible with the profitability of the exploitations, both hydropower and agricultural. For future uses, it is supposed that the water circulation along the border stretches is going to be very similar to present ones, and will increase due to the environmental requirements that the Agreement introduces.
The inter-annual variability of the supply could be contemplated through a flow compensation mechanism for a given period of time. The difficulties of defining this are evident. For example, it cannot be forgotten that between 1991-1995 a drought situation occurred lasting for an unusual length of time, but which would have invalidated the triennial computation[290] proposed by Portugal during the negotiations. In addition to this, this type of situation could be modified if the possible effects induced by the climatic changes are considered.

Basin	Gauging Stations	Weighting
Miño	Lugo Orense Ponferrada	30 % 47 % 23 %
Douro	Salamanca (Matacán) León (Virgen del Camino) Soria (Onservatory)	33,30 % 33,30 % 33,30 %
Tagus	Cáceres Madrid (Retiro Park)	50 % 50 %
Guadiana	Talavera la Real (Air Base) Cuidad Real	80 % 20 %
The mean values are understood to be calculated in accordance with the registers of the period 1945/46 to 1996/97 and will be updated every 5 years.		

Table 2: **Indicators for the situation of exceptions.**

One adopted the focus of considering the years with abnormally low rainfall exceptional years. In this case, the fulfilment of the guaranteed flows is not required, however, this does not mean that this is really going to happen. To define these exceptional situations, objective indicators have been established, which are shown in Table 2, referring to a reference rainfall for each basin, calculated on what is produced over two or three selected rain gage stations in terms of their

[290] Which, as with any other, lacks specific physical meaning.

representativity and length of the observation period available[291]. The idea is to define a simple indicator, the accessibility of which for any interested person will be ensured beforehand such as precipitation data. The indicator does not claim to define a drought situation, only a state in which it is not feasible to ensure the guaranteed flows.

The greater irregularity that occurs from North to South means that this method may only be applied in a simple manner in Miño and Douro, while on the Tajo, it is necessary, in some cases, to consider the situation during two consecutive years. In the case of the Guadiana, more irregular, but with a greater regulation capacity both in the Spanish part and in the Portuguese part, the exceptional situation also takes into account the storage volumes in a series of six reservoirs, a piece of information that is easy to check.

The standard series obviously refers to past situations, which means a five-year revision of the reference rainfall is necessary. During this period no problems have occurred, although it has coincided with normal or slightly dry years. However, in the hydrological year 2001-2002 the Douro's indicator has not shown the existence of an abnormally dry period, although with an irregular distribution in the territory, as may be seen in Fig 3. We will have to investigate whether the chosen stations are the most suitable ones as well as whether it is necessary to extend the number of stations, without making the considered indicator more complex.

The temporary thresholds on which the declaration of exception are carried out are different for each of the basins. They take into account the climatic characteristics of each one, but also the methods of water use, which are usually linked, these being earlier in the Guadiana basin, more to the South and with a preferably agricultural vocation. In this way it is possible to make changes in the use of the water and in the management procedures without which the effects of the exception would be senseless or would be extremely tiresome. The regulation capacity of the basin and the system's operation possibilities also have an influence.

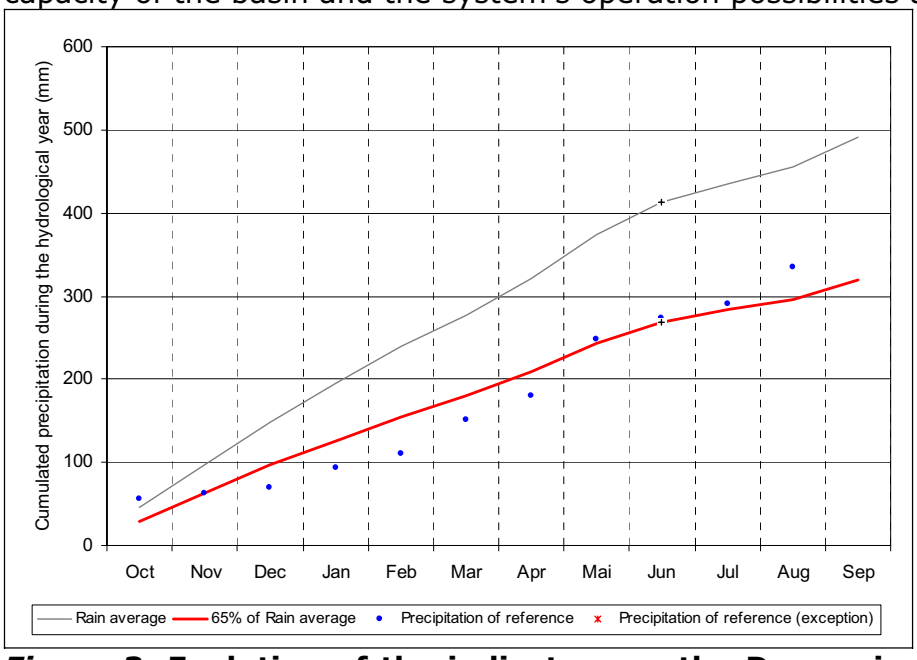

Figure 3: **Evolution of the indicators on the Douro river; hydrological year 2001 - 2002**

[291] Taking into account that the idea is not to characterise the total rainfall in the basin, but the difference between the existing situation and an average situation. This is what the indicator is attempting to define.

In any event, during an exceptional situation, sufficient flows have to fulfill urban supply as well as the irrigation of woody crops. The environmental conditions in the river, including the estuary, have to be maintained as well, although in a low rainfall period, the situation that can be catered will be lower to the one relative to average conditions. However, these requirements do not have a definite nature and as the hydrological regime evolves, the previous uses may be limited in accordance with decisions that the Commission has to take.

6. THE AGREEMENT'S MANAGEMENT ORGANS

The operativity of an international agreement on water is determined by the existence of certain institutions which exercise functions going from the control of the fulfilment of the conditions set forth in the agreement, to the management of its contents and in general, a mixture of both.

In the case of the Albufeira Agreement two organs for the development of the co-operation were formed, with parity compositions and therefore strictly bilateral. The Conference of the Parties, has a high political level while the Commission for the Development and Application of the Agreement (CADC or Commission), focusses more on a technical activities. This second instance is the reference framework for the impulse and follow up of the conventional process, but it is also its control mechanism, forming the first step for the resolving of the possible conflicts that could arise.

Except for the parity nature, no formula was specified, for the organisation of the Commission or for the profile of its members. The analysis of its undertakings, as with that of the remaining ones from the 1964 and 1968 Agreements allowed a technical and legal nature to be recorded. The number of members must be as reduced as possible to make the Commission operational, taking into account the fact that all the sectors of the administration involved must be represented in it[292]. Each national delegation is currently formed by seven delegates – a Chairman, a Vice-chairman and five directors – although this number may be modified at any time by agreement between the Parties.

The Commission, as opposed to other International Commissions, has no legal personality. It is an international agreement and therefore it may only pronounce in a corporate manner on those questions that have been agreed upon within the Commission itself while it cannot hold any other representation than that corresponding to the national Delegations that form it. It also does not carry out its agreements, which correspond to the competent national administrations. This situation can have advantages in the sense that it allows it to concentrate more on the development of its undertakings, without having the heavy bureaucratic load or the obligation to carry out actions. Its greatest disadvantage may lie in the lack of specialisation of its members on the specific questions of the bilateral relations.

One of the first tasks that the Commission carried out was the drafting of its own operating Statute since the Agreement only established a set of operational

[292] A Commission directly linked to the State Administrations of each country has been opted for. The Statute of the CADC opens up the possibility of participation of other public administrations or other social groups in its work.

regulations. This Statute follows the general operating regulations of professional organs. It should be noted that the decisions are adopted by consensus and that these are submitted to a right of review by the respective governments. The Chairmen are authorised to take urgent decisions, reporting what they have done to the Commission supposedly in the next ordinary meeting since if the subject is of a particular importance and requires an urgent corporative response, an extraordinary meeting of the Commission can be called, which may be carried out at the request of only one of the Parties.

The fundamental element on which the Commission's action is based is formed by the Work Groups. The Statute does not restrict the number of these, which must be created by the Commission itself, specifying the terms of mandate and their general composition. In principle, the members of these Groups belong to the respective public administrations, but there is nothing to prevent the presence,of people outside these administrations as technicians or advisors.

The Commission's operating practice and that of the Work Groups has shown the existence of two types of groups: some to deal with specific questions and others to cover more general topics. The latter are to do with the development of certain functions that the 1964 and 1968 Agreements granted to the International Rivers Commission (IRC), although not exclusively, and therefore with an important territorial basis that involves the incorporation of the bodies of this type to these groups although the creation, by this indirect route, of an organ for the joint management should be avoided, since it is something that the present Agreement did not set out. This type of difficulty, more obvious on the Spanish side, has meant the Work Groups of this kind have not been set up; the main task of the Statutes Work Group at present being that of finding the appropriate operating formula.

The participation of civil society in the Commission's work and in short in the development of the co-operation between Spain and Portugal in the field of water that forms the object of the Albufeira Agreement must be extensive. As a first step, the Commission's Statute sets forth the starting up of Participation Forums referring to specific topics where the Commission considers it necessary to obtain the opinion of the aforementioned civil society, a line of work that will have to be suitably explored.

The Conference of the Parties is laid out as a high level political organ on which the Agreement's development rests. Owing to this nature, no specific frequency is fixed for their meetings. One of its most important functions, although this is not exclusive, is that of forming a higher instance to resolve those questions on which it has been impossible to agree within the Commission. In this case, the meeting takes place at the request of the interested party.

The conflict solution mechanism, which is started up when all the possible negotiating lines have been exhausted, consists of a classic arbitration procedure supported in the last instance by the International Court of Justice. However, in the case that the Parties were to consider that the controversy was predominantly technical[293], they may resort to a Research Commission, appointed by common agreement.

[293] Although nothing has been declared, the Commission itself must define this nature, even when the subject is referred to the Conference of the Parts.

The Agreement is valid for seven years, which allows a certain perspective of its operation to be obtained and it is automatically extendable for triennial periods, although this may be modified by mutual agreement at any time. This possibility of amendment must be seen in the positive sense, in line with the framework nature that the Pact has, with the aim of allowing a better adaptation to the different circumstances.

7. CURRENT DEVELOPMENT

The Pact attempts to materialise the rights and duties that each part has with criteria of equity, adapting the bilateral relation to the provisions of the most recent International Environmental Law. Therefore, the Commission's main task consists of ensuring the respect of this equity, making the development of sustainable water use initiatives possible as well as adapting the new regulations to the peculiarities of the Mainland Rivers.

Since it came into being, the commission has held three plenary meetings and has started up eight Work Groups covering the most relevant aspects of the bilateral relations. One of these Groups is working on the co-ordination of measures in the area of the Directive Framework on Water. The need for this co-ordination is required by the Directive itself and it seems that the corresponding proposals affecting the transborder rivers must be carried out within the Commission itself.

Much of the Commission's work is concentrated on the adaptation of the regime of the 1964 and 1968 Agreements to the one defined by the Albufeira Agreement. We have already mentioned the authority aspects. Among the more technical aspects, some harnessed stretches have been regulated existing on the left bank of the Guadiana river in the stretch assigned to Portugal and the work to define the sustainable exploitation of the Guadiana river, along its border stretch and of the Erjas river, stretches which, due to a lack of clear hydropower interest where not assigned in the former Agreements, can be mentioned.

In any case, it should not be forgotten that we find ourselves faced with a framework Pact that in itself contains provisions that must be developed throughout its period of validity. The day-to-day work, particularly on subjects referring to water, is dynamic, with a changing future, as we have seen in the modification of the paradigms with which our management itself held less than 10 years ago. Therefore, the aim of the Commission's work must be orientated towards finding a "basket of benefits", where, in spite of the clear dissymmetry at the starting point, all the parties, including the social and environmental agents, acknowledge the benefits of mutual co-operation.

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AN IRRIGATION PROJECT IN A TRIBAL AREA, RAJASTHAN, INDIA: CONFLICTS AND COOPERATION DUE TO RESETTLEMENT AND COMPENSATION PAID TO FARMERS. A CASE STUDY

A. S. Solanki

1. INTRODUCTION

Irrigation has proved to be a technology carrier as well as a tool for improving the socioeconomic conditions of farmers. India has realized huge irrigation potential since independence. How this has been utilized, however, and whether or not it has brought real improvement in farmers' conditions, are still in question. Although the construction of dams provided a lifeline for millions of people, they disturbed the environment and the socioeconomic life of many due to the submersion of land. The state paid compensation for the value of materials lost but at rates below the market value, leading to farmers agitating against the government. The situation is worse when a project of this kind is constructed in a tribal area. The tribal peoples are a socially backward caste, and their resource base and socioeconomic conditions are very poor. Politically they are also backward. While the government has undertaken several irrigation projects to improve their socioeconomic conditions, farmers have been dissatisfied with the compensation paid to them for land lost to submersion.

The author is very grateful to the irrigation division, Som Kagder irrigation project, Udaipur, and to the Department of S.W. Engineering, Udaipur, for their kind and timely help when collecting data and preparing this paper.

2. METHODOLOGY

The present study deals with the Som Kagder irrigation project. A sample of eighty-five farmers was considered by an in-depth survey of the socioeconomic conditions of displaced farmers' families. A pre-project study was made in 1991, while a post-project study was undertaken over three years in 1997–2000 to assess the conflicts that arose, compensation paid, changing socioeconomic conditions, and other factors. A questionnaire was developed and pre-tested in the study area. The detailed study observed conflicts and cooperation with farmers, the reasons behind these attitudes, and the socioeconomic impacts of displacement and of the compensation paid.

3. RESULTS

3.1. Compensation Paid To Farmers

S.No.	Particulars	*Compensation paid to farmers**	*Approx. market sales (Rupees)***
1	Pacca house	2080	10000
2	Kachna house	1820	6800
3	Irrigated lands (in Biga)	2120	6000
4	Unirrigated lands (in Biga)	980	3000
5	Trees lost to submersion (each)	120	1800
6	Pacca walls (each)	1180	18080
7	Kachna walls (each)	790	1780

*As per project report – 1991
**As per local approximate market rates

Table 1: **Compensation paid to farmers (in Rupees)**

Table 1 reveals that farmers suffered badly in terms of compensation paid to them. For a (600 sq ft) house with a market value of Rs. 10,000 they would be paid only Rs. 2,080. Compensation for irrigated and unirrigated land was also paid at rates far below those of the local market. The farmers were deeply dissatisfied and came into conflict with irrigation officials.

3.2. Cropping Pattern

Table 2 compares the cropping situation at two points in time, before and after the project. The data shows that the area under cereals has decreased, and that cereal cash crops like rice and wheat have vanished. By contrast, the area under maize has increased from 14.02 percent to 35.62 percent.

S.No.	*Particulars*	*Before (1991)*	*After (2000)*
(I)	*Cereals*		
1	Paddy	4.00	–
2	Jawar	1.00	12.60
3	Maize	14.02	35.62
4	Wheat	24.82	–
5	Barley	10.89	1.12
	Sub total	54.69	49.34
(II)	*Pulses*		
1	Kharif pulses	2.06	10.08
2	Gram	6.82	1.86
	Sub total	8.86	11.94
(III)	*Oil seeds*		
1	Ground nut	4.02	0.82
2	Sesame	6.12	1.12
3	Rape seeds & mustard	10.62	–
	Sub total	20.76	1.94

(IV)	*Other crops*	*25.83*	*36.78*
	Total gross cropped area	**100.00**	**100.00**

Table 2: **Cropping pattern (as percentage of gross cropped area)**

The areas under kharif pulses, sesame, and groundnut have also decreased. Similarly, there is no area under rapeseed and mustard since resettlement. The farmers shifted to other crops.

These results are discouraging. All cash crops, important pulses, and oil seeds have vanished, making the farmers more dependent on kharif (rainy season) crops. The farmers have turned to traditional crops due to the non-availability of irrigation: the newly allotted land is situated in a hilly tract and is barely suitable for cultivation.

3.3. Changes in Total Household Income

Table 3 illustrates the change in total household income. The data revealed that arable farming income of Rs 18,629 reported in the "before" situation has decreased to Rs. 6,709 – almost three times less – after the project. Income from dairying was found to have increased in the "after" situation, while that from wages, salary, and other sources also increased by Rs 2,012, Rs 1,780, and Rs 3,218 respectively. The total income was reduced significantly, however, from Rs 27,791 to Rs 18,511. The farmers had become increasingly dependent on sources other than arable farming for their income.

S.No.	*Particular*	*Before (1991)*	*After (2000)*
1	Arable farming	18629	6709
2	Dairy farming	2904	4012
3	Hiring out of machinery	1016	–
4	Other farm resources (rent, net sale value, etc.)	1788	780
5	Wages	820	2012
6	Salary	622	1780
7	Other sources	1012	3218
8	**Total Income**	**26791**	**18511**

Table 3: **Changes in total household income (in Rupees)**

3.4. Cooperation and Conflict Resolution

In the year 2000–1, with the support of their own social group, NGOs, and others, the farmers were re-allotted irrigated fertile land near Sagwada Tehsil, Udaipur after eleven years of displacement. All farmers' families had been disturbed significantly and some even gave up agriculture, migrating in search of gainful employment. Altogether around 186 families were displaced, but only eighty-five families were found to have returned to the study area. Other families have moved elsewhere for gainful employment and have left agriculture.

4. CONCLUSION

The implementation of an irrigation project can serve as an economic "ladle" to improve the socioeconomic life of the people; on the other hand it can not only disturb that life but also harm the environment. Inadequate and unplanned compensation schemes for displaced people can cause serious problems. Here, in the case of the Som Kadgar irrigation project, a survey of eighty-five farmers revealed that their land use, cropping patterns, farm and family assets, and household income had all suffered after displacement. Other people and NGOs came forward and helped them gain allotments of fertile land.

Dissatisfaction with government compensation policy has led to conflict on many occasions. Compensation must be matched to market prices, and consideration of this must form a part of project planning. Displaced families must not be "left out," but instead must be treated as part of the project.

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SUSTAINABLE MANAGEMENT OF THE USANGU WETLAND AND ITS CATCHMENT (SMUWC), TANZANIA

M.J.P. Mulagwanda[294]

Paper related to Poster

ABSTRACT

Holistic Watershed management is essential in the planning and utilization of water resources. It calls for the rational use of resources that are often depended by more than one group. Because these communities frequently have different needs, undertake different social and economic activities and also because the water resource in question transcends community borders, there is no choice but to create open dialogue (co-operation) with other stakeholders or users of the same resource. Watershed management is an integrated process that addresses the economic, social and political aspects of land, water and other environmental resource usage. It aims to maintain equity and sustainability within a watershed There are a number of issues relevant for watershed management. The main ones are environmental concerns, production activities (crop, fishery, minerals and livestock), social and cultural concerns and infrastructure planning. The most important factors in the whole planning and implementation process are community involvement and accountability of those responsible for implementation at all stages, from formulation to evaluation and monitoring. This paper examines the project on Sustainable Management of the Usangu Wetlands and its Catchments (SMUWC).

1. INTRODUCTION

This project was initiated following local and national concerns about the management of water and other natural resources in the Usangu sub-Catchment of Rufiji. The chief concern was:

- Diminishing water resources which resulted in
  - Power shortage in the 1990s
  - Water conflicts among water users
  - Diminishing wetland, loss of natural resources and changes in biodiversity

The project began in 1998 and is part of Rufiji River basin study financed by the British Government. The project will be carried out in two phases.

Phase one centres on technical data collection and social aspects of management. It will lead to the drawing up of a plan for a sustainable approach in management for the wetland and its Catchments. Phase two will center on monitoring and social aspects

[294] Dar es Salaam Water ad Sewerage Authority, Tanzania.

2. GENERAL DESCRIPTION OF THE SITUATION BEFORE THE PROJECT STARTED

Before 1991, the Ministry of Water managed water resources in the basin at regional and district administrative levels. This type of management made it difficult to determine the availability of water resources and their usage in a hydrological unit. In addition, planning on the use of water was either sectorally or regionally oriented or district-based. This resulted in over-apportionment and degradation of the resources and hence conflicts among different users.

The major Watershed management issues in the Rufiji Basin are:

- Water use conflicts between different user groups especially in the Usangu area (livestock keepers, irrigators, wildlife, energy etc).
- Lack of a government agency or institution clearly responsible for co-ordination and management of environmental issues.
- Lack of clear policy and legislation on resource use and management.
- Diminishing resources and environmental degradation
- Inadequate co-ordination in the management of environmental issues.
- Inadequate policy and legislation on resources use and management.

SMUWC's main objective is the development of a strategy for the management of natural resources (including water) in integrated way in the Usangu Sub Catchments.

The main activities leading to water use conflicts in the basin are:

- Excessive use of water for irrigation both during wet and dry seasons.
- Overstocking and deforestation
- Disturbance of the ecosystem
- Poor land management plans etc.

The Principal Stakeholders in The Usangu Sub-Catchment are:

Primary stakeholders – local people, village government

Co-operate stakeholders – (Organizations and agencies in the watershed)

- Irrigated farms (Mbarali and Madibira smallholder schemes managed by NAFCO.
- Usangu Game Reserve managed by Wildlife Dept.
- Ruaha National Park Managed by TANAPA
- The Mtera/Kidatu Reservoir Hydropower System managed by TANESCO.

Administrative Stakeholders – Ward division, district and Regional governments

National Stakeholder – Agencies, which have responsibility for policy and decision making in relation to water, land etc at national or basin level.

Secondary Stakeholders – Other individuals or organizations with interest in the catchment but who are neither primary, corporate, administrative nor national stakeholders; example IMF, donor countries/agencies, the media, and non governmental organization.

3. MAJOR PROBLEMS IN THE WATERSHED AND PRIORITIZED ACTIONS

These are as following:
Rising water demand on limited water supply as a result of a failure to control demand to match it to supply

- Power interruption
- Sectoral conflicts and conflicting interests due to failure to co-ordinate water use, which is managed by different projects through unco-ordinated sectors and institutions.
- Environmental degradation – disturbance of the ecosystem
- Poor data base on the resources available in the basin
- Poor land use plans, overgrazing, deforestation etc.

4. MAIN FOCUSES OF THE PROJECT AIMED AT CONTRIBUTING TO THE IMPROVEMENT OF THE SITUATION:

- Understanding the processes and dynamics of resource use in the Catchments.
- Participatory and consultative approach for improvement of the resource management.
- Integrated planning – co-ordination with other projects with similar objectives.
- Improvement of both information and decision supporting systems
- Enhance capacity (at different levels and in different institutions) to develop an integrated natural resources management strategy.
- Technical aspects include:
  - Development of the Usangu basin model to increase understanding of the resource.
  - Flow regimes during different seasons taking into account water abstraction for various uses.
  - Assessment of utilization of land resources, biodiversity, and effects of environmental impacts on management options (including surveys of livestock, wildlife and fisheries etc.)
  - Capacity building of local people (community engagement programmes).

5. APPROACHES TAKEN IN THE PROJECT'S EARLY STAGES: PUBLICITY AND INVOLVEMENT OF THE PEOPLE

- The project commenced with surveys during two critical seasons of the year; the surveys included topography, biodiversity of the wetland during the wet season, irrigation and livestock survey during the dry seasons.
- Community engagement (though capacity building and strategic planning).
- Strategic planning

- Workshops (these included the local people, stakeholders and local communities); the workshops were also used to address specific aspects of the project.
- Co-ordination with other physical impacts on environmental management of the Catchments.

People were involved in the project as follows:

- Participatory mapping
- Demarcation of settlements, resources and boundaries with GIS
- Public meetings with village government and hamlets to establish problems and concerns of people.
- Prioritization of the problems
- Categorization of problems into:
  - Those that can be solved within the village
  - Those that can be solved within the village but with some external help
  - Solutions that depend entirely on external help.

6. MONITORING, EVALUATION AND FOLLOW-UP

- Follow-up and monitoring are an important part of the project. There remain, however, some weaknesses, particularly in the inspection mechanism.

- The system of evaluation includes: regular progress reports (Interim report), workshops, donor missions to the project area etc.

- Meetings of steering committees, which are composed of representatives from local and national government agencies, provide feedback to the project.

7. MAJOR ACHIEVEMENTS OF THE PROJECT AND OTHER INITIATIVES

- Baseline data has been established
- Level of understanding of the issues involved in the Catchments by stakeholders has been increased.
- The Usangu Game Reserve has been gazetted
- Two irrigation schemes in the pilot villages have been taken up for improvement under the RBMSIIP.
- There has been a donor mission to identify further support for irrigation.
- A proposal for land-use measures to control livestock on the plains has been put into action.

8. FINANCING OF THE ACTIVITIES AND SUSTAINABILITY

- In the Catchments, there are various tariffs charged for services, or user fees.
- There are also government and donor contributions to various projects; the donors include the World Bank, UNDP, DFID, etc.

Part of the funds collected are used for incentives for communities within the project area.

9. CONCLUSION

Watershed management is a suitable strategy for resource conservation and economic growth. If practiced, the watershed resources will be properly used and managed because the stakeholders feel a sense of ownership, hence, proper use of the resources will lead to improved social, economic and environmental welfare.

IMPLEMENTING INTERNATIONAL SECURITY AGREEMENTS – INTERACTION WITH WATER RESOURCES MANAGEMENT

WATER AND SECURITY

Gianluca Rampolla[295]

1. INTRODUCTION

Security studies recognise the interdependence between poverty and stability and much of the thinking about the concept of "environmental security" has moved beyond a presumed causal relationship between environmental stress and violent conflict to a broader notion of "human security" – a more inclusive concept focusing on the intricate sets of relationships between environment, society and security.

Among environmental factors, water resources – including their scarcity, distribution, and quality aspects – have been recognised as a potential factor that can lead to political pressures.

Since 1950, the renewable supply of water per person has decreased by 58% as the world population has swelled from 2.5 billion to 6 billion. According to the findings released at a symposium of the International Water Management Institute of Stockholm in August of 2001, nearly a third of the world's expected population will live in regions facing severe water scarcity by 2025. One billion people lack access to safe drinking water.

With the rise in population, the amounts of water withdrawn from rivers, lakes and aquifers increased at an exponential rate. The UN's Global Environmental Outlook of 2001 reported that the world water cycle seems unlikely to be able to cope with demands for water in the coming decades. Expanding agricultural, urban and industrial activities cause pollution of the sources, thereby reducing the amounts of water that can be used without substantial treatment. Also other management objectives for which water is controlled, including hydropower production, flood control and navigation, compete with the uses for which water is withdrawn from rivers and lakes.

These pressures on water resources cause competition between uses and users both within and between countries.

As Professor Aaron Wolf, Oregon State University puts it: water disputes occur when the rate of change within water basin exceeds the institutional capacities to absorbs that change.

In the world there are 261 watersheds which cross the political boundaries of two or more countries. These international basins cover 45.3% of the land surface of the earth, affect about 40% of the world's population, and account for approximately 60% of global river flow. In the OSCE region there are 104 watersheds shared by two or more countries, 14 between Canada and USA, 71 in Europe, 19 in Asia. These basins have certain characteristics that make their management especially difficult, most notable of which is that these basins require co-operation of sovereign, independent political units. Disparities between riparian

[295] OSCE; Organization for Security and Co-operation in Europe, Office of the Co-ordinator of OSCE Economic and Environmental Activities, Vienna, 27 January 2003

nations – whether in economic development, infrastructural capacity, or political orientation – add very serious complications to water resources development, institutions and management.
There are some good news. While water has been the cause of conflicts within and between countries, and raising water scarcity could make water wars more likely in the future, history tells us otherwise. Water has been a basis for co-operation more often than a cause for wars.
Riparians have shown tremendous creativity in approaching regional co-operation, often through preventive diplomacy, and the creation of "baskets of benefits" which allow for positive-sum allocations of water between various partners and different users.

2. THE ROLE OF THE ORGANIZATION FOR SECURITY AND CO-OPERATION IN EUROPE

OSCE participating states concerned by the potential instability threats posed by unsustainable water uses, yet aware of the opportunities offered by water management for building confidence and fostering greater co-operation, decided to select the sustainable use and the protection of the quality of water as topic of our 2002 Economic Forum (which is the most important yearly event in the OSCE economic and environmental dimension).

The issues discussed at the Economic Forum and its three preparatory seminars taught us a number of lessons.

2.1. Lessons learned

1. Water can in combination with other factors (such as poverty, inequality, discrimination etc) trigger disputes and ultimately conflicts. At the same time co-operation on water management can be a contributing factor in the solution of disputes.

2. Institutions (such as river basin commissions) matter and they need to be capable to absorb change, both political and environmental.

3. Water can be a catalyst for co-operation because it facilitates building technical, personal and ultimately political relations between parties.

4. Agreements on water disputes in general are not achieved as long as parties are defining their positions on "their rights". When parties in conflict departure from their historical or otherwise defined rights and begin to negotiate on the principle of their "needs" and "interests" agreements are more likely achieved.

5. Using a regional approach through technically oriented issues can facilitate the solution of bilateral political disputes. Multilateralism can offer a convenient platform for the deliberation of issues that can be resolved later within that framework bilaterally.

6. A multilateral approach can provide for common denominators, personal acquaintances and confidence building measures.

7. Last, but not least, water is to be seen in the political context of international relations. Solutions to water problems which do not take into consideration such context have limited chances of achieving sustainable results.

2.2. OSCE Activities

To follow up the recommendations made at the Economic Forum and on the basis of the lessons learned, the OCEEA in partnership with specialised organisations, identified a number of projects that aim at addressing water related security risks and at promoting dialogue and co-operation on sustainable water management. The implementation of these projects will contribute to enhancing early warning and conflict prevention mechanisms and strengthen processes of confidence building and post conflict rehabilitation.

Central Asia: some of the issues at stake include the degradation of the Aral Sea, environmental over-exploitation, problems related to water and irrigation, and water and energy.
OSCE aims at facilitating dialogue and mobilize political willingness of the governments of the countries of the region to make full use of existing management mechanisms so as to avoid mid term/ long term threats to regional stability (the institutional framework set up in CA is equitable in structure, but the enforcement mechanisms lack effectiveness because of political problems: we aim at reversing the current trend from disintegration to integration).
OCEEA is evaluating together with the five Central Asian participating States what and how they believe OCEEA could help them in their dialogue on water management and, quoting Prof. Dukhovny, "promote hydro-solidarity". At the same time, we are talking to partner organizations and trying to identify what we can jointly offer to Central Asian states according to their needs and priorities.
Currently OCEEA is working with UNECE in providing assistance to Kyrgyzstan and Kazakhstan in setting up an interstate water commission on the Chu and Talas rivers. The implementation of this project would not only contribute to an improved co-operation between Kazakhstan and Kyrgyzstan on the Rivers Chu and Talas, but would also be an example for the whole region on how improved co-operation on transboundary waters could be established and beneficial.
In February 2002 governments of Kyrgyzstan and Kazakhstan submitted a request to the UN Economic Commission for Europe and UN Economic Commission for Asia and Pacific for assistance in establishing an intergovernmental transboundary water commission, including developing the Commission statute and other actions aimed at effective implementation of the intergovernmental transboundary water agreement. The UNECE has, in Prague, asked for the active support of the OSCE in establishing such a Commission.

The implementation of this project would not only contribute to an improved co-operation between Kazakhstan and Kyrgyzstan on the Rivers Chu and Talas, but would also be an example for the whole region on how improved co-operation on transboundary waters could be established.

The project is aimed at establishing good governance in managing shared water resources between Kyrgyzstan and Kazakhstan through developing institutional arrangements, policies and procedures; and capacity building activities for effective implementation of the transboundary water agreement signed between the two countries.

Firstly, the project will provide assistance in formulating a Statute and rules/ procedures of operation of the joint commission through a series of informal meeting and fact-finding missions to the region and negotiations sessions. Meetings of the respective authorities of the Republics of Kazakhstan and Kyrgyzstan and major stakeholders in the region will be arranged with participation of UN and OSCE officials and project consultants. During the project, the Commission statutes, rules and procedures will be developed and adopted by the Parties.
Secondly, the project will promote development of policies and tools as well as capacity building of the Commission for operation and effective implementation of the agreement through field trips to meet transboundary water commissions' representatives in other regions of Europe and Asia; publication of a brochure on the Commission, and a leaflet on Internet and hard copies; training tailored to the needs of the technical experts involved in implementation of the agreement will be provided.

Thirdly, an overall economic analysis of the water resources will be conducted and policy recommendations for development of economic instruments for sustainable management of the transboundary waters will be developed; results of the study will be published as a report in English and Russian languages.

The Governments of Sweden and United Kingdom have both pledged 50,000 EUR to cover the costs of the project. The operational phase of the project will start in early 2003. A preparatory meeting among partners and experts was held in Bishkek on the 28th of November 2002.

Furthermore, in partnership with the Interstate Commission for Water Co-ordination (ICWC), which is based in Tashkent, OSCE will organize in early 2003 a one-week workshop devoted to irrigation issues. The workshop will provide a forum where governmental officials and NGO representatives from the five Central Asian states come together to focus on irrigation issues, and how irrigation practices may be enhanced in each country. Irrigation topics will be related to the wider issues of sound water management practices in Central Asia.

Funds for the implementation of the project have been pledged by the Government of Sweden

South Caucasus: within its mandate, the OCEEA is trying to use co-operation on water management as a confidence building measure.

Just to mention few of the issues at stake, there are no institutional mechanisms or legal instruments available for water management in the Kura – Araks Basin, no mechanisms for aquifers management and limited and obsolete availability of data and high levels of pollution.

To overcome gaps in unified water standards and bring about a consistent application of international standards throughout the region and to re-establish regional water-monitoring systems and databases, OSCE/OCEEA and NATO Science for Peace had decided to join forces and support the South Caucasus River Monitoring Project.

Quoting Dr. Ferenc László, a consultant to NATO, „development of a system of information exchange in water management contributes to economic and political stability, security and peace in the South Caucasus region".

The NATO – OSCE project on river monitoring in the South Caucasus has been in the planning stage for over two years. It consists of parallel monitoring of water resources (30 sites in each of the three South Caucasus countries in the Kura-Araks river system) with the objective of increasing local technical capabilities, establishing standard sampling, analysis and data management techniques and creating a database accessible by internet. The methodology includes sample and data collection preparation, training, laboratory analysis and data management and watershed management infrastructure and system development. Data will be placed on a WWW site managed by the University of New Mexico, permitting free access to all who wish it.
The project has been approved by NATO Science for Peace (SfP) programme for funding and the co-directors of the project requested the support of OSCE. NATO SfP will provide a grant of 433,000 EUR for a period of 3 years that will cover the core budget of the project. OSCE will contribute, thanks to the funds provided by the Swedish Government, 50,000 EUR for part of the supplementary costs not included in the core budget and not covered by NATO. These costs include training and salaries of scientists, which amounts to a total of 283,000 EUR for the three years. OCEEA is still fund raising to cover the remaining costs.
The operational phase of the project has started in December 2002.

Furthermore, the OSCE proposed recently in a meeting held in Tbilisi the establishment of a South Caucasus Water Management Co-ordination Group. The Water Management Co-ordination Group would be an advisory body consisting of representatives from the Governments of Armenia, Azerbaijan and Georgia, the international donor community, international organizations and implementing partners working on regional water related projects in the South Caucasus. We interpret the proposal as a process which would eventually bring from a current situation of unilateral actions, through stages of co-ordination and collaboration to, hopefully, the establishment of a regional water body.

The role and functions of the Water Management Co-ordination Group are to:

a. ensure timely and smooth flow of information on completed, ongoing and planned programmes and projects between the members of the Group;
b. facilitate the co-ordination of donor initiatives in the sector with an objective to ensure complementarity and synergy of effort and avoid duplication;
c. formulate recommendations to the respective donors agencies and/or government representatives for priority action in areas in need within the water sector.

Moldova and Ukraine: OCEEA's objective in this area is to promote, through water initiatives, transboundary co-operation and confidence-building.

OSCE is working so as to bring together all main stakeholders of Ukraine and Moldova, including Transdniestrian region, and to give them the opportunity to share knowledge and experience in field of river management and nature protection in the Dniester Basin, facilitate NGOs networking and promote civil society dialogue.

The OSCE Project Co-ordinator in Ukraine together with the Ministry of Environment and the State Committee on Water Management of Ukraine launched in March 2002 the project "Introduction and Implementation of the EU Water Framework Directive in Ukraine".

Within the framework of the project, the EU WFD was translated into Ukrainian and Russian and a comparative analysis was elaborated. Furthermore a guide book "EU Water Framework Directive and Ukraine" with general information on the EU WFD and Ukrainian legislation on water issues was published. These materials have been disseminated during two workshops in order to introduce it at the state and local level to Ukrainian authorities, public and NGOs.

The project was entirely funded by the German Government.

During the workshops representatives of Moldova expressed interest in developing a similar project. Relevant contacts between the Moldova Ministry of Environment and the office of the OSCE in Chisinau were established and possibilities of replicating such project are being discussed.

Furthermore, OSCE is trying to facilitate the discussion on the current legal status of relationships between Moldova and Ukraine on transboundary water issues and support the of final elaboration, signing and ratification of the Dniestr Convention and to bring together all main stakeholders of two countries, including Transdniestrian region (OSCE is mediating in the Transdnietstrian conflict) and to give them the opportunity to share knowledge and experience in the field of river management and nature protection in the Dniester Basin.

Lastly, the OSCE/OCEEA, UNDP and the United Nations Environment Programme (UNEP) are heading a project to promote co-operation on environmental management as a strategy for reducing insecurity in south-eastern Europe and Central Asia.

The initiative will harness the partner organizations' special strengths to identify the environmental threats to security, determine potential solutions, encourage regional co-operation and help ensure that these issues are properly integrated into national decision-making and international assistance efforts.

The project will result in thematic maps illustrating the significant environmental threats to each region and the environmental policy tools that can be employed to mitigate these threats.

Regional consultations with local stakeholders will be aimed at defining the most relevant environment and security linkages both in south-eastern Europe and Central Asia.

The maps will be presented in a report as well as on a web site. The report and its conclusions and recommendations will be presented at the 'Environment for Europe" Ministerial Meeting in Kiev and at the Eleventh OSCE Economic Forum, both in May 2003.

Funds for the implementation of the project have been so far pledged by the Dutch, Swiss and German Governments and by UNDP.

AGREEMENTS AND OPERATIONAL PRACTICES ON SHARED RIVER BASINS BETWEEN FINLAND, SWEDEN, NORWAY AND RUSSIA

Risto Lemmelä[296]

ABSTRACT

Finland is sharing fresh water resources along all its land borders, nearby 2500 km, with the neighboring countries Sweden, Norway and Russia.

Even internationally, the co-operation between these countries on the transboundary riverbasins started relatively early. Bilateral agreements and joint commissions date back to 1917, 1927 and 1971 between Finland and Sweden, to 1980 between Finland and Norway, to 1947 between Finland and the Soviet Union (this especially on the regulation of the water level of Lake Inari), and a new one on the same matter in 1959 between Finland, Norway and the Soviet Union. Later, in 1964, 1973, 1991 and 1992, Finland made agreements on waterbranch with the Soviet Union/Russia.

The main topics covered by these agreements have been the usage of the joint water resources, fishing, timber floating, water power, water level regulations, flood protection and forecasts, water pollution control, monitoring water quantity and quality, natural resources and exchange of data and information.

1. FINLAND AND SWEDEN

The border line between Finland and Sweden, about 500 km long, runs along the River Tornionjoki and its tributaries (Fig.1. The riverbasin 67). The area of the riverbasin is 40 131 sq.km, of which 63.2% is on the Swedish side and 36.1% in the Finnish side. A minor upper course, 0.7%, belongs to Norway.

The valid bilateral agreement from 1971 consists of 103 articles in 10 sections aiming to ensure the usage of waters in accordance with the interests of both countries. The agreement overrides the respective national water acts and regulates both procedures and substance. The agreement covers general provisions, the commission itself, construction works, river regulations, fishery, prevention of pollution, compensation procedures, supervising and penalty clauses. Timber floating came to an end in the border river during 1972.

The border river commission consists of three country members. One of the members must be equipped with legal knowledge, one must be a specialist in technical or natural sciences and one familiarized with local conditions. The commission is entitled to grant expert assistance and secretariat facilities.

The commission's main task is to handle permit applications of activities affecting the border river systems. The decisions of the commission are binding, in the same way as the decisions of the water courts in Finland.

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The administrative decisions of the commission are final, but on the decisions concerning property or damage compensations, appeals to these can be made to the supreme water court in the country in question.

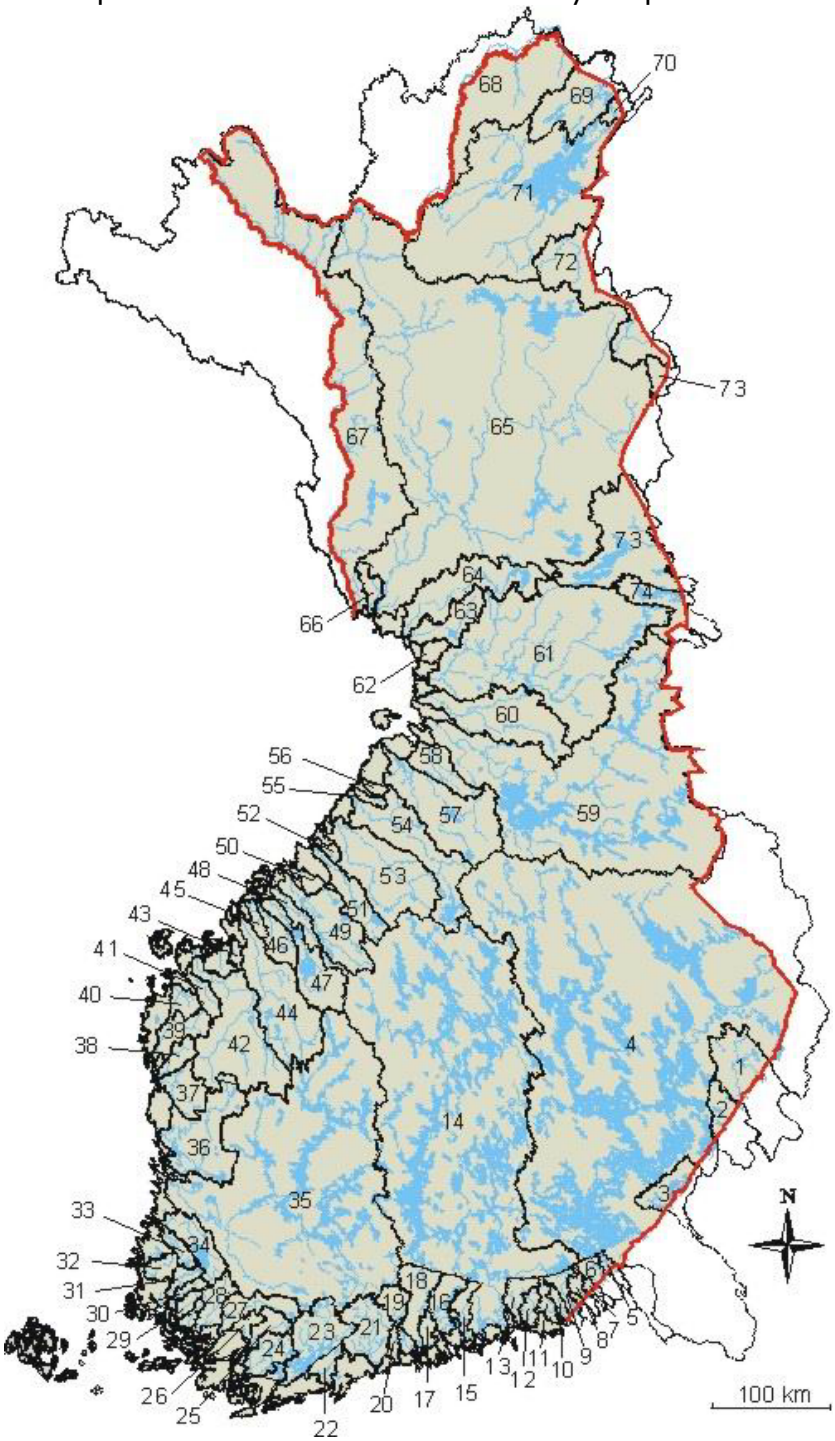

Figure 1: **The discharge basins in Finland**

There are several reasons for bringing the legislation up to date: the changes in international justice, the EU framework directive on water policy and changes in local conditions during the passed three decennia, with only limited possibility to appeal against the decisions of the commission. The new agreement should be ready in 2003 and come into force at the beginning of 2004, covering the co-operation in protection, usage and care of waters as well as in flood protection and mitigation of environmental hazards.

2. FINLAND AND NORWAY

The main river shared between Finland and Norway is the River Teno with its tributaries (Fig.1. The riverbasin 68). The surface of this riverbasin is 15 690 square km; 68% belonging to Norway and 32% to Finland. The borderline runs along the river for 235 km. With Norway, Finland shares the River Näätämönjoki, 2 962 sq.km, of which 80% on the Finnish territory and the River Uutua, 403 sq.km, of which 58% on the Finnish side (Fig.1. The basins 69 and 70).

The existing agreement between Finland and Norway dates back to the year 1980 and consists of 11 articles including the establishment of the commission on border water systems.

The aim of this agreement is to ensure that the water environment and natural conditions are sustained on the joint transboundary catchments, with the emphasis on producing joint plans on water management, monitoring the water quantity and quality, fishing, preventing water pollution, construction works, regulations of the water resources as well as all the other matters propably affecting these waters.

This commission counts three members of both countries: one of them being an expert in water administration and one with experience of the conditions of the local area. The commission is entitled to grant assistance and secretariat facilities, and the members of the commission and the secretaries have the right to pass the border for professional reasons, whenever it is deliberate.

This commission has less legal and administrative power than the Finnish-Swedish commission. For example, it can present its views in matters like water act permit procedures, but it hasn't the right to appeal.

3. FINLAND, NORWAY AND RUSSIA

A special case is the transboundary Paatsjoki riverbasin, 18 400 square km (Fig.1. The basin 71). The watershed is for the overwhelming part, 79%, situated on Finnish territory, with its main lake, Lake Inari. The outlet river from the Lake is forms on almost all of its length, or 150 km, the border between Norway and Russia before discharging into the Barents Sea.

The water level of Lake Inari is regulated by the regulation dam, situated at the Kaitakoski water power station on the Russian side of the Finnish-Russian border.

This agreement dates back to 1959, and is supervised by the delegates representing the countries who signed the agreement.

Following this agreement, Finland must report on weekly basis, in normal water conditions, on the water level of the Lake and the inflow into the Lake, and give the obligatory guidance for the discharges at the Kaitakoski power station and for the regulation dam for the coming week. During wintertime, the reports should also cover the water equivalent on the drainage basin. In high and low flow periods daily reports should be made.

4. FINLAND AND RUSSIA

On the about 1 600 km long border between Finland and Russia, almost 800 rivers and brooks run from one territory to an other. The main discharge from the Finnish side is about 900 cu.m/s and from the other side 100 cu.m/s. The most important discharge s the biggest Finnish riverbasin Vuoksi (68 500 square km of which 77% inside the Finnish borders) (Fig.1. The basin 4). The riverbasin begins in Finland, runs through the Russian territory to return into Finland. Finally, the outlet river from Lake Saimaa, (4 460 square .km), the Vuoksi River, (MQ 600 cu.m/s) discharges through the Russian territory to Lake Ladoga, (17 840 square km) and from there to the Gulf of Finland.

The need for an agreement on the frontier waters between Finland and the Soviet Union/Russia became particularly acute in late 1950s when water power utilization and water protection required urgent actions in the frontier river basins. The agreement was signed 1964 with the Soviet Union and continued 1992 with Russia. The Joint Finnish-Russian Commission on the utilization of frontier watercourses started its work in the Spring of 1966.

This agreement's main characteristic is its comprehensiveness. It covers all aspects of water management; water power, water regulations, pollution control, timber floating, fishery and drainage. Economic questions as well as scientific work, monitoring, models and research are included. In practice this means that water quality standards are defined for all the border waters There are agreements for actions to prevent pollution or degradation of these waters taking into consideration changes in water quality, harm to fish resources, threats for human health, impacts on local people and economy or scenic value. Then, if damage causing actions are allowed or stated, compensation must be paid. The agreement also states that all materials for works carried out for the commission are tax and duty free.

The Finnish-Russian Commission has members from both countries representing the administrations on water management, environmental protection, fishery, foreign ministries and frontier quards. The Committee meets once a year but it has working groups and task forces, which meet when necessary.

Unanimous decisions of the Commission bind both parties and can be considered equal to decisions made by authorities or courts in each of the countries. When the decision is not unanimous, the matter is handled by the Governments. Disputes concerning the agreement are solved by a joint body with two representatives of both of the countries.

In the Spring of 1992 separate agreements, dealing with environmental protection and on water pollution control, were signed between Finland and Russia. These programs include concrete goals for reducing polluting discharges on the areas near the frontier. At that time the city of St-Petersburg was the most remarkable single point source of pollution in the Baltic Sea area. Since 1992 a total of 47 point projects have been implemented with a total investment cost of about 28 million EUR.

Based not only on the Finnish experiences, the co-operation has been successful and good results have been achieved during the years. For example, Russia has signed or is preparing agreements with Mongolia, Kazakhstan, Ukraine, China,

Latvia, Lithuania, Estonia and Poland, based on the Finnish-Russian experience. The agreements and the work of the Commission have been adapted to other international treaties including the agreement on frontier waters of the Economic Commission for Europe, which plays a role in solving environmental problems of the frontier water courses.

5. SUMMARY

The joint frontier river co-operation has shown that a legal framework is essential. Jointly established monitoring systems and jointly implemented programs are needed to assess the amount and quality of problems. Implementation policy and management plans must be made, and local interests must be taken care of. Joint bodies may vary in composition, structure or function but mutual trust, understanding and respect are prerequisites for successful co-operation.

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ENVIRONMENT, CONFLICT AND CO-OPERATION IN CENTRAL AMERICAN INTERNATIONAL RIVER BASINS: THE CASE OF THE LEMPA RIVER BASIN

Alexander López [297]

1. THE GEOGRAPHICAL AND GEOPOLITICAL CONTEXT

The natural environments of all countries of Central America are relatively small, but extremely diverse. Central America has a remarkably heterogeneous natural endowment. There is a wide climatic variation and the region harbors 7% of the planet´s biological diversity.

The region also exhibits wide disparities in the distribution of population, the level of economic development, and access to wealth and resources. Distribution of wealth within each country is highly skewed. Despite their heterogeneity, all the countries of the region share common dynamic interrelationships between natural resources and population.

One major consequence of these general physical demographic circumstances is that in many of Central America countries the velocity of change in the natural environment is extremely rapid. The point is not so much that the region is on the threshold of running out of its vital renewable resources. Rather, it is that the unprecedented physical changes taking place across the region have major ecological side effects and may entail large future opportunity costs that could be reduced if better resources management efforts were instituted. (Leonard, 1987:p.133).

An important characteristic is that the region has a large number of international river basins. Nearly 3941 km of borders separate seven national states in Central America (Guatemala, Belice, El Salvador, Honduras, Nicaragua, Costa Rica and Panama). Broadly considered, the Central American trans-boundary territories comprise some 137.216,1 km^2, an area bigger than the size of any of the region's countries individually considered (FUNPADEM: 1999).

In this context, many tend to forget that most of the region's remaining forests and almost 40% of the protected areas of the region are located in its borderlands. Furthermore, 23 of the most important Central American river basins are shared by one or more states, comprising some 36% of all of the region's territories (FUNPADEM: 2000).

Unfortunately, these ecosystems are divided along traditional notions of security and sovereignty. This explains why the governments adopted unilateral approaches to resource management in those areas, which almost inevitably led to their militarization. This was particularly troublesome in international river basins, whose vulnerability and strategic significance could trigger serious confrontations at the bi-national and tri-national levels.

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The rapid process of environmental changes have important long-term economic implications. In terms of water resources, soil erosion from deforested watersheds and poorly managed agriculture lands have reached such a high level along most of the Pacific coast that virtually every major hydroelectric power project is expected to have diminished generating capacity and large sums of money are spent in dredging of sediments from dam reservoirs.

The problem is that virtually every major watershed of Central America is also responsible for contributing large amount of sediments to most of the fresh water streams, rivers, and lakes of the region, as well as to coastal bays and estuaries (Leonard, 1987). These sediment loads pose some of the most difficult challenges to be overcome by the governments of the region seeking to regulate and harness stream flows for agricultural development, hydroelectric power, urban consumption and other contributions to economic development.

In spite of the above problems, Central America has an enormous wealth of surface and underground water resources due to its geographical position. Currently, the region has the Central American Action Plan for Integrated Development of Water Resources (PACADIRH), whose main objectives are to take care of the potential of Central America´s wealth of water as well as to urge solutions for problems concerning watershed. The plan proposes actions for the conservation and sustainable management of water and joint work in shared or transboundary watersheds (CCAD, 2000).

To these problems must be added Central America's high vulnerability. The devastating impact and aftermath of recent atmospheric phenomena (hurricane Mitch, El Niño and La Niña) have revealed the region´s severe environmental deterioration, which has significantly lowered its capacity to drain off extraordinary volumes of water.

2. ENVIRONMENTAL CONFLICTS IN CENTRAL AMERICA: A REAL THREAT?

The threat of environmentally induced violence along Central American borders is not theoretical, however. The so-called "Soccer War" between Honduras and El Salvador in 1969, had an environmental origin. Currently, both countries continue to have unresolved disputes over the degradation of the Lempa river basin. Such is also the case of the San Juan river between Costa Rica and Nicaragua, whose waters are being contaminated by agricultural and mining waste and erosion from Costa Rica.

Environmental problems in Central America are not limited to inter-state relations. Many arise from and affect subregional and local contexts. There are numerous complaints from border communities that have had to endure the negative effects of ill-conceived waste disposal practices, the contamination of their water sources and the impact of floods, hurricanes and other natural disasters in highly deteriorated contexts.

Reasons for conflict in Central America are varied, but two of them are important: the use of strength to impose or oppose control in unifying projects and territorial

quarrels among the states. Some other topics have been added to this traditional agenda: the strained relations that are produced by the massive movements of population among countries and the definitions of maritime borders. Environment could be an issue soon, suggesting that in the short term we may observe a rise in the environmental conflicts.

This environmental conflict could occur in Central America due to two factors. Firsty, this is a region of strong environmental interactions and interdependencies, which forces each state to pay for the cost of environmental deterioration. Secondly, the alarming levels of environmental degradation in the region are very well known. These degradation levels are key to economic loss and increasing vulnerability of the inhabitants.

3. ENVIRONMENT AND CONFLICT IN CENTRAL AMERICAN INTERNATIONAL RIVER BASINS

There are approximately 120 main river basins in Central America, 23 are international. These international river basins represent 19% of the hydrographic systems in the region and 10.7% of the international basins worldwide. The existence of such a large number of international basins and the environmental damage they go through, highlight the importance of addressing transboundary water issues urgently in the Central American region. It is necessary to start a sustainable use of the international basins to avoid negative consequences leading to changes in soil use affecting the land and generating conflicts among neighboring countries.

The potential for conflict over water resources in Central America's international river basins is predicted to be high, given its fundamental importance for basic survival, industry, agriculture and energy production. However, the emergence of violent conflicts at interstate level due to water disputes in this region seems to be unlikely even in the more critical scenario. Interestingly enough, our preliminary findings indicate that the existence of conflicts and the potential development of new ones are to be found at sub-national level; for instance, the conflicts in the Papaturro river which is a tributary of the San Juan river. In addition, research in the region has demonstrated that riparian countries face common challenges such as water and food production, energy use and agricultural use, water pricing and distribution, waste water treatment and reuse, etc.

4. THE LEMPA RIVER BASIN AS CASE STUDY

The Lempa river basin encompasses an area of about 18 246 square km and is divided by the international boundaries of Guatemala, Honduras and El Salvador. The Lempa River Basin, object of an intense and long human occupation, shows very severe levels of environmental deterioration. As a matter of fact, experts agree that it is the most environmentally damaged of the main international river basins of Central America.

To understand the potential of environmental conflict, we must analyze three main issues: the level of environmental deterioration, the level of foreign causation of pollution and, the level of dependence of populations and the riparian states on transboundary waters.

Concerning environmental deterioration, the Lempa River Basin shows one of the main ingredients of environmental conflict. 53,1% of the land in the basin area is used beyond its land use capacity. This situation, and the general mismanagement of soils, triggers erosion processes leading to an increased sedimentation of the river basin. Almost half of these sediments (48%), come from Honduran territory, meanwhile sediments produced in El Salvador reach 39% and those produced in Guatemala, 13% (HARZA. 1999).

Foreign causation can be considered another element promoting environmental conflict. The risk of environmental conflict is higher when there is certainty that environmental degradation comes across the border from a neighboring country. In the river basin, however, is a prevailing low level of foreign causation. There is a low chance that one of the States in the river basin could transfer the responsibility for its environmental problems to the other countries. This situation can be explained by the diversity of sources of environmental deterioration in the area, and by the geography of El Salvador, which, located in the lower basin, is responsible for most of the environmental deterioration in the area.

However, problems like the Honduran production of sediments, which is the highest in the area, have a high potential for generating conflicts, if it is considered that an excess of sediment load in El Salvador dams could impair its power generation, and that this country satisfies most of its energy supply with the energy generated in the Lempa's dam system.

The third issue is dependence. Out of the three countries involved, the one showing the highest degree of dependence is El Salvador. Such high level of deterioration is reinforced by several aspects in a negative sense. Undoubtably, the main factor of conflict is observed in the great dependency that a country –El Salvador— has on the Lempa river and its basin in general. There is not one single country in the region that depends on a river as much as El Salvador does on the Lempa river.

For example, the Salvadorian basin area:

- counts 48% of the population as well as some of the main cities, including the capital, San Salvador.
- comprises 49% of the territory of the country. Unlike Honduras, where only 4.9% of the territory is at the basin and Guatemala where 2.3% is.
- counts for 85% of the economically active Salvadorian population, which generates a similar Gross Domestic Product amount. For Guatemala and Honduras, those percentages are only 9.7% and 5.3% respectively.

At the basin there are four dams that generate 37% of the energy used by the country. A high proportion of this water is destined for industrial and domestic use. 49 million of cubic meters of water were drawn to supply the Metropolitan Area of San Salvador; which is 1/3 of the demand. (AID/CCAD/CATIE: 2001: 72).

Finally it is important to remember that the Lempa flows into the Pacific coast and, as a consequence, it affects the coastal and fishing resources of the country. El Salvador's coast line is 307 kilometers long (184.2 miles) and the territorial sea is 88,026 square kilometers (33,978 square miles). (AID/CCAD/CATIE: 2001: 23).

El Salvador has the lowest endowment of natural water in Central America and it is entirely located in the "Drought Arch". During six to seven months per year there is shortage in the Lempa river basin. As a consequence the soil does not have a normal development for farming, and therefore, irrigation is necessary. (AID/CCAD/CATIE: 2001: 17).

The predominant situation of the Lempa River Basin might lead one to expect a high potential for transborder environmental conflict. The Lempa might be the Central American river basin with the highest level of environmental deterioration. El Salvador, located in the lower riverbasin, depends strongly on the existing resources and suffers from the environmental mismanagement taking place in the Honduran and Guatemalan catchment's areas. However, it is critical to note that the high conflict potential is attenuated because El Salvador, being the country that contributes most to the environmental deterioration of the river basin, cannot protest for the overall environmental crisis because of its own contributions.

In conclusion, we are facing two scenarios in which environmental conflict could be increased in this river basin. If environmental degradation persists, becoming a major threat against hydroelectric power generation and water sources for El Salvador, in which situation, very possibly, this country will demand from its neighbors.

Another possible scenario could arise, if one of these countries sharing the basin, implements actions towards environmental restoration. This is a very important issue considering that actions leading to the river basin restoration could substantially increase the conflict potential. For example, if El Salvador starts investing large amounts of resources in water and solid waste management, it will probably ask the other two countries to take similar actions.

5. CHALLENGES FOR ENVIRONMENTAL CO-OPERATION IN CENTRAL AMERICAN INTERNATIONAL RIVER BASINS

It is widely recognized that water problems shouldn't necessarily lead to conflict, but instead can be solved co-operatively. This includes promoting the use of co-operative international agreements on shared water resources since they have played an important role in establishing peace and environmental co-operation.

Research conducted seems to confirm that in order to foster co-operation in the region it is necessary to focus more on the qualitative side of the water issue. The quantity of water has brought many riparian states into disputes. The quantitative issue amounts to a zero-sum game; what country X gets, is denied to country Y. Better water quality is something all may gain from, and qualitative control is comparatively easy to achieve. Such focus creates an important space for negotiation in Central America due to the fact that problems in the region's international river basins are basically related to quality and not as much to quantity, with the exception of the Lempa River, and the dependency of El Salvador on this basin. Regional integration mechanisms seem to be a very promising opportunity in this regard.

It is clear that a broad range of stakeholders should be brought into the political process of designing environmental solutions at the various levels for the river basins: domestic (indigenous communities, local and provincial public and private actors) and transnational (riparian, regional and international governmental and non-governmental actors).

We have learned that it is possible to foster co-operation even while points of disagreement remain. However, the strongest conflicts of interests are taking place in the San Juan and Lempa rivers, while the case of the Lempa River shows there is an enormous space for co-operation. Win-win projects such as the ones being developed in the Lempa river can help to build confidence and a mutual language so as to support solutions to the long term-points of contention.

Finally, it is important to point out that the political interests of the basin countries are important in deciding if countries head towards co-operation or not. However, even more crucial is the fact that Central American governments are starting to look at international river basins as elements to promote regional integration in border areas instead of being perceived as mere natural borders.

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ROMANIA'S EXPERIENCE IN IMPLEMENTING WATER AGREEMENTS

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1. INTRODUCTION

Water is an essential element both for life existence and for social and economic development of the humanity. The water existence and its abundance has determined the world economic and social geography, with the watercourses being assimilated as real routes for the development human beings. At the global level, the freshwater resources availability varies widely according to the geographical position, the natural conditions and with the human activities.

Among the major courses providing water supply is Danube River. With a river basin, which covers surfaces located on the 15 countries' territory, it is the most shared watercourse in the world. Running in Europe from west to east, the Danube is gathering its waters upon a surface exceeding 817,000 square Km and discharge them into the Black Sea through the Danube Delta.

This situation calls for a change in the approach of the development of the Black Sea and Danube River region, not only to reach a short term development but to provide the future generations the possibilities to enjoy and to benefit this gift of the nature. This perspective should be the base and the objective of the integrated water management in this region.

The water of the Black Sea and the Danube River represents both an important aquatic ecosystem and a source for social and economic development. The water is being used for a great number of activities, from navigation and water supply to hydropower and recreation. In order to serve such a wide variety of human activities and needs, a large number of dams, dykes, locks and other waterworks have been built, including 40 major reservoirs, which are located on the main stream of the river.

Intensive agriculture (having the soil only as support base), aggressive industrialization and urbanization have had and still have a significant impact on the water quality and implicitly on the biodiversity and the degree of meeting water supply needs.

The Danube River basin management, as part of Black Sea basin, must have sustainable development as a strategic objective. This objective cannot be achieved without an active co-operation between the countries, which should allow the correlation of the actions undertaken both at the European and regional level.

This objective was the main target of the bilateral and regional water Conventions signed by Romania. As a result are the establishment of the Commissions in charge with the implementation of the provisions of Conventions.

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2. THE BILATERAL COMMISSIONS FOR THE IMPLEMENTATION OF THE PROVISIONS OF BILATERAL AGREEMENTS IN THE FIELD OF WATER MANAGEMENT

1. The Commission for the appliance of the provisions of the Agreement between the Governments of Romania and the Federal Republic of Yugoslavia concerning the hydro-technical problems on the hydro-technical systems and watercourses located on the border or crossed by the border –Bucharest 1955 (former convention was signed in 1930)
2. The Commission for the appliance of the provisions of the Convention between the Governments of Romania and the Republic of Hungary for the regulation of the hydro-technical problems concerning the waters which form the border or are crossed by the border – Bucharest 1986 (former Conventions were signed in 1924, 1950, 1962, 1969; a new Convention is under discussion between the two countries)
3. The Commission for the appliance of the provisions of the Convention between the Governments of Romania and Ukraine concerning the co-operation in the field of water management –Galati 1997 (former convention was the Convention between Romania and former USSR concerning the collaboration on the field of transboundary water management – Moscow 1996).
Chairmen of the Commissions are the respective Government of the countries while the members of the Commissions are experts of both neighbouring countries.

2.1. The Activities In The Framework Of The Bilateral Water Commission

Systematic and operative information sending – between the water bodies of the riparian countries - concerning the meteorological and hydrologic phenomena and accidental water pollution;
collaboration for the prevention and protection against the harmful impacts to the water (flood, icy phenomena and accidental pollution);
systematic analyses of the main water quality parameters;
solving issues related to sustainable water management, elaboration of hydrological studies, exchange of experience concerning the EU directives related to water, elaboration of different Regulations;
permitting activity related to all hydro technical works built in the neighbourhood of the border, witch can have negative impact on the water flow in the border section.

2.2. The Importance Of The Co-Operation In The Bilateral Water Commission

Avoiding and solving transboundary conflicts related to water issues;
good knowledge of the water management systems of the riparian countries as basis for harmonization of national development and measures;
increasing the lead time available for preparation in case of flood or accidental pollution;
contribution to reduce the pollution loads of the Danube River from tributary rivers;
identify and develop commune interest studies/projects in the field of water management.

3. REGIONAL COMMISSIONS FOR THE IMPLEMENTATION OF THE PROVISIONS OF REGIONAL AGREEMENTS IN THE FIELD OF WATER MANAGEMENT

I. Tisa River Forum on Flood Control for the implementation of the provisions of the "Budapest Declaration"

signed by the ministers in charge with water management of Romania, Hungary, Ukraine, Slovakia and Federal Republic of Yugoslavia (Tisa River is one of the most important tributary of the Danube) on may, 2001.
The Tisa Forum consists of the heads of government bodies responsible for water management and the national co-ordinators of the professional activities under the Forum. Meetings are held every year, as required, on the territory of the presiding country

3.1. The Activities In The Framework Of The Tisa Forum

- Elaboration of the "Tisa River basin flood control concept" aiming to co-ordinate flood control co-operation in Tisa River Basin;
- co-ordination of the current issues of the national control policies, regular exchange of information;
- harmonization of national flood control developments and measures;
- identification of common flood control and flood emergency measures;
- involvement of third partners (international professional organizations, financial institutions) in the implementation of the tasks of the Forum.

3.2. Importance And Expected Results Of The Co-Operation In The Tisa Forum

- Avoiding and solving regional conflicts related to water issues (related to flood protection);
- common evaluation of the situation of the flood control at regional level (Tisa River Basin);
- co-ordination of the actions aimed at increasing the lead time available for preparations;
- co-ordination of the emergency measures at basin/region level;
- determination of the potential flood control improvement measures;
- identification and development of bi- and multilateral programs and projects;
- to undertake joint efforts to identify and involve, in addition to their own resources international support and sources of funding (EU, EBRD, World Bank, and other financial institutions).

All the Romanian rivers are tributaries and discharge to the Danube. As a result, the co-operation with the Danube countries is very important for Romania, because Romania in the Danube basin represents:
1. The largest surface and population within the basin
2. The longest section from the Danube length – 1076 Km out of 2857 Km - on the Romanian territory
3. Danube River discharge into the Black Sea through the Danube Delta- the second largest wetland in Europe, located in Romania.

In this terms, Romania is very active within the:

II. *International Commission for the Protection of Danube River (ICPDR) of Wine*

- responsible for the implementation of the Convention on co-operation for the protection and sustainable use of the Danube River was agreed in Sofia on 1994.
- ICPDR has a permanent Secretariat
- This Convention takes over activities under the Environmental Program for the Danube River Basin that was a PHARE program, including its expert bodies:
- Monitoring, Laboratories and Information management expert Group (MLIM) (Head at this expert group is a Romanian expert)
- Emission Expert group (this group was set up for Convention activities, but before coming into force)(EMIS)
- Danube Accident Emergency Warning System Expert Group (AEWS) (Head at this expert group is a Romanian expert)
- River Basin Management (RBM)
- Ecological Ad-Hoc Expert Group.

3.3. The Activities In The Framework Of ICPDR

Implementation of the Water Framework Directive of the EU;
improvement of technical and management capacities for the implementation of following programs:
*Pollution Reduction Program
*Strengthening of Implementation Capacities for Nutrient Reduction and Transboundary Co-operation.
maintaining and improvement of the current environment and water quality conditions of the Danube River and of the waters in its catchment area;
prevention and reduction of adverse impacts and changes.

3.4. Importance And Results Of Co-Operation Under ICPDR

Avoiding and solving problems related to water issues in the Danube basin;
achievement of sustainable and equitable water management, including conservation, improvement and the rational use of surface waters and groundwaters in the Danube Basin;
providing immediate information about sudden changes in water characteristic, with special attention to transboundary impacts;
development of a Satellite-based communication network to ensure fast and reliable international information exchange between the co-operating countries;
conservation, improvement and the rational use of surface and groundwaters in the catchment area;
control of the hazards originating from accidents involving substances hazardous to water, floods and ice-hazards;
establishment of complementary and joint programs within the scientific or technical field.
to reduce the pollution loads in the Black Sea from sources in the catchment area.

The following activities and measures fall under the scope of the Convention, as far as they cause or are likely to cause transboundary impacts:

The discharge of waste waters, the inputs of nutrients and hazardous substances both from point and non-point sources as well as heat discharge;
planned activities and measures in the field of water construction, in particular regulation as well as run-off and storage level control of water courses, flood control and ice hazard abatement;
other planned activities and measures for the purposes of water use, such as water power utilization, water transfer and withdrawal;
the operation of the existing hydro-technical constructions,
the handling of substances hazardous to water and the precautionary prevention of accidents.

The Danube "ecological heart of Europe" represents a resource, a life environment but also a transport vector from the spring to discharge of "all our sins" bigger or smaller, materialized in a single laconic word "pollution".
The base principle of the co-operation on the essential water management problems should be to undertake all technical quality conditions of the Danube River waters and of the whole basin, because the Danube reaches the Black Sea through Danube Delta. It is obvious that the works and measures carried out in Danube basin have a major impact on the Black Sea marine environment quality, a situation that calls for an active co-operation between Danube and Black Sea countries.

In this means was established the:

III. *Istanbul Commission for appliance of the provision of the Convention for the protection of the Black Sea against pollution*,

signed in 1992 in Bucharest, which represent the framework for the co-operation of the Black Sea riparian states

3.5. The Activities In The Framework Of The Istanbul Commission

- Implementation of the measures to prevent pollution of the marine environment by the substances and matters specified in the Convention (heavy metals, persistent substances and radioactive substances);
- prevention, reduction and control of the pollution from land-based sources and vessels;
- co-operation to combat pollution in emergency situations;
- prevention, reduction and control of the pollution by dumping;
- prevention, reduction and control of the pollution from activities on the continental shelf such as exploitation of natural resources and atmospheric sources;
- measures for the protection of the marine living resources;
- prevention of the pollution due to the transport of hazardous waste;
- co-operation in scientific research;
- complementary or joint monitoring programs.

3.6. Importance And Expected Results Of The Co-Operation Under The Istanbul Commission

- Solving problems between riparian countries related to Black Sea protection issues;
- integrate to a large extent the sustainable development principles by achieving some activities concerning biodiversity and sea water quality;
- integrated coastal zone management;
- development of a system for intervention in case of accidental pollution
- development and implementation of the "Program concerning Black Sea water quality and biodiversity conservation" signed by all riparian countries and financed by Global Environment Facility (GEF).

The measures of this program will have to take into account the social and economic changes occurred in the last 40 years and should create the conditions for a viable reconstruction of the natural environment. This program will impose a reconsideration of the existing development strategies and will involve a careful review of the cost-benefit ration both for economic and social aspects and ecological rehabilitation, because, whatever is our whishes, the "restoration" is only in a very small extent possible.
For the achievement of this aim are important financial resources necessary, which are at present not available. Therefore great importance will be placed on the international assistance programs. At the same time, we consider that the future assistance programs, which will be launched in the Danube River Basin and Black Sea region, will have to include also a practical part to demonstrate the way of solving a certain problem.
The framework of these two last conventions, supplemented with other agreements at which each country is Part, could and is necessary to determine the agreement and achievement of a realistic program intended to assure a significant improvement for the waters belonging to the Danube River Basin and Black Sea region.
In order to achieve a sound environment in the Black Sea and Danube River Basin, the work within the Commissions has to be based on an efficient, clear and honest communication, without any other hidden interests, the only interest being the promotion, in partnership, of the "sustainable development" principle. Therefore, the communication is of essential importance for the achievement of a sustainable future.
We consider that the future work in the joint Commissions must be focused on solutions and not on problems. Many of technical solutions for the "environment crises" are available but the challenge is to put them in practice.
We change the legislation and methodologies, elaborate programs and projects, find out and make inventory for the problems and fall into the sin to forget that "useful experiences" are a powerful motivation for the change and improvement of the water quality and the environment.
The improvement of the Black Sea and Danube waters quality, and the achievement of the "good ecological status" will lead to a clean environment both for human beings and the living creatures of the ecosystem.
The technical problems are in the most cases simple ones, however the difficulty is to reach an agreement concerning the priority and, especially, the successfull implementation of the financing programs. We consider that, in this field, "partnerships" in the framework of water Commissions can and must have an essential role.

Taking into account the complexity of the problems generated by the necessity to rehabilitate the aquatic environment in the Black Sea and Danube River Basin and the achievement of the sustainable development for the countries from this region, an integrated approach at regionlevel, based on the implementation of the provisions of the existing conventions of the countries in the region, is necessary.
In this respect, we consider the recently adopted Water Framework Directive of the EU most important instrument to achieve this objective.
The Water Framework Directive covers all the necessary measures to reach the "sustainable development" objective in the European part of the Danube River, including basin ecological aspects and, at the same time, giving the possibility for a better cohabitation between peoples and environment, impartially and advantageous for both parties.
It is well known that the European environment, under the influence of the human activities has been and is continuously in change. A part of these activities has had and still have social and economic development models damaging or neglecting the environment. Their impact has endangered both the environment and the possibilities of economic and social activities support and development, which lead to important damages for the public health, living standards and human development in general.
Having in view this situation, reconciliation between the need of further social and economic development and water quality and quantity protection is essential and is the only way for an increase in water quality. In this respect, the promotion of the sustainable development in our region is necessary in which the development process should integrate economic growth, life quality improvement, healthcare, education, social development and a natural environment "at least good".
Is not difficult to conclude that sustainable water management in the interest of local and regional development is a factor of stability. There is a real shared interest for the different uses of a river/water, even a transnational one, but the users are usually better off with concerted management rather than with a conflict on.

THE BATTLE OF WATER-"To–Who"

Keith W. Hipel and Amer Obeidi[299]

ABSTRACT

The overriding objectives of this research are to clearly identify the ubiquitous conflict taking place at the local, national and global levels between the basic values underlying trading agreements and those principles providing the foundations for environmental stewardship, especially with respect to water, and to suggest solutions as to how this most basic of disputes can be responsibly resolved. To begin with, this research exposes the fundamental driving forces contained in current international trading agreements, such as those coming under the World Trade Organization (WTO) and the North American Free Trade Agreement (NAFTA), so one can see the powerful engine of bottom-line economics and intense competition that propels these very influential vehicles of trade. These market-driven values are in direct conflict with those of environmental stewardship of our water and other natural resources as well as social welfare concerns. Therefore, this global clash of values is systematically studied as a game in which the principles of the Global Market-Driven Economy (GMDE) are in confrontation with those of a Sustainable Ecosystem (SES) philosophy. A strategic analysis using the Graph Model for Conflict Resolution reveals that the environment and social standards will continue to deteriorate if the value system of GMDE and associated trade agreements are not appropriately reformed. One way to accomplish this is for SES proponents to carry out extensive educational and lobbying programs to educate the general public and GMDE supporters regarding the ethics and economic benefits of practicing sustainable development.

1. TRADE AND THE ENVIRONMENT

Because the earth's natural resources are finite and depleting steeply, they should be utilized and managed with great care and wisdom. We are, however, squandering our natural capital as we continuously exploit the ecosystem with our greed for power and consumption, rather than living sustainably on the interest. The tragedy is that we are shortening the lives of all species, including ours. Economic disparity between rich and poor is widening, and the extinction of ecosystems is rampant. Wilson (2002, pp. 149) morally reflects on that by saying, *Mortal humans are also handicapped by our separation from Earth, but our impairment is self-administered, and it has a twist: our exertions also weaken Earth.* He argues that an environmental ethics exists in people which are compatible with religious beliefs (Wilson, 2002).

All Abrahamic religions, Judaism, Christianity, and Islam, have explicit commandments that support that argument. Judaism sees nature as an instrument of God and not revering nature is considered a transgression. The Halakhah, for instance, prohibits the interference with water sources. Christianity regards nature to belong to all species: *And God said, "Let the water teem with living creatures, and let birds fly above the earth across the expanse of the sky*" in Genesis 1:20. Finally, in Islam, the ecosystem is God's creation, and therefore human beings

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should share its use and conserve it. The Prophet of Islam states that: *people are partners in tree, water, vegetation, and fire.* These discourses have been tautologically reverberated by many philosophers and environmentalists including Wilson (2002, pp. 165) and Barlow and Clarke (2002, pp. 221), to mention a few.

The current foreign policy of the United States is to provide foreign aid only to countries which adopt democracy and market economics. Although the vast majority of people are in favor of countries being controlled by their citizens through democratic elections, deliberately forcing an economic system on democratic or non-democratic countries is simply not democratic. The marketplace, for example, can produce good quality products at low cost when true competition exists but, as demonstrated by the collapse of Enron, an international service company, the marketplace may not be an appropriate mechanism for delivering certain types of public services, including water supply and maintaining public infrastructure. In the United Kingdom, for instance, the privatization of public services such as water supply and treatment, and the train system, has resulted in British citizens drinking the poorest quality water in Western Europe and having a dangerous railway system that functions ineffectively. As McMurtry (1998, pp.10) convincingly states: *If a value system* [such as market economics] *is simply presupposed and obeyed as the given structure of the world that all are made to accept and serve, it can become systematically destructive without knowing there is a moral choice involved*.

International trade rules are embodied in several complex agreements. In 1947, the General Agreement on Tariffs and Trade (GATT), was initially drafted and subsequently amended by several agreements. GATT was created as part of the post-war Bretton Woods Agreements that also established the World Bank and the International Monetary Fund. With the conclusion of the Uruguay Round of negotiations, started in 1986, the World Trade Organization (WTO) was established on January 1, 1995. Concurrent to the Uruguay Round of negotiations, Canada, the United States of Mexico, and the United States of America were negotiating the North America Free Trade Agreement (NAFTA), which officially became operative on January 1, 1994.

International trade rules, such as those embedded within WTO agreements and NAFTA, have influenced or superceded a growing range of public policies and laws implemented by elected governments. In fact, by signing international trade agreements, governments have made themselves and the citizens who elected them subservient to transnational corporations and foreign investors (Hart and Dymond, 2002) and hindered their ability to achieve national objectives (Stumberg, 2001). Through intense lobbying efforts by transnational corporations and other opponents of international marketplace economics, governments have been coerced into adopting rules and procedures that do not hamper the transboundary flow and control of goods and services. Unfortunately, this shortsighted surrender of sovereignty has not been accompanied by improved standards of living for the vast majority of citizens and national social programs and the environment have been adversely affected (McMurtry, 1998).

Well-documented cases confirm the severe negative impacts that international trade agreements such as GATT, WTO stipulations, and NAFTA can have upon the environment. Because these trade agreements prioritize profits of corporations, bottom-line economics and protection of foreign investors, it is not at all surprising

that they directly challenge national social and environmental policies, laws and regulations, and thereby cause social hardship and environmental devastation. For example, in September 1991, a GATT dispute panel ruled that an embargo against Mexican tuna imposed under the US Marine Mammal Protection Act (MMPA) violated the GATT agreement. MMPA was trying to eliminate and protect the *incidental* killing of Dolphins brought about by tuna fishing. Although Articles XX (b) and (g) of GATT, and WTO (General Exceptions), provide exclusive instruments for countries to pursue environmental measures that may otherwise contradict trade rules, the panelists circumscribed those Articles precluding such measures from reaching beyond a country's borders (French, 1999; Shrybman, 2001). In the dispute known as the Beef and Hormones case, the WTO tribunal challenged the European Community food safety and health measures banning the import of beef treated by hormones from Canada and the USA. Many cases have been filed under Chapter 11 of NAFTA that are related to the environment: Sun Belt versus Canada, which is about bulk water removal and export, yet to be decided; Methanex versus the United States where the Canadian Methanex Corporation is suing the U.S. for $970 million over a California ban on MTBE, a gasoline additive. In 1995 Canada imposed a ban on exports of PCBs in order to comply with the Basel Convention––a United Nations convention that directs every country to deal with its own hazardous waste instead of shipping it to another country for treatment. S.D. Myers Inc., an American company, sued Canada on the grounds that it had been economically harmed by the Canadian ban and won its case before a NAFTA tribunal. In 1997, the US chemical giant, Ethyl Corporation, used NAFTA to sue the Canadian government. Canada had imposed a ban on MMT, a manganese-based gasoline additive. The Canadian government lifted the ban on MMT, and paid Ethyl Corporation $13 million in US dollars. Cases like those just cited, as well as many others, confirm McMurty's (1998) allegation that WTO stipulations and similar agreements are fundamentally unethical.

2. CONCEPTUALIZING THE CONFLICT: A CLASH OF VALUES

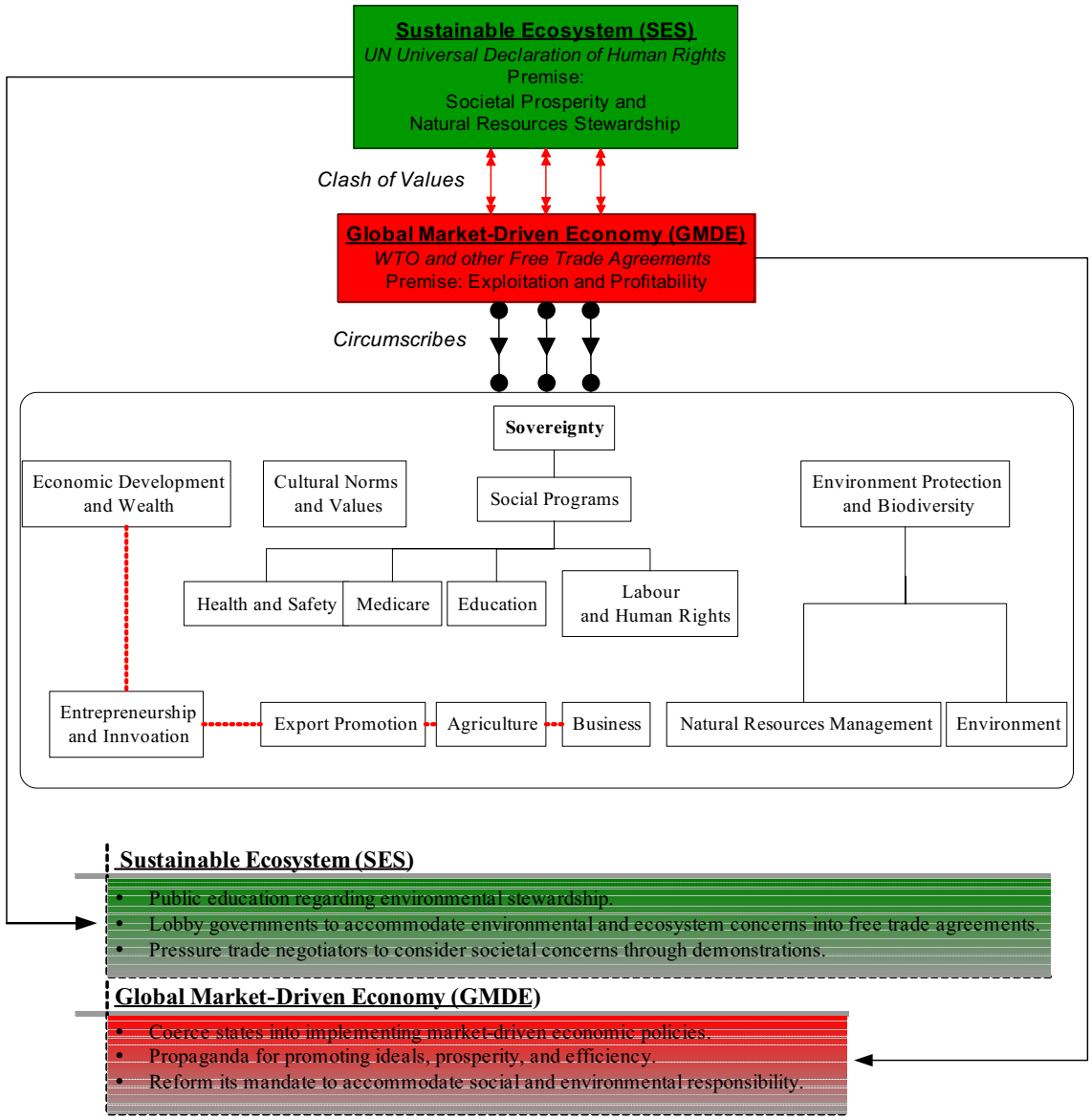
A protracted dissension is growing between those who support the removal of trade in goods and service barriers among nations and those who do not. The first group is proponents of economic globalization through international free trade agreements like the WTO and NAFTA, and which uphold the principles of the market-driven economy. This group claims that trade liberalization has produced many benefits internationally. Emphasizing the goodness of its value system, this group claims that internationalization and free trade are the only course to a healthy global economy and prosperity. With respect to the effects of a global marketplace on the environment and ecosystems, it adds that: *trade liberalization can have a positive impact on the environment by improving the efficient allocation of resources, promoting economic growth, and generating revenues that can be utilized for environmental improvement* (DFAIT, 2002).

As illustrated in Figure 1, the values of the global market-driven economy (GMDE) are proliferating through societies by circumscribing their sovereignty on key issues, which include economic development, culture, social programs and ecosystem stewardship. Hart and Dymond (2002) argue that Chapter 11 of NAFTA threatens national sovereignty, stating that *it is not a shortcoming but a goal of Chapter 11*. This value system is realized by considering efficiency of resource

allocation and production, rise in market share, increase of wealth, and increased returns on investments. Its main premise is exploitation and profitability. No consideration is given to *environmental ethics* (Wilson, 2002), and to biodiversity and sustainability of our ecosystem. Therefore, a clash has emerged between these principles and the value system of a sustainable ecosystem. Everything has an economic value and all life supporting systems are treated as a need rather than a right (Barlow and Clarke, 2002). At the second World Water Forum in the Hague held in March 2000, the CEO panel on business and industry, Chief Executive Officers of a number of transnational corporations that have interest in the commercialization of water, issued a joint statement to the ministerial conference declaring *Water is an economic good and its economic value should be recognized in the allocation of scarce water resources to competing uses* (World Word Forum, 2000).

The second group represents environmentalists, socialists, and human rights advocates. Their stance is that economic growth and environmental protection and biodiversity should be concomitantly considered, and governments' sovereignty should not be appropriated to transnational companies by extending rights to private access beyond those rights of their own citizens. They are not against economic growth as a means of creating wealth and well-being, but they are against the practices and intentions of transnational corporations and the new global market-driven economy, which do not consider the need of the poor and the biodiversity of the environment. They further claim that the WTO is undemocratic and a secretive institution designed to enhance the fortunes of the industrialized countries to the detriment of the developing countries. Moreover, WTO critics contend that rather than benefiting from trade liberalization, many developing countries that have opened their markets are now worse off. This claim has unleashed a growing discontent and opposition to globalization and market-oriented reforms in some developing nations (Economic Reform Today, 2000). Furthermore, Bello (2000) argues that there is no necessity to creating WTO: the 'old' GATT was functioning well *as a framework for liberalizing world trade* as it was flexible in recognizing the special needs of the developing countries.

Figure 1: **Clash of Values**



3. CONFLICT MODEL

This model considers a general type of conflict that is now taking place around the world at the local, national and global levels between the basic values of the new global market-driven economy (GMDE) and those of the sustainable ecosystem (SES) with a value system built on the premise of societal prosperity and natural resources stewardship. The lower part of Figure 1 lists the options available to each party. GMDE has three options: coerce states into implementing market-driven economic policies and thereby lessen their abilities to govern in the interest of their citizens; spread propaganda for promoting their ideals of globalization and internationalization through the media; and reform the WTO so that more consideration is given to the diversity of different cultures and societies, especially in third world countries, and the treatment of the environment as a public trust rather than a commodity. SES contends that the private sector should work within the public-trust domain governed by legitimate and democratic regimes with no

favorable treatment to lobby groups such as GMDE. SES also has three main options: foster public education that promotes environmental integrity and social responsibility as well as warns of the dangers of succumbing to values of GMDE; lobby governments to incorporate environmental and ecosystems concerns into free trade agreements; and put pressure on trade negotiators to consider more societal concerns in their agenda.

As explained in an overview paper by Hipel (2001) and in articles contained within Theme 1.40 on Conflict Resolution in the Encyclopedia of Life Support Systems (EOLSS) (2002), a wide range of psychological, sociological, operational research, game theory, system engineering and other kinds of models have been developed for systematically studying conflict and its resolution. Here, a formal systems engineering approach called the Graph Model for Conflict Resolution (Fang et al., 1993) is employed to model and analyze *The Battle of Water 'to-Who'*. This flexible methodology is implemented in practice using the decision support system called GMCR II (Hipel et al., 1997; Kilgour et al., 2001).

Table 1: **Decision Makers and Options.**

Decision Makers and Options			Status Quo State
GMDE			
	1. Coerce	Y	Strategy
	2. Propaganda	Y	of
	3. Reform	N	GMDE
SES			
	4. Education	Y	Strategy
	5. Lobby	Y	of
	6. Pressure	Y	SES

The left side of Table 1 lists each of the two decision makers (DMs) in the values conflict followed by the options under the control of each DM. A DM can make a selection from the options it controls, called a strategy, and a collection of all DMs strategies forms a state or scenario. In Table 1, a "Y" opposite an option indicates "Yes" the option is selected by the DM controlling it, whereas an "N" corresponds to "No", the option is not taken. The status quo in the table represents the state existing at the time of conducting the analysis. In that state, GMDE is coercing governments and promoting the ideals of free trade agreements but not considering reforms. SES is doing everything it can: educating the public, lobbying governments, and pressuring negotiators by demonstrating whenever they conduct a meeting. Tension between the two combatants is high and widening. Since an option can be taken or not by each DM, mathematically there exist 64 (2^6) states, and part of the modeling step is the removal of those states that in reality are unlikely to happen. In our model, there are two main reasons for unfeasibility. First,

some options are mutually exclusive and cannot be selected at the same time. Hence, GMDE will not simultaneously select the options "reform" and "coerce", nor will it choose "reform" and "propaganda" together. In addition, there are infeasible states whenever the three options "coerce", "propaganda", and "reform" occur together. Second, if GMDE chooses to reform, SES will not pressure trade negotiators. Table 2 illustrates the remaining 36 feasible states in the conflict, where state 36 corresponds to the status quo state.

Table 2: **Feasible States in the Conflict.**

DM	#	Option	State																	
GMDE			1	2	3	4		6		8	9	10	11	12	13	14	15	16	17	18
	1.	Coerce	N	Y	N	Y	N	N	Y	N	Y	N	N	Y	N	Y	N	N	Y	N
	2.	Propaganda	N	N	Y	Y	N	N	N	Y	Y	N	N	N	Y	Y	N	N	N	Y
	3.	Reform	N	N	N	N	Y	N	N	N	N	Y	N	N	N	N	Y	N	N	N
SES																				
	4.	Education	N	N	N	N	N	Y	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y
	5.	Lobby	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
	6.	Pressure	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
			State																	
GMDE			19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	1.	Coerce	Y	N	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
	2.	Propaganda	Y	N	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
	3.	Reform	N	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SES																				
	4.	Education	Y	Y	N	N	N	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
	5.	Lobby	Y	Y	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
	6.	Pressure	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

The stability analysis of each state for all the DM's requires that the feasible states be ranked from most to least preferred for each DM. GMCR II allows different approaches to do that –however the most convenient one is by specifying the preference information in terms of options for each DM. Then an internal algorithm will accordingly calculate a ranking of the states for the DM. When all of the preference information is complete for all of the DM's, GMCR II then can perform the stability analysis using the solution concepts outlined in the next section in Table 5. For the present conflict, Table 3 illustrates our depiction of the option

prioritization for the DM's using logical preference statements in order of priority from top to bottom, where the numbers represents the options given in Table 2.

Table 3: **Preference Statements for the DM's.**

GMDE	SES
-3|1	3
2 IF 4	-1
2	4
-4	5 IF -3|1
-5	

The feasible states shown in Table 2 are now ranked from most to least preferred for each of the DMs where ties are allowed. Option prioritization constitutes a flexible method for preference elicitation encoded into GMCR II whereby preferences of a given DM are expressed using preference statements about options that are listed in a hierarchical fashion. The two columns in Table 3 list the prioritized preference statements for GMDE on the left and SES on the right, where the statements in each column are listed from most important at the top to least important at the bottom and the numbers refer to options.. The symbols "-", "|", and "IF" represent the "not", "or", and "if condition," respectively. As indicated by -3|1 at the top of the left column in Table 3, GMDE most prefers not to reform the WTO or to continue coercing states. Bello (2001) argues that the recent calls from prominent officials for reforming the WTO are only "damage control statements" and not serious. The statement 2IF4 means that GMDE next prefers the propaganda option (2) if SES chooses to rebut WTO ideals through educating the general public (4). Then GMDE prefers in decreasing order to select the option of propaganda (unconditional) (2), SES does not educate (-4), and SES not lobby (-5).

The right column in Table 3 lists SES's preference statements. As can be seen, SES' most preferred option is the WTO reforms (3). This means that GMDE will incorporate social, environmental, and ethical considerations into its mandate. Next, SES prefers that GMDE not coerce states (-1) and thereby allows freedom of expression and choice. Then SES prefers educating people about the effects of the international trade agreements on their lives (4). Finally, SES prefers lobbying trade negotiators (5) if GMDE refuses to reform (-3) or continues coercing governments (1).

The hierarchical preference statements listed in Table 3 for each DM follow all the rules of first order logic. Assuming transitivity, an algorithm within GMCR II uses prioritized preference statements to rank the feasible states from most to least preferred where ties can occur. The ordinal ranking of states for GMDE and SES from the most preferred to the least preferred are shown in Table 4 using the state numbers defined in Table 2. The states enclosed in parenthesis are equally preferred states for a DM and states given higher in a column are more preferred than those lower down. For example, GMDE equally prefers the states in the first set: (3,4,23,24), but this set is more preferred to the states in the second set: (13,14,31,32), and so on.

***Table 4*: Preference Ranking of States.**

GMDE	SES
(3,4,23,24)	(10,20)
(13,14,31,32,)	(5,15)
(8,9,27,28)	(16,33,18,35)
(18,19,35,36)	(6,25,8,27)
(1,2,21,22)	(11,29,13,31)
(11,12,29,30)	(1,21,3,23)
(6,7,25,26)	(17,34,19,36)
(16,17,33,34)	(7,26,9,28)
(10,5,15,20)	(12,30,14,32)
	(2, 22,4,24)

More Preferred States.

Less Preferred States.

4. ANALYTICAL RESULTS AND INSIGHTS

Each state is assessed for stability from the point of view of each DM using certain solution concepts, which constitute mathematical definitions about how people may behave under conflict. A state is considered to be stable for a DM if and only if that DM is not tempted to move away from it unilaterally. A state is an equilibrium, or possible resolution under a particular solution concept, if all DMs find it to be stable under that stability definition. Table 5 lists the solution concepts that are incorporated into GMCR II for calculating stability and equilibrium of states. Foresight is a measure of a DM's ability to consider futuristic possible moves. Disimprovement refers to the tendency of a DM to put itself in a worse position in order to either reach to a more preferred state eventually or to block unilateral improvements of other DMs. The knowledge of preferences refers to the amount of information available to a DM about its own and the others' preference structures over the different states. Fang et al. (1993) present mathematical descriptions and comparisons as well as original references for the solution concepts given in Table 5.

Table 5: **Solution Concepts and Human Behavior.**

Solution Concepts	Foresight	Disimprove-ment	Knowledge of Preferences	Stability Description
Nash Stability	Low	Never	Own	Focal DM cannot unilaterally move to a more preferred state.
General Metarationality	Medium	By Opponent	Own	All of the focal DM's unilateral improvements are sanctioned by subsequent unilateral moves by others.
Symmetric Metarationality	Medium	By Opponent	Own	All focal DM's unilateral improvements are still sanctioned even after possible responses by the focal DM.
Sequential Stability	Medium	Never	All	All of the focal DM's unilateral improvements are sanctioned by subsequent unilateral improvements by others.
Limited-move Stability (L_h)	Variable	Strategic	All	All DMs are assumed to act optimally and a maximum number of state transitions (h) is specified.
Non-myopic Stability	High	Strategic	All	Limiting case of limited move stability as the maximum number of state transitions increases to infinity.

All states in Table 2 were analyzed for stability using GMCR II for each DM according to each of the stability concepts listed in Table 5. The resulting equilibria are listed in Table 6. Note that states 18, 19, 35, and 36 possess a higher degree of stability than the other equilibria because they are stable according to all of the solution concepts.

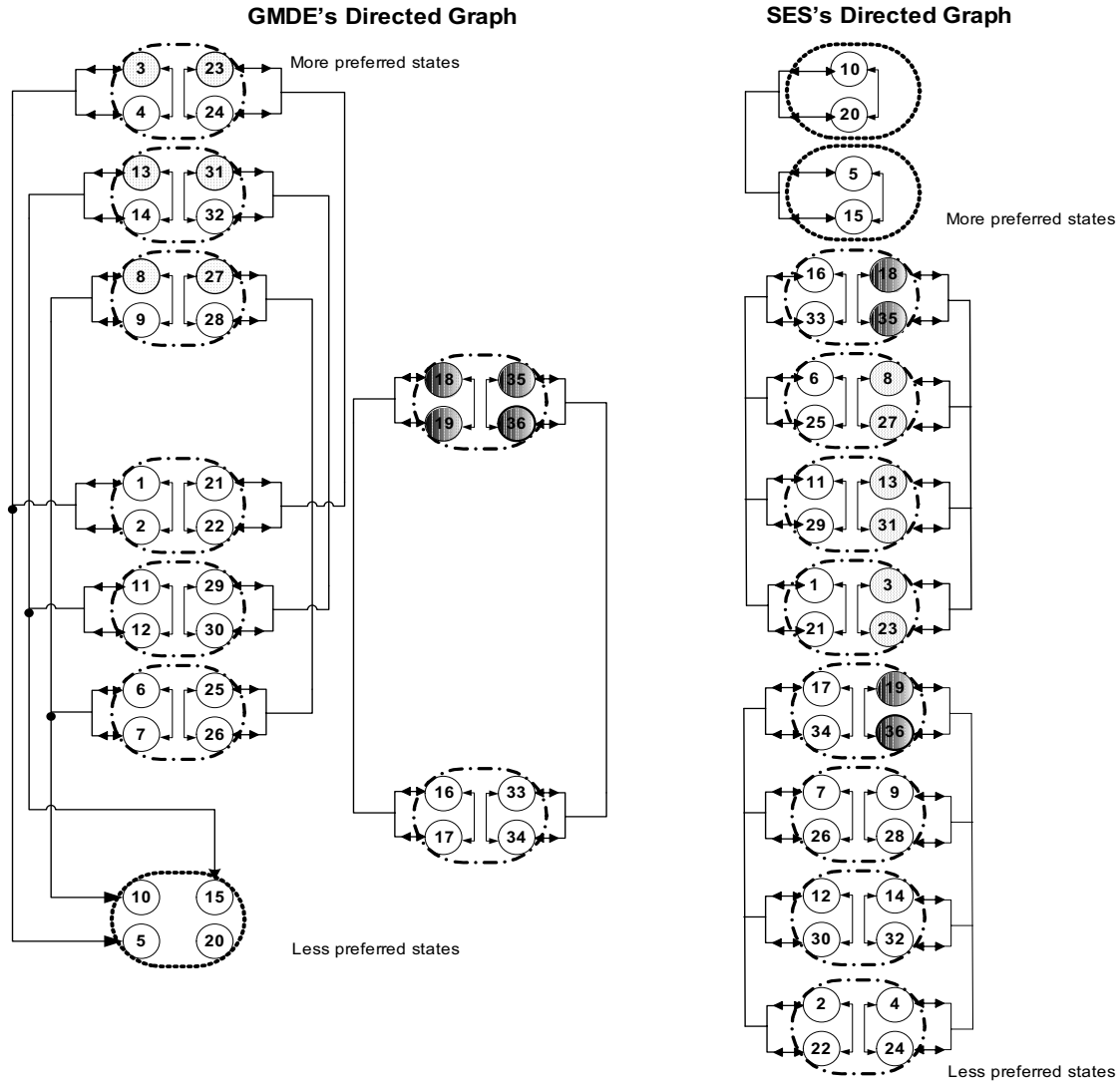
Table 6: **Equilibria List for the Conflict.**

Equilibria	States									
	3	8	13	18	19	23	27	31	35	36
Nash Equilibrium				☑	☑				☑	☑
General Metarationality	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Symmetric Metarationality	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑

Sequential Stability	☑	☑		☑	☑
Limit-move Stability (L_2)	☑	☑		☑	☑
Non-myopic Stability	☑	☑		☑	☑

We can further investigate those strongly stable states by observing the DMs' preference rankings among them. Figure 2 shows the graph model of the conflict for each DM. The directed graph of each DM records the DM's unilateral moves as a series of transitions from one state to another via the directed arcs. Moreover, the listing of states in each column in Figure 2 follows the preference information given in Table 4 for each DM. Equally preferred states are enclosed within ovals in Figure 2 and shaded states refer to the equilibria given in Table 6.

Figure 2: **The Graph Model of the Conflict.**



As indicated in the right column in Table 3, SES prefers that GMDE does not choose its *coerce* option as it is doing in states 18 and 35 (see Table 2), and it prefers

continuing its education campaigns and, to a lesser degree, lobbying efforts. States 18 and 35, therefore, are more preferred over the status quo (state 36) and state 19 for SES. As can be seen in the fourth row from the top on the left side of Table 4, all of these strong equilibria are equally preferred by GMDE. However, it can only make a unilateral move from state 36 to state 35 without being sanctioned by SES since SES prefers state 35 over state 36. Notice that the status quo is a strong equilibrium for all solution concepts, but it is not the most preferred state for both DM's. GMDE and SES can move to states 18 or 35 as a compromise, which represent better potential outcomes than states 19 or 36. As shown in Table 7, this can be accomplished if GMDE shows goodwill such that it will consider stopping the coercion of states, thus moving the conflict from the status quo to state 35. SES can further demonstrate an understanding by avoiding selecting the *pressure* option, and thereby moving the conflict to state 18.

Table 7: **State Transitions from Status Quo to Final Outcome**

State Numbers	36		35		18
GMDE					
1. Coerce	Y	→	N		N
2. Propagande	Y		Y		Y
3. Reform	N		N		N
SES					
4. Education	Y		Y		Y
5. Lobby	Y		Y		Y
6. Pressure	Y		Y	→	N

An alarming conclusion we can draw from the foregoing strategic analysis is that among all the equilibria states given in Table 7 none include GMDE's *reform* option. Both DMs are diametrically opposing each other on the issue of *reform*. Our analysis reveals that there is definitely a point at which both values can meet. It is one that requires visionary statements and a responsible globalization mandate. GMDE can stop intimidating states and adopt more democratic methods for conveying ethics for free trade agenda, and start approaching states with persuasive arguments and reasoning rather than coercion. However, SES needs to understand that unless GMDE changes its value system, reform will not materialize. SES could develop some options that would encourage GMDE to consider a change in its value system. One way for doing this is to better educate the public and market forces of the clear environmental and social drawbacks of the current global market economy and to provide clear evidence that there are better ways of doing business that ensure that everyone gains in a win/win ethical resolution.

5. RECOMMENDATIONS

Sitting behind the steering wheels of international trade agreements are transnational corporations representing the marketplace who drive the trading juggernauts in the direction of maximum profits while complacent politicians lounge in the passengers' seats barking approval of all decisions taken by the drivers and usually ignoring the appeals for restraint by the populace who elected them. From the viewpoint of espousing integrative water resources management and being a guardian of our rich environmental heritage, the Boundary Waters Treaty of 1909

between Canada and the United States of America (USA) constitutes an exemplary and long-tested illustration. However, the basic values of equity between the citizens of Canada and the USA as well as environmental integrity that are encoded into the structure of the Boundary Waters Treaty are bound to clash directly with the one dimensional value of monetary gain in the marketplace hardwired into treaties like NAFTA and the WTO – and so they have. Numerous cases illustrate the blatantly unethical decisions that can be reached when a flawed international agreement like NAFTA is allowed to crush environmental and social issues that may inconveniently lie in its path as it blindly plunders ahead. One nightmare of epic proportions that could become a future reality is the proposed export of bulk water from Canada. In direct contradiction to the promises of the Canadian politicians who helped design and approve NAFTA in the early 1990's and who had boldly declared that water is not included in NAFTA, water is in reality part of NAFTA and it is only a matter of time before the commodification of water is actually implemented under NAFTA – except, of course, if reason eventually prevails and it is stopped in its tracks. Our analyses given above indicate that this will probably occur if the values of GMDE do not change towards environmental stewardship. A strategic analysis of the proposed bulk export of water from Lake Gisborne in Newfoundland predicts that these exports will take place when the price of water rises unless laws and trading agreements are appropriately changed (Hipel, Fang, and Wang, 2003). In fact, the International Joint Commission, which is the implementation mechanism of the Boundary Waters Treaty, recommended in a 2000 study that no boundary waters be exported in bulk unless it can be definitely proven that the ecology is not harmed.

Currently, Sun Belt Corporation of the USA is continuing its suit against the Canadian government under Chapter 11 of NAFTA because it was prevented from exporting water in bulk from British Columbia to California. This international dispute over the commodification of water has been investigated in detail (Obeidi et al., 2002) using the graph model for conflict resolution (Fang et al., 1993). Pertinent insights gained from this study are utilized for exploring what can be done to foster sustainable development by appropriately changing or replacing international treaties. In fact, the authors believe that a win/win solution can be reached between the creative forces of capitalism that have been spectacularly successful in delivering desirable consumer products at low prices to the citizens of the world and the wise proponents of environmental and social responsibility. Stated differently, the short-term profit motives of transnational corporations can be accomplished within reason if proper international agreements are put into effect to prevent "corporate feudalism" from spreading on a global basis in the 21st century. Interesting suggestions are proposed by authors including Barlow and Clarke (2002), de Villiers (1999), Dellapenna (2001), McMurty (1998), Wilson (2002), and Wolf (1998) for designing a better future for all of us. All of their solutions hold environmental and social concerns at a higher priority than economic values in international agreements that are comprehensive in nature and go well beyond humankind's propensity to be greedy. The most favorable conclusion to the ongoing Battle of Water-"to-Who" is ultimately ensuring that everyone gains in a win/win ethical resolution. Nonetheless, without proper global agreements supported by appropriate national and provincial laws, legal impediments will chronically hinder society from evolving from potential conflict to co-operation potential and thereby losing valuable opportunities to employ water for peace and prosperity. In the final analysis, the answer to the question to whom the control of water should be given is simple – to all of us. Clearly, this is achievable. We do not

have to defeat a marketplace Napoleon to gain a victory at Waterloo, but rather we can get everyone on side by controlling the excesses of our own human nature and by encouraging its creative genius to work towards a sustainable future.

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TRANSBOUNDARY FRESHWATER MANAGEMENT: WHEN AND WHY DOES IT SUCCEED OR FAIL?

Thomas Bernauer[300]

ABSTRACT

When and why are international efforts to solve transboundary river management problems successful? When and why do such efforts fail, and what does success or failure mean? With more than 260 international river basins covering 45% of the Earth's land surface, and with freshwater being humanity's most valuable natural resource, these questions are hardly trivial. Natural scientists and engineers have provided some answers, but they remain far from complete without major input from the social sciences. While technical know-how and innovation are also crucial to successful international river management, success in this context hinges primarily on political processes in which institutional arrangements are designed and implemented. This review essay maintains that social scientists have made considerable progress in this field since 1977, when a landmark book by David Le Marquand on the politics of international river management was published. This progress includes the development of theoretically more sophisticated explanatory models and their evaluation against an increasing amount of empirical information. It provides a solid foundation for proceeding to a larger-scale research effort that involves the analysis of a larger set of empirical cases on the basis of a single explanatory model. Keywords: international river management, water policy, transboundary water resources.

1. INTRODUCTION

Recent work by geoscientists has established that, as of 1999, there were 261 river basins that crossed international boundaries and covered more than 45% of the Earth's land surface (Wolf et al. 1999). While obstacles to successfully coping with domestic river management problems can be formidable, pollution and other problems on transboundary rivers appear to be particularly difficult to solve. The sovereignty of states, the dominant principle in international politics, implies that there is no political unit above and beyond the nation state that may impose solutions on unwilling states (e.g., prohibitions, emission taxes or licenses, subsidies, product or production process requirements).[301]

Legal frameworks, through which victims of water pollution or other problems involving international rivers might seek remedy, are weak at the international level (Cano, 1989; Benvenisti, 1996). International courts and tribunals exist; for example. the International Court of Justice in The Hague. But in most cases, states have maintained their right to accept or refuse referral of a dispute to an international body. The same holds for verdicts rendered by such institutions.[302] States have also maintained a monopoly in enforcing international judgments and

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[301] This paper draws heavily on an article published by the author in Aquatic Sciences (64/2002:1-19). The author would like to thank Elisabeth DeSombre, Ronald Mitchell, Raphaël Tschanz, David Victor, and Oran Young for highly useful comments on earlier versions of this paper.

[302] Exceptions include the European Court of Justice, the WTO, and the UN Security Council.

international regulations more generally. In regard to international rivers, general principles of international water law exist but, in practice, they provide very little guidance in resolving transboundary river management problems (e.g. Frederiksen, 1992; Wolf, 1997; Marty, 1997; Salman/Boisson-de-Chazournes, 1998). Marty (1997:17) notes that "the golden rule of water law (…) says that there is no golden rule." More generally, institutional structures for reconciling conflicting interests at the international level tend to be less sophisticated and less resilient to opportunistic manipulation than their counterparts at the domestic level. At the international level, solutions thus have to be found through consensus-oriented negotiations among riparian countries under conditions that, in many parts of the world, resemble what Realist theorists of international politics have called an anarchical self-help system (Waltz, 1979).[303]

Wolf (1997:334) observes, "Water is the only scarce resource for which there is no substitute, over which there is poorly developed international law, and the need for which is overwhelming, constant and immediate." While this statement may not be valid in any rigorous sense (e.g., biodiversity is not substitutable either), water is clearly a key resource for most human activity, and with regard to the ecosystem as a whole. Motivated by its practical importance (see, e.g., Gleick, 1998), research on international freshwater issues carried out by natural scientists and engineers has produced an enormous amount of literature. I dare claim that, although these contributions are important, they cannot provide conclusive explanations of success and failure in international river management. Technological know-how and innovation are obviously important to finding solutions to international freshwater problems; however, in most cases, the most serious obstacles to successful international river management do not appear to be technical but political. Answers to when and why such efforts succeed or fail must then, to a large extent, be found through the study of societal processes in which institutional arrangements are designed and implemented. This is the domain of political science, economics, and other social sciences.

The United Nations Food and Agricultural Organization (FAO) has counted more than 3600 treaties on international water issues between the years 805 and 1984. Wolf (1997; see also FAO, 1978) has counted around 300 international treaties on non-navigational issues of water management, flood control, hydroelectric projects, and allocations for consumptive and non-consumptive uses of international rivers since 1945. The opportunities for using these "real world experiments" for observational studies designed to evaluate theory-derived explanations of success or failure in international river management are almost infinite. These opportunities are in stark contrast to the actual amount of social science research on the issue.
International environmental policy is (still) a small subfield in all social sciences, with very few researchers having focused on international rivers. Given the large number of international rivers, the even larger number of associated transboundary institutions and treaties, and the small number of researchers active in this area,

[303] There is an ongoing debate among theorists of international politics on the differences between international and national political systems, and the implications for resolving conflicts at the two levels (see Waltz, 1979; Keohane/Ostrom, 1995). See also Wolf, 1997. In one of the extremely rare cases of supranational imposition of an environmental policy, the Iraq compensation commission, established and operated by the United Nations, is allocating parts of Iraq's oil revenue to victims of environmental damages resulting from Iraq's occupation of Kuwait and the subsequent war. It has also funded environmental monitoring.

social scientists have, at this stage, very limited knowledge of the nature and extent of variation in the performance of existing international river management schemes. The criteria for measuring performance remain disputed (discussed later). However, some international river management institutions appear to work rather well, the performance of others leaves much to be desired, and some arrangements have remain only "paper tigers" (Le Marquand, 1977; Marty, 1997; Birnie and Boyle, 1994; Bernauer, 1997; Golubev, 1993; Biswas, 1994). The extent of variation in institutional performance among the total population remains unknown.

Not surprisingly then, knowledge on the conditions for success/failure is also in its infancy. Social scientists and practitioners have put forward a large number of characteristics of international river management problems and institutional structures, postulating negative or positive associations between these characteristics and success or failure (for earlier reviews, see Marty, 1997; Bernauer, 1997).[304] But very few attempts have been made to develop coherent explanatory models embedded in social science theories and to evaluate them systematically against the empirical evidence. Most of the literature on international river management is almost entirely descriptive and focuses on management practices on individual rivers. In some cases, such descriptive work is assembled in collective volumes in an effort to tease out the "lessons learned". Other work is predominantly prescriptive, proposing (presumably) effective or efficient management strategies and arguing rather eclectically with empirical illustrations, or (often the case in work by economists) making claims on the basis of pure theory (e.g., game theoretical or economic optimization models; e.g., Kilgour and Dinar, 1995). The vast majority of the very few observational studies that are designed to empirically evaluate an explicit set of hypotheses derived from social science theories are single case studies (e.g. Mingst, 1981; Lowi, 1995; Bernauer, 1996).[305]

In this review essay, I concentrate on the latter type of research because, in my view, it holds the greatest potential for generating cumulative knowledge on the issue. In view of the shortcomings pointed out above, the research task ahead may look rather challenging, and yet social scientists have made substantial progress since the landmark study by David Le Marquand in 1977. This progress is particularly visible in recent work by Rainer Durth (1996), Frank Marty (2001), and Aaron Wolf (1997), who have all addressed what is arguably the biggest gap in research on international river management: the lack of multi-case comparisons within a single and coherent theoretical/analytical framework. I, therefore, will focus more systematically on publications by Durth, Marty, and Wolf, while referring to work by other authors only when it provides additional insight.

Le Marquand (1977) was the first to outline an explicit set of hypotheses explaining when and why riparian co-operation succeeds, when and why it fails, and how to

[304] First efforts to study more systematically how international rivers are managed and how such management could be improved were made by the United Nations, with a first symposium on the subject in 1949. Marty (1997) explores the extent to which the major academic disciplines have concentrated on different aspects and problems of international river management. He distinguishes an ecological, a developmental, a political, a legal, and a management paradigm.

[305] Lowi, for example, highlights the role of hegemonic powers in resolving transboundary water disputes, focusing on the Jordan. Bernauer examines the effectiveness of compensating upstream polluters in an effort to resolve pollution problems on the Rhine.

evaluate these hypotheses against a set of empirical cases (Marquand studied the Colorado salinity issue, the High Ross Dam controversy, the integrated development of the Columbia River, and Rhine water quality problems).[306] Le Marquand's list of explanatory variables is rather long, but insufficiently embedded in social science theory (as it existed in the mid-1970s). Also the empirical evaluation of propositions is, from a methodological viewpoint, less rigorous than one might hope for. Nonetheless, Le Marquand's five principal conclusions are quite plausible, and in any event, more systematically derived from empirical analysis than those in previous research. They have, in part, also been confirmed by subsequent research as discussed later.

First, Le Marquand finds that riparians are better able to solve their respective problem if they have common perceptions of the problem, if win-win solutions are created, and if national leadership is committed to solving the problem. Secondly, economic optimization is less crucial to co-operation than non-economic factors. Third, co-operation is more successful when social concerns and objectives are evaluated and defined in the planning process, and when consequences and costs of alternative strategies are assessed in detail. Fourth, co-operation is more successful when agreements are flexible enough to adapt to changing values, technologies, and market conditions. Fifth, reciprocal interests in co-operation are most conducive to problem solving, whereas upstream-downstream problems are the most difficult with which to deal. Third parties, such as international organizations and donor countries, were instrumental in overcoming the latter type of problems.

The remainder of this paper is structured by the following questions:

1. How do the three authors, on whose work this review essay primarily focuses, define the overall analytical framework for their research?
2. How do they define success or failure in international river management?
3. What are their key explanations accounting for when and why riparian countries are able to establish co-operative arrangements?
4. What are their findings in associating particular characteristics of institutional arrangements with success or failure in international river management?

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[306] Other comparative studies include, for example, Chapman, 1963, United Nations, 1975, Fox/Le Marquand, 1978, Vlachos et al., 1986, Frey, 1993, World Bank, 1993, Rangeley et al., 1994, Barrett 1994, Ganoulis, 1996, Nakayama, 1997, Elhance, 1999, Shmueli, 1999, and Holtrup 1999. While these studies also compare several cases of international river management, they are less systematic than Le Marquand's book in terms of using a coherent analytical framework. The latter two, which are edited volumes, illustrate this drawback rather well. Both of them contain some theoretical chapters and some chapters with empirical case descriptions. But no attempt is made to connect theoretical arguments and empirical analysis in a coherent manner. Among the very few larger-N studies on international rivers are articles by Mandel (1992) and Haftendorn (2000). Mandel studies 14 river basin conflicts, concluding that conflicts are most intense in cases where border and water disputes coincide (Shatt-al-Arab, Rio Grande) than in water quality cases (Colorado, Danube, La Plata), and when conflicts are triggered by man-made technological disruptions (Euphrates, Ganges, Indus, Nile) rather than by natural events (e.g. flooding, Columbia, Senegal rivers). Haftendorn concentrates on the origins of water conflicts and attempts at solving them. Her comparison suggests that co-operation is facilitated by improvements in information exchange and promotion of confidence, embedding the conflict in a positive interactive complex, creation of package solutions through linkage strategies, use of arbitration, mediation, and intervention.

I conclude that, taken together, the work by Durth, Marty, and Wolf, as well as other work referred to at various points throughout this paper, has contributed substantially to answering these questions. It provides a sufficient foundation for proceeding to a larger-scale research effort that involves the analysis of a larger set of empirical cases on the basis of a single explanatory model that is well embedded in extant social science theories.

2. ANALYTICAL FRAMEWORK

Marty distinguishes three groups of explanatory variables: (1) the structure of the problem to be solved; (2) the tools employed to achieve the formation of an international regime[307]; and (3) institutional properties (i.e., design features of an international regime). Environmental problem structure as well as policy tools and socio-economic conditions (in terms to be defined) influence the likelihood of international regime formation (the creation and form of institutions and regulatory output). The latter, in turn, affects the behavior of riparian actors and ultimately environmental outcomes. This framework sets the stage for two principal analytical steps; the first focusing on the explanation of regime formation, and the second on the explanation of changes in actor behavior and environmental conditions. As discussed below, each of the two outcomes to be explained may be regarded as a measure of success or failure.

This approach connects research on the causes of success or failure in international river management to a larger research program, particularly in political science and international law, which examines the determinants of international regime formation and effectiveness in international environmental policy (e.g., Miles et al., 2001; Brown and Jacobson, 1998; Haas et al., 1993; Keohane and Levy, 1996; Young, 1999, 1999a). While Marty draws extensively on this literature, Durth and Wolf ignore it almost completely.

3. SUCCESS AND FAILURE

As noted above, analysts of international river management have defined the outcome to be explained, and thereby also success or failure, primarily in terms of regime formation and the effects of co-operative arrangements on riparian behavior and environmental outcomes. At a more general level, social scientists have measured outcomes of international environmental policy or, more specifically, the success or failure of policies, mainly in terms of Pareto-efficiency, compliance, and problem solving (e.g., Mitchell, 1994; Victor et al., 1998; Sprinz and Helm, 2000; Sand, 1992; Young, 1999; Bernauer, 1995).

Economists tend to concentrate on Pareto-efficiency (e.g., Wishart, 1989; Colby, 1995). Success or failure, in this context, means the extent to which a given policy approximates the point at which no riparian country could be made better off without making another riparian country worse off. Political and other social

[307] The term international regime is widely used in political science and international law and denotes a system of principles, norms, rules, and decision-making procedures designed to influence the behavior of states, firms, or individuals. These systems may or may not include international organizations. In this essay, I use the terms international regimes and international institutions synonymously. See, e.g., Young, 1999.

scientists regard this criterion of success with skepticism. More importantly, it is very difficult to apply empirically: gains or losses of concern to policy-makers in the real world are often difficult to express in economic terms. In addition, measurement of Pareto-efficiency involves a counterfactual element; namely, showing whether or not other policies, which did not materialize, would have made one or more players better off and no one worse off. So, political scientists have instead focused on behavior; that is, the degree to which the existence and operation of an agreement has changed the behavior of key players.

Legal scholars and some political scientists have concentrated on compliance with international treaties. This criterion has been heavily criticized because, in many cases, it does not capture the extent to which riparian countries are able to resolve a particular problem. Indeed, full compliance with an international treaty that is nominally but not substantively designed to resolve an international river management problem should rightly be regarded as a poor indicator for success (see Mitchell, 1994; Bernauer, 1995; Downs et al., 1996).
Many social scientists have employed broader empirical proxies for the measurement of success or failure, the most popular being the extent of "problem solving" (e.g., Young, 1999; Victor et al., 1998). This concept may appear more vague than Pareto-efficiency or compliance; moreover, problems along international rivers can differ enormously, making rigorous comparisons and generalizations across rivers and time difficult. The decisive advantage of this concept is, however, that it connects researchers more directly to what policy-makers and natural scientists or engineers are preoccupied with; namely, when, why, and how riparian countries are able to solve specific environmental problems. Or more precisely, they ask how the institutions that riparian countries create in order to solve a problem actually cause changes in behavior that help to solve the problem at hand. In addition, the empirical literature focusing on Pareto-efficiency and compliance in international environmental policy illustrates rather well that systematic assessment against these criteria is no less problem-ridden than measurement of the extent of problem solving.

Recent work on a variety of international environmental policies (e.g. Victor et al., 1998; Suter, 2000) demonstrates that the following research steps can produce reliable and meaningful measurements of success or failure: (a) clearly delineating the problem (e.g., pollution by specific substances, decline of biodiversity in specific forms); (b) choosing a starting point in time and establishing the state of affairs at that time; (c) measuring whether and to what extent the problem has increased or decreased over time, whether and how far the outcome (e.g., the level of pollution) has moved towards what experts would define as desirable, and what the outcome would have looked like without policy intervention (see, e.g., Sprinz and Helm, 2000; Mitchell, 2001; Suter, 2000).

To date, the most sophisticated attempt to connect social science theory on policy success or failure with empirical research on international rivers is Gurtner-Zimmermann's (1998) study on the effectiveness of the Rhine Action Program (RAP). Based predominantly on 'expert' interviews, he assesses the RAP's problem-

solving ability, studies progress in program implementation and behavioral changes connected to the program, and assesses the degree of goal-attainment.[308]

How does the work by Durth, Marty, and Wolf compare to these standards? Durth's theoretical arguments concentrate very much on Pareto-efficiency; his empirical analysis then withdraws without further discussion to a much simpler measurement of success/failure. In his statistical analysis, a dummy variable, the existence/non-existence of an international treaty, serves as a proxy for success/failure. This measurement is highly problematic. As noted above, too many international river treaties are known to have remained "paper tigers". In the worst case, rivers whose riparians engage in the greatest amount of green window-dressing and conclude ecologically meaningless treaties will, in this type of measurement, be coded as successful . In his qualitative case studies on the Rhine, the Elbe, and the Euphrates, Durth does not specify in detail how he measures the outcome to be explained and does not make any reference to the conceptually relevant literature. Instead, he uses a broad set of rather opaque criteria to argue that co-operation was most successful in the Rhine case, followed by the Elbe, and has been largely unsuccessful in the case of the Euphrates. Readers with some knowledge of the three cases will probably agree with his overall assessment of variation across the three cases, but will crave for more precise criteria of success/failure and empirical assessments guided by these criteria.

Marty's study includes a more thorough conceptual discussion of success/failure. He distinguishes "regime formation" (i.e., the conclusion of international treaties and establishment of institutional arrangements) and "regime effectiveness" with explicit reference to the extant social science literature on the topic. The latter concept leads Marty to define more clearly what problem solving means. It also helps in assessing whether a particular problem was solved or reduced because of international co-operation or other reasons. Marty applies these concepts and criteria in qualitative case studies on the regulation of the Alpine Rhine (involving Switzerland and Austria), the Rio Grande rectification project (involving the United States and Mexico), the Pancheshwar multipurpose project on the Mahakali River (involving India and Nepal), the Colorado River salinity problem, and the sanitation problem in the Tijuana River basin (both involving the United States and Mexico).

While Durth's assessment of success/failure suffers from a combination of oversimplification and opaqueness, Marty's measurement of success/failure subscribes strongly to the problem-solving criterion and will thereby be of greater interest to practitioners, natural scientists, and engineers. On the downside, Marty's measurement sometimes drowns the reader in empirical detail, making it difficult to focus on the criteria of success/failure and the respective empirical evidence, and to compare success over time and across cases.
The work by Wolf does not explicitly define "conflict resolution", the authors' principal outcome to be explained. The quantitative part of this work subscribes to the legalistic approach also adopted by Durth, without much reference to or discussion of the literature on international regimes and institutions. The University of Alabama/State University of Oregon Transboundary Freshwater Dispute Database Project, run by Wolf and others, is almost exclusively concerned with

[308] In view of the questions of principal interest in this essay, the drawbacks of Gurtner-Zimmermann's study are that it focuses on one river only, and that it does not explain why the RAP was successful.

analyzing treaties. It also contains a number of process case studies: Danube, Euphrates, Jordan, Ganges, Indus, Mekong, Nile, La Plata, Salween; two aquifer systems, U.S.-Mexico shared systems and the West Bank aquifers; two lake systems, the Aral Sea and Great Lakes; and one engineering works, the Lesotho Highlands Project (see also Bingham et al., 1994; http://terra.geo.orst.edu/users/tfdd/). But these case studies are less substantive than those of Durth, Marty, and others s (see, e.g., Lowi, 1995 on the Jordan) and define "conflict resolution" only in vague terms.

4. REGIME FORMATION

International environmental policy analysts have proposed a plethora of explanatory variables in an effort to account for the likelihood of regime formation and associated institutional design principles (e.g., Young, 1999; Victor et al., 1998; Keohane and Levy, 1993).[309] The work by Durth and Marty, as well as other studies on international river management that are directly connected with the broader research program on regime formation in international environmental policy, has framed the explanation more narrowly; it regards environmental problem structure as the key determinant of regime formation and has conceptualized socio-economic variables and process-oriented variables (policy tools) in terms of conditions for overcoming adverse environmental problem structures.

More precisely, Durth's and Marty's principle hypothesis is that regime formation is generally less likely in upstream-downstream situations than in situations characterized by more symmetrically distributed environmental damages, notably in the case of common pool resources (see below). Even in the more adverse situation, however, regime formation is still possible if specific socio-economic situations are present and particular policy tools are applied. The reason for this approach is primarily empirical; while many international environmental policy issues are characterized by mutual pollution (e.g., ozone depletion, loss of biodiversity), unidirectional externalities are at the heart of many international river management problems.

Durth and Marty, whose theoretical argument on regime formation is more detailed and sophisticated than that of Wolf, agree that upstream-downstream conditions are least conducive to co-operation. This argument corresponds to what game theorists call a deadlocked game. In this stylized situation, which is typical of many international river pollution and water scarcity problems, the upstream country is assumed to be able to fully "export" the social costs of its water consumption (e.g., discharge of pollutants) downstream, while the downstream country suffers on the order of 50% from 'self-inflicted' and 50%from "imported" pollution.[310] In this case, the dominant strategy of the upstream country (meaning it cannot increase its benefit by changing its strategy, irrespective of the strategy adopted by the downstream country) is to not reduce pollution; the dominant strategy of the

[309] For reasons of space and focus I do not discuss in detail how the conclusions drawn from research on international river management map onto the conclusions drawn from research on local common pool resources and international environmental regimes more broadly.

[310] In this example, the benefits each country can obtain range from zero to four. The benefits of the downstream country are depicted in the lower left corner of each quadrant, those of the upstream country in the upper right corner of each quadrant.

downstream country is to reduce pollution. The equilibrium in this game (i.e., the outcome of the interaction) is located in the field marked by an asterisk and consists of pollution reduction by the downstream country, but not by the upstream country.

In economic theory, problems of this nature are referred to as externality problems. In the case of international rivers, externalities are costs (though sometimes also benefits) that one player, in consuming water, which is a scarce natural resource, imposes on another player or on future generations. Externalizing consumption costs becomes possible when entitlements to quantities or qualities of water are not or only poorly defined, and no riparian player can, at acceptable cost, be excluded from using the river. These two circumstances create incentives for unsustainable use of water resources (referred to as "market failure" by economists) because those consuming river water do not incur the full cost of their activity. Game theory and collective action theory (e.g., Sandler, 1992; Ostrom, 1990) have shown that the infamous "tragedy of the commons" (Hardin, 1968) logic may also prevail in cases of symmetrically distributed externalities. Resources affected by this problem are often defined as common pool resources[311] (e.g., in global climate change, where virtually everyone pollutes everyone else). However, unidirectional externalities are particularly difficult to resolve. In game theory terms, unidirectional externalities are frequently deadlock games, whereas public goods problems are very similar to N-actor prisoner's dilemmas[312] (see also Waterbury 1997:280).[313]

Of the three research efforts examined in most detail in this essay, Durth's book provides the most rigorous argument as to when and why riparian countries are likely to overcome upstream-downstream asymmetries and engage in efficient co-operation. His principal hypothesis is that such problems are easier to solve when riparian countries are more "integrated" i.e., when the density of political, economic, and societal ties among countries is greater. He claims that efficient co-operation is more likely in more integrated settings because: (a) compensation of upstream countries, which is needed to motivate the latter to co-operate, is easier; (b) integrated settings enable riparian countries to make more credible commitments to one another because they interact in a larger number of policy areas; (c) information is likely to be more complete and evenly distributed; (d) notions of equity or justice are more likely to be congruent; (e) unequal bargaining leverage is mitigated by transboundary institutions, which also provide for more clearly defined, transferable property rights and lower transaction costs; and (f)

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[311] Common pool resources are resources characterized by 'non-excludability' and 'rivalry', i.e. everyone has access to the resource concerned, and the consumption of the resource by one actor reduces the opportunities for consumption by other authors. Fisheries are an example.

[312] In the prisoner's dilemma game, each country would be better off if all countries co-operated. However, the worst outcome for each country is if it reduces pollution whereas all the other countries do not. In this game, the inability of countries to credibly commit to co-operation produces an unco-operative equilibrium. Strategies for overcoming the prisoner's dilemma include co-operation in steps (notably, tit-for-tat strategies in iterated interactions) and the establishment of institutions that provide for monitoring and enforcement, which in turn enables countries to credibly commit themselves. See Sandler, 1992, Young, 1994.

[313] In most general terms, solutions to upstream-downstream problems can be achieved through coercion, compensation, issue-linkage, and changes in the group of participants and/or bargaining fora. See Bernauer, 1997:174-180.

opportunities for non-governmental (including private) players to influence outcomes are greater. As to the last item, Durth highlights two competing predictions. In integrated settings, one might expect international river commissions to lose importance relative to private players. One might also expect, however, that they could gain importance; governments may be more willing to establish, fund, and entrust such commissions with more substantive tasks because they have already lost their monopoly on transboundary information flows and negotiations, while countries in non-integrated settings have yet to lose that monopoly and are thus more likely to resist a transfer of authority.

Similarly to Durth, Marty claims that upstream-downstream externality problems are more difficult to solve than what he calls "collective problems" (the more common term would be common pool resources -- problems that affect all riparians similarly). He then concentrates on process variables that may enable riparians to overcome adverse problem structures. Most of Marty's arguments in this context, (e.g., on compensation of upstream externality producers and the reduction of uncertainty and transaction costs) are, in terms of their substance, very similar to those of Durth.. In contrast to Durth and Marty's work, Wolf adopts a predominantly inductive approach. He concentrates on "lessons learned" from studying 140 transboundary water treaties and 14 process case studies collected on the University of Alabama/State University of Oregon Transboundary Freshwater Dispute Database, as well as workshops with stakeholders and scientists that took place in the framework of the International Water Resources Association Committee on International Waters. Theoretical arguments about the success or failure of riparian co-operation appear at some points in the discussion of empirical results, but the author does not outline and then systematically test a specific set of propositions derived from social science theory.

In view of the large number of candidate explanations[314], possible interaction effects or colinearity of explanatory variables, and conditions exogenous to explanatory models that vary substantially across time or rivers, there is an evident degrees of freedom problem in every empirical analysis of international river management. Even if there were sufficient data on all relevant environmental and policy variables for all 261 international rivers – and we are still far away from having such a data set – the problem would be more than challenging. How have social scientists coped?

Using descriptive statistics, Durth examines whether riparian co-operation occurs earlier and is more frequent in more integrated areas of the world. The areas he examines are – in decreasing order in terms of integration – the European Union, the European Economic Area, all other European States, and Canada, Mexico, and the United States. His sample includes 127 agreements (involving a total of 35 countries plus the EU) from 1852 to 1992. He concludes that the evidence, especially for upstream-downstream cases, confirms his principal hypothesis. Plausible as these findings may be, they suffer from two shortcomings. First, as

[314] In an overview of the literature on international river management, Marty (1997) lists the hypotheses most frequently encountered. Explanatory variables include, for example: demand for problem-specific co-operation, a high level of regional integration, consensus on fundamental principles and norms, creation of win-win solutions, leadership commitment, availability of data and information, third-party assistance, issue-specific confidence building. See also Bernauer, 1997.

noted above, the dependent variable is measured in terms of treaty/no treaty with no reference whatsoever to the substance of co-operative arrangements. One way of reducing the risk that validity problems with the dependent variable bias the results would be to make sure that the "paper tigers" among the agreements analyzed are evenly (statisticians would prefer 'randomly') distributed across the four country groups and time. The author does not address this issue. Second, the analysis should have controlled for the number of international rivers in each country group, the extent of their utilization, and other factors. In the absence of these considerations, the reader is left to speculate whether or not the observed correlation between integration and the timing and frequency of co-operation is a function of exogenous variables; for example, the number of transboundary rivers or population density, the extent of industrial activity along these rivers, the level of economic development more generally, water scarcity, the number of countries involved, etc. One should also expect strong colinearity between the level of economic development, integration, and public opinion on environmental issues. Indeed, if one subscribes to the "environmental Kuznets curve" argument (e.g., WTO, 1999), public demand for environmental protection increases with the level of income, particularly as societies approach the so-called third industrial revolution (information technology boom, expansion of the services sector).

The results of Durth's qualitative case studies are more convincing. At the most general level, he finds that co-operation has been more successful in the case of the Rhine. International efforts on that river have indeed been so successful that the very interpretation by decision-makers of the problems to be solved has evolved from an upstream-downstream matter to a public goods issue.[315] Co-operation in the case of the Elbe was more successful, but only after the unification of Germany and when closer ties between the Czech Republic and Western Europe were established (equivalent to increased integration). International efforts on the Euphrates have failed all along. In his overall explanation of success/failure in terms of integration, Durth also adds a series of *ad hoc* explanations, including industrial accidents (e.g., Sandoz in 1986), political prestige benefits, and interactions between domestic and foreign environmental policy.

The most interesting findings emerging from Durth's case studies are arguably those that respond to why (rather than whether) integration increases the chances of solving upstream-downstream problems. First, because in more integrated settings countries find it easier to credibly commit to binding agreements, the Rhine riparian countries were able to move to more flexible forms of co-operation (notably the Rhine Action Program).

Second, compensation or transfer payments are used less frequently than initially assumed by Durth (and many others). Issue linkages to reduce or neutralize existing asymmetries in countries' expected benefits of co-operation appear to be easier to employ than direct transfer payments. While compensation seems to be a prerequisite for co-operation in non-integrated settings, it tends, in Durth's view, to

[315] See also Nollkaemper, 1996, who makes this point very convincingly. See also Holtrup (1999), who examines the Rhine and assesses the applicability of a similar management scheme to rivers in Center and Eastern Europe (Elbe, Oder, Weichsel, Bug, Nemunas (Memel), and Daugava (Düna)).

be less important in integrated settings.[316] Given that we do not have data of this nature for the total population of international rivers, such conclusions are very preliminary. Moreover, the even more interesting question, why compensation or transfer payments are rarely used in integrated settings, is not answered by Durth (or by others) and awaits further research.[317]

Third, Durth observes that norms of equity and justice have converged more strongly in more integrated settings, such as the Rhine case, where there has been a paradigm shift from "upstream-downstream" co-operation to ecosystem protection/restoration and the provision of a public good.

Fourth, efficient co-operation is more likely when information is more symmetrically distributed and institutional structures provide a better guarantee that agreed measures will be implemented (problem of clearly defined, enforceable, and tradable property rights). These conditions are met in decreasing order in the Rhine, the Elbe, and the Euphrates cases. The same holds for the hypothesis that co-operation is more likely and more efficient when risk perceptions and preferences regarding the timing of proposed solutions are similar and when there are fewer possibilities for threats as a bargaining tactic.

Fifth, in what at first glance appears to be a paradox, private parties find it more attractive in integrated settings to have governments represent their interests: one might have expected private action to gradually replace intergovernmental co-operation in more integrated settings. The theoretical explanation for this finding is that, in integrated settings, governments maintain certain comparative advantages in representing domestic interests abroad, while private players find it more attractive to resort to their respective governments because they now have more alternatives (e.g., lawsuits abroad, direct negotiations with foreign polluters) and can thereby reduce their political rewards to governments; in other words, asking the government to represent their interests abroad is becoming cheaper for private players. Again, the Rhine case provides interesting evidence supporting this proposition.

In conclusion, Durth's analysis is particularly commendable for going far beyond the usual hypothesis that better relations among riparian countries facilitate co-operation, and for showing systematically why and how closer ties among societies on international rivers make a difference.

Marty's five case studies lend support to the hypothesis that, *ceteris paribus*, upstream-downstream externality problems are harder to solve than collective (common pool resource) problems. In the Alpine Rhine flood control case, the bay villages of Hard and Fussach in the Austrian Vorarlberg, in association with some industry groups, complained that construction of a channel proposed by Switzerland would negatively affect them. In the Pancheshwar case, the Nepalese government did not expect any benefits from a joint project with India, at least not in the first phase of the process, and believed that all benefits from developing Nepalese water

[316] Bernauer (1996) shows that compensation or side-payments in international river management among highly developed countries have been extremely rare. Moreover, in the most prominent case to date, the Rhine chloride pollution case, this strategy has resulted in an inefficient and in many ways also ineffective solution to the problem.
[317] See Bernauer/Ruloff, 1999.

resources would flow to India. The seven US states in the Colorado River basin, as well as the Wellton-Mohawk irrigation and drainage district, rejected demands for a reduction of their salinity input because of high costs and alteration of existing water rights in favor of Mexico. The Mexican government rejected U.S. demands to invest more in sewage treatment in the city of Tijuana. In the Rio Grande flood control case, Mexico was somewhat less eager to solve the problem because of lower land values threatened by floods on the Mexican side of the river. In all five cases, there were some asymmetries that had to be overcome by riparian countries; however, asymmetries were less pronounced, and co-operation more easily obtained, in the two flood control cases (Alpine Rhine and Rio Grande) than in the three upstream-downstream externality cases.

Durth's focus on integration as the key condition for overcoming upstream-downstream problems produces a theoretically compelling, though empirically perhaps not very surprising, explanation. It also leaves the reader wondering whether all international river problems in less integrated parts of the world are necessarily impossible to solve. Marty's explanation focuses on "tools" for overcoming externality problems and is somewhat less compact and systematic than Durth's explanation, but it contains a number of empirically important and innovative insights that are relevant beyond the divide of integrated and non-integrated societal settings. It also directs our attention to variables that policy-makers can manipulate or improve on in the short- to medium-term, with evident implications for the policy-relevance of research results.

In contrast to Durth, Marty finds that concerns over equity (or fairness) may be equally intense in more integrated and less integrated settings; moreover, he shows convincingly that such concerns can arise and stall international efforts even when there is no substantial cost-benefit asymmetry in the material (economic) sense. This finding receives support from a recent book, edited by Blatter and Ingram (2001; see also Ingram and Blatter, 2000 and Blatter, 2001), in which the authors explore the range of subjective meanings and values that water has in different societal contexts. They claim that, in many places, water is essential for the existence and identity of social players and serves as a focal point for community building. They assume that when riparian players' connection to water is "essentialist" or even fundamentalist, policy processes "cannot be captured by game theory based on the assumption of strategic action. Neither perceived threats to national security nor fundamental value conflicts allow for 'rational' solutions like side-payments or package-deals" (Blatter and Ingram, 2001). Blatter and Ingram do not systematically test this hypothesis. The empirical evidence produced by Durth and Marty suggests, however, that fairness concerns of riparians that are unrelated to material (economic) costs or benefits can indeed complicate international efforts to resolve upstream-downstream problems through compensation, issue linkage, or other policy instruments. Marty proposes that joint research, joint development and implementation of solutions, jointly owned infrastructure, and third party input of know-how can help in overcoming such difficulties.

Another important finding by Marty is that cost-benefit asymmetries often exist at the local level, rather than at the national level of riparian countries. One of the key questions then concerns the conditions under which local interest groups are able to engage their respective national governments in international negotiations on the issue. The analysis of the Alpine Rhine flood control, the Colorado salinity, and the

Tijuana sanitation cases demonstrates that transforming an issue from an inter-local to an inter-national problem can foster progress in two ways: first, a wider set of possible issue linkages for changing the incentives of unco-operative players is available at the international level; second, national governments' capacity to fund projects is higher. The Colorado case testifies to both these mechanisms. Hardest to solve are, in Marty's words, problems plagued by a "double asymmetry", i.e., strong differences of interest between riparian countries and between local players and their respective national government. The Tijuana case comes closest to the "double trouble" situation, followed by the Alpine Rhine case in some phases of the interaction. In contrast to Durth, Marty finds that compensation of the more unwilling participants - either by national governments, other riparians, or third parties (e.g., non-riparian countries and/or international financial institutions such as the World Bank) - is crucial to co-operation in many cases.

5. DESIGN PRINCIPLES

The "real" success or failure in sustainably managing international rivers depends, of course, on more than whether or not riparians are able to sign treaties and establish international organizations (the outcome on which explanations discussed in the previous section focus). Policy-makers, in particular, will often be primarily interested in how co-operative arrangements should be designed so that they have a positive (problem-solving) effect on riparian behavior and the environment.

Again, this question is tied to a broader research program in political science, law, and economics, which examines the effects of variation in regime design on environmental policy outcomes. One line of research in this larger program concentrates on design principles that make for more successful management of common pool resources at the local level (e.g., fisheries, irrigation schemes, alpine meadows; see, e.g., Ostrom 1990). The second line of research, which in terms of theory is closely connected to the first (e.g., Keohane and Ostrom, 1995), examines the effects of variation in international regime design on problem solving (e.g. Haas et al. 1993; Victor et al. 1998). Marty's work draws quite systematically on this larger research effort, whereas Durth and Wolf refer to it only minimally.

Research on the effects of regime design on success/failure in international river management is hampered by three interrelated problems. First, the explanatory variables in this context (institutional design features) are analytical constructs with no objectively definable boundaries; co-operative arrangements may be characterized and compared in terms of an almost infinite number of features. Research on design principles in regard to local common pool resources and international environmental regimes more broadly (see above) has resulted in a wide range of candidate propositions (e.g., Young, 1999; Mitchell, 2001; Brown and Jacobson, 1998; Haas et al., 1993; Bernauer 1997). Yet, at this stage of the research program, it provides only vague guidance as to which variables are potentially the most influential in international river management. Second, the number of international rivers that have been studied in detail by social scientists is very small. Of the 261 international rivers (if one counted also smaller rivers or tributaries, there would be many more), around 20 have been subjected to intense scrutiny; but even those that have been studied in greatest detail, for example, the Rhine, Jordan, Danube, Colorado, Rio Grande, Nile, and Mekong, have not been systematically compared in larger number within a single analytical framework. The studies by Durth and Marty, and to a limited extent also by Wolf, are so far the

most substantial efforts of this kind.[318] Third, many of the features of co-operative arrangements studied so far do not vary much over time. These three problems (many explanatory variables, few cases, little variation over time) amount to the well known "too many variables, too few observations" problem.

The easy way out, one might assume, is to confine inferences strictly to the empirical observations in the analysis. While such findings may still appeal to policy makers interested in case-specific knowledge, they will be less attractive to social scientists interested in the development of generalizable theory; however, even inferences restricted to very few river management cases are problematic because contextual conditions (i.e., variables exogenous to the explanatory model) frequently vary substantially across cases and/or over time and are difficult to control.[319] More generally, emphasizing what social scientists call "internal validity" (fit between theory and observed/analyzed data) will often come at the expense of "external validity" (fit between theory and unobserved/non-analyzed data). Linking the validity of findings to dozens of contextual conditions characteristic of the cases analyzed will automatically make the findings less amenable to generalization. Emphasizing external validity without compromising internal validity tends to result in a higher level of abstraction of explanatory models, which implies reduced policy relevance of findings. In other words, there is no optimal solution to the problem. Each analyst must weigh the pros and cons of emphasizing internal or external validity with a view to the principal purpose of the analysis (e.g., theory building vs. policy advice).

In qualitative case studies, the most frequently used method in the analysis of international river management, these problem arise at the earliest stages in the research process. Whereas in multivariate statistical analysis certain algorithms permit researchers to isolate the effects of individual explanatory variables, qualitative case study research must do so through case selection (Mitchell and Bernauer, 1998). Researchers must conduct a quasi-experiment with the cases that nature and politics offer. Ideally, the cases to be analyzed must be selected so that there are at least as many observations (and if possible more) than values on the explanatory variables (the well-known degrees-of-freedom issue in statistics), and that conditions exogenous to the model to be tested remain constant. Unfortunately, nature and politics are,not as benign to social scientists as one might hope. To make things worse, qualitative case studies often involve an enormous amount of work, while offering no guarantee that, when the empirical work is done, all contextual conditions were in fact constant or could, in other ways, be controlled.

In view of these problems, orthodox methodologists are likely to give up and turn to other topics that are more accessible to statistical analysis. Others may convert to "post-positivist" approaches that have, in recent years, become fashionable in

[318] Those few works that have compared more rivers than Durth and Marty within a single theoretical framework rely on a rather cursory use of data from secondary sources (e.g. Haftendorn, 2000; Mandel, 1992).

[319] A very common problem in the study of international river management (and also other areas of environmental policy) is the focus on cases where policies were successful. Such studies are often prone to understating the importance of favorable problem structure and high willingness of riparian actors to pay.

some areas of the social sciences.[320] Fortunately, those few social scientists who have studied international river management have (thus far) not been deterred by these fundamental epistemological dispute, but have adopted a pragmatic position..

Concentrating only on those issues in international river management that lend themselves to statistical analysis would either force researchers to concentrate on very few (and perhaps not the most relevant) aspects of the overall problem, or it would force analysts to structure research at a level of generality and abstraction that does not capture the hearts and minds of practitioners. Durth's statistical finding, for example, that co-operation in more integrated settings takes place earlier and is more frequent. has virtually nothing to offer in terms of policy advice (e.g., try telling the Israelis and Palestinians to establish an EU-like setting in the Middle East to solve the Jordan River problem!).

Turning one's back on positivist social science and focusing on how riparian players attribute different meanings and values to water in specific contexts, thereby constructing their own identity and communities, may be helpful for better understanding the interests of different riparians in specific cases. Ultimately, however, "post-positivist" approaches cannot provide systematic answers to the questions pursued in this essay because they reject hypothesis-based empirical research designed to produce generalizable findings.

The works by Durth, Marty, and Wolf perform quite differently in light of these concerns. Marty pays more attention to case selection than the two other authors. In comparing the results of his case studies, he also makes an attempt to compare pairs of cases with most similar contextual conditions, e.g., the Alpine Rhine regulation and the Rio Grande rectification project. He also more systematically highlights the difficulties in comparing the cases analyzed and generalizing results than the other studies. Symbolized by a very specific problem in one case of international river management (pocket mice!), Marty discusses at considerable length and at the very beginning of his book, the issue of theoretically unexpected (or non-generalizable, random) events or developments that may affect river management. In the spring of 1994, when the U.S. and Mexican governments had finally agreed to solve the Tijuana sanitation problem by building a sewage treatment plant, there were suddenly rumors that an endangered species, *Perognathus longimembris pacificus* (or Little Pacific Pocket Mouse) might be present on the project site. Fortunately, an additional investigation showed that there were no pocket mice on that site, so the project could proceed. But what if?

Ultimately, and not surprisingly, none of the three authors (and none of the authors of other publications referred to in this essay) is able to fully cope with these methodological difficulties. All findings in regard to institutional design features and their effect on success/failure must, therefore, be taken with a grain of salt. Moreover, at this stage of research, any policy recommendations that flow from these findings cannot be more than preliminary suggestions. Because Marty's book contains the most extensive analysis of institutional design features and their effect

[320] Post-positivist approaches deny the usefulness of empirically testing hypotheses and striving for generalizable findings. They stress the singularity of political events and processes, relying on hermeneutic (interpretational) approaches. The most comprehensive research effort of this kind in regard to international water issues is Blatter/Ingram, 2001. See also Ingram/Blatter, 2000.

on success/failure in international river management, I concentrate largely on this publication.

The finding likely to spark the most debate among policy makers and ecologists is Marty's conclusion that integrated river basin management, though desirable in ecological terms, has in practice been a recipe for failure (see also Marty, 1997). He states that international river regimes that focus on a small number of core issues and detailed and operational regulations tend to be more effective. This conclusion is especially vulnerable to criticism by the large and strong community of integrated river management supporters because it suffers from selection bias: all cases studied by Marty are cases of specific (functional) river management. His claim would have been more defensible had he also explicitly studied attempts at integrated river management (e.g., those on the Zambesi or the Rhine).

A quick look at the evidence suggests that the history of international river management is littered with cases in which integrated river management schemes have largely failed (e.g., Gambia River Development Agency, Niger Basin Authority, Lake Chad Basin Commission, Kagera Basin Organization, Zambezi Action Plan; see Lee and Dinar, 1995). Though the total population of integrated international river management efforts remains unknown, it appears that failure is most common in sub-Saharan Africa. More sophisticated analysis of this proposition would need to take in to account the level of development of riparian countries, their geographic region, political stability, and other variables.

The ultimate test of Marty's claim would be to show that, in a range of empirical cases (including cases in the developing and industrialized world), policy makers engaged in efforts of integrated (or nonspecific) river management that ended in failure, that it would have been possible (given the bargaining situation, the particular 'win set', and other conditions) to have engaged in more specific (functional) river management, and that the latter approach would have been more successful. Needless to say, this is a heroic but necessary task. It will be instrumental in moving beyond simple claims about whether or not integrated international river management is useful, and towards more insightful arguments about the conditions under which integrated management can succeed.

Other design features Marty associates with successful river management include "feasibility" (match between objectives and available resources and know-how); "flexibility" (adaptive capacity of co-operative arrangements in view of changing interests of riparians and changing scientific knowledge and environmental problems); effective organizational structures (notably well-run professional international river commissions); inter-administrative relations (close ties between international river commissions and national-level authorities); and "openness" (involvement of non-governmental stakeholders and sub-national political units).[321]

The principal problem with all these findings with regard to institutional design features is the inability of Marty (and others working on this subject) to ultimately disentangle the effects of institutional features, such as specificity, from the effects of antecedent co-operation problems (e.g., upstream-downstream vs. common pool

[321] The list of institutional design principles discussed here is far from complete. For a more comprehensive overview of the relevant literature and the design principles discussed therein, see Marty, 1997 and Bernauer, 1997.

resources). Marty's research design rests on two assumptions he does not explicitly discuss. The first assumption is that the problem structure (e.g., upstream-downstream) as well as political efforts (negotiations among riparians) to deal with it result in a "win set" – the latter denotes the range of possible bargaining outcomes that each of the participants regards as preferable over the status quo (non-agreement). The second assumption is that policy makers can make better or worse choices within this win set. This analytical distinction is rarely congruent with the real world of politics. For example, lacking specificity that is associated with failure of the problem-solving effort may simply be the result of riparian countries' inabilities to come to terms with a difficult upstream-downstream situation, rather than inability of policy makers to get the institutional design right. In other words, we still do not know whether or not, in the Colorado salinity case for example, it was the upstream-downstream obstacle or the attempt of some policy maker to broaden the range of issues to be tackled that produced delays in solving the problem.

Verweij (1999, 2000a, b, c) and Tschanz (2001) are among the very few who have made systematic attempts to overcome such difficulties.[322] Both authors have focused on the effect of variation over time in one regime design principle on environmental outcomes in one international river management case.[323] While this approach does not permit generalizations beyond the case studied, it is commendable for its methodological rigor; it enabled the authors to focus on a single and important hypothesis while holding conditions exogenous to the explanation (e.g., the nature of the environmental problem, the number and level of development of riparians, the institutional setting) constant.

Verweij and Tschanz examine whether voluntary pollution reduction measures (notably in regard to heavy metals), adopted by industry along the Rhine, have been more effective than government-imposed national and international measures (notably, the Rhine Action Program and earlier agreements). Verweij (2000) claims that industry made large-scale voluntary investments in water protection and thus reduced water pollution *prior* to the imposition of reduction measures by governments and the Rhine Commission. Voluntary measures implemented by industry (in addition to domestic political measures) are, in his view, primarily responsible for the dramatic reductions in heavy metal and other pollution of the Rhine.

Verweij's conclusion rests primarily on data demonstrating the industry's massive overcompliance with international pollution control standards. Tschanz argues that Verweij's interpretation of the available data is, in part, incorrect. Correcting for such errors, he arrives at the opposite conclusion: that government-imposed measures (national and international) have contributed more to reducing heavy metal pollution of the Rhine than voluntary measures. Further analysis will be required to determine whose conclusions are, in light of the available evidence, more warranted. Findings of this nature are not only theoretically interesting, but also highly relevant from a policy perspective.

[322] See also Bernauer and Moser, 1996; Dieperink, 1998, 2000.
[323] Verweij's study also includes a comparison of the Rhine case to the Great Lakes in North America.

6. RESEARCH TASKS AHEAD

Natural scientists and engineers have provided some answers to when and why international efforts to solve transboundary river management problems are successful, when and why such efforts fail, and what success or failure means. But these answers remain incomplete without substantive input from the social sciences. While technical know-how and innovation are obviously crucial to successful international river management, success in this context is shaped primarily by political processes in which institutional arrangements are designed and implemented.

In this review essay, I have shown that social scientists have made considerable progress since David Le Marquand's influential 1977 book on the politics of international river management. This progress is particularly well reflected in books by Durth (1996) and Marty (2001), as well as work by Wolf (notably, 1997). As a result of this work, and other research referred to throughout this paper, we now have theoretically more sophisticated explanatory models and more robust empirical evidence. Durth and Marty, in particular, have contributed to improving on Le Marquand's rather eclectic explanatory framework. They have also gone far beyond earlier studies that focused mostly on "political will" as a catch-all explanatory variable for success/failure (e.g., Donahue, 1988:136; Biswas, 1977; Biswas, 1993; Linnerot, 1990; Nakayama, 1997). Their explanations include a more systematic distinction of different problem structures and their implications for the likelihood of international co-operation. They also provide a more sophisticated explanation as to the likelihood of overcoming adverse problem structures by means of specific policy instruments. Moreover, Marty, and to some extent also Wolf and Durth, explore the effect of variation in institutional design features on the success/failure of problem-solving efforts. In addition to progress on the theoretical side, researchers have produced a vast amount of new qualitative and quantitative information on international river management, primarily in the form of case studies.

As shown above, even the most sophisticated explanations still suffer from substantial deficiencies. These problems notwithstanding, time seems ripe to address what is perhaps the most important gap in the literature at this stage: the lack of large-N research on the basis of a single theoretical framework. Diagnostic, single case studies are certainly useful in developing theory; the same holds for small-N studies. Ultimately, however, probing the generalizability of findings requires larger-scale research guided by a single explanatory model. Large-N research will, moreover, help in addressing problems of selection bias, since a disproportionate number of cases studies have thus far concentrated on the more successful river management efforts.

Many researchers have stressed the importance of the following explanatory variables, thus providing a starting point for constructing an analytical framework for a larger-N project: the nature of externality flows (e.g., upstream-downstream vs. public goods); the extent of political, social, and economic integration between riparian countries; the level of economic development; the scope of co-operation (e.g., integrated vs. issue-specific management); number of riparian countries; involvement of NGOs and other non-governmental actors; extent of federal government and/or third party funding; application of liability rules; technical and political possibilities for monitoring compliance with agreements; endowment and

efficiency of international river management authorities; and political symbols and prestige effects.[324]

In designing a larger-scale project, researchers will also have to explore whether focusing on international rivers alone is sensible, or whether comparisons should, for example, be organized along environmental problems with a similar structure (e.g., upstream-downstream problems in a variety of environmental issue areas). Because existing data and expertise around the world are organized primarily in terms of environmental issue areas, I submit that it will be more productive (for pragmatic reasons) to focus on international rivers at this stage. This approach should not, however, preclude intense collaboration with researchers focusing on other international environmental issues, notably in regard to theory and methodology. Moreover, larger scale comparative research on international rivers should be co-ordinated with ongoing efforts to compare larger numbers of international environmental regimes in an effort to understand the determinants of regime formation and effectiveness. In particular, data collection in research on international river management should be designed in a way that also produces information on key variables in the broader research program.

In conclusion, social scientists have thus far examined only a fraction of worldwide international river management efforts; in fact, the total number of such efforts remains unknown. The opportunities for drawing on a huge reservoir of social science theories, constructing explanatory models, and applying them to international river management efforts around the world are almost infinite. Engaging in such research promises not only to produce new and interesting theoretical insights into the workings of international environmental policy, is also crucial from a practical viewpoint. If social scientists can contribute to a better understanding of when and why international river management succeeds or fails – and I believe they can – it is, from a normative viewpoint, more than appropriate for them to do so.

REFERENCES

See Thomas Bernauer, *Explaining Success and Failure in International River Management*. Aquatic Sciences 64 (2002):1-19 and www.bernauer.ethz.ch.

[324] Such variables could, for example, be organized into a coherent framework along the lines recently proposed by Ronald Mitchell (2001). Mitchell's framework includes regime design features, problem characteristics, context characteristics, and country characteristics. See also Breitmeier et al., 1996.

OPERATIONALIZING INTERNATIONAL LAW FOR TRANSBOUNDAY WATER RESOURCES

E. A. Abdelgalil*

Paper related to Poster

ABSTRACT

This paper is one of the first attempts to operationalise the 1966 Helsinki Rules on the uses of the waters of international rivers and the 1997 United Nations Convention on the law of the non-navigational uses of international watercourses. These two legal documents have laid down the rules of international law for sharing the waters of international rivers and generally define what constitutes a reasonable and equitable water share. The international acceptance of these legal documents, especially the UN Convention, renders them a useful starting point for discussing what comprises an equitable and reasonable utilisation of international watercourses. A simple and straightforward methodology of how to put these documents into practice is designed, using as an illustrative example the common water resources between Ethiopia, Sudan and Egypt. The analytical results of this paper can readily be translated into relevant information for policy making regarding the sharing of international rivers waters.

1. BACKGROUND

The Helsinki Rules of 1966 on the uses of the waters of international rivers, henceforth denoted by HRs, and the United Nations Convention[325] of 1997 on the law of the non-navigational uses of international watercourses, henceforth denoted by UNC, have set the general rules of international law for the use of waters of international rivers and generally define what constitutes a reasonable and equitable water share in the light of certain relevant factors. Article V of the HRs and Article 6 of the UNC have specified these relevant factors. According to these two legal documents, each basin country is entitled, within its territory, to a reasonable and equitable share in the waters of an international drainage basin or watercourse[326]. The two documents are almost identical when it comes to the relevant factors that are considered in determining what constitutes a reasonable and equitable water share. The two legal documents have made it clear that other relevant circumstances and factors should also be taken into account (ILA 1967 and UN 1997).

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[325] The UN General assembly adopted a resolution on the Convention on the Law on Non-Navigational Uses of International Watercourse by 103 countries in favour, 3 against, and 27 abstentions.

[326] According to Article II of the HRs, "An International Drainage Basin" is a geographical area extending over two or more States determined by the watershed limits of the system of waters, including surface and underground waters, flowing into a common terminus (ILA, 1967). And according to Article 2 of the UNC, "International Watercourse" means a system of surface waters and underground waters constituting by virtue of their physical relationship a unitary whole, parts of which are situated in different States, and normally flowing into a common terminus (UNC, 1997).

2. WATER DISTRIBUTION FACTORS

The following ten factors generally constitute what the HRs and the UNC have called relevant factors in determining a reasonable and equitable share of a country in an international river's waters:

1. Drainage basin area within a country (D)
2. Efficiency of water use (E)
3. Ground water resources (G)
4. Hydroelectricity generation (H)
5. Land under irrigation (L)
6. Population number (P)
7. Rainfall in space and time (R)
8. Surface water produced internally (S)
9. Use of water at present (U)
10. Economic growth (Y)

3. MODEL DESCRIPTION

In this model, a country's water share function can be stated generally as follows:

$$W = f(\mathrm{D}, \mathrm{E}, \mathrm{G}, \mathrm{H}, \mathrm{L}, \mathrm{P}, \mathrm{R}, \mathrm{S}, \mathrm{U}, \mathrm{Y})$$

Where the arguments of the general function are the water distribution factors. A country's water share is positively related to some distribution factors and negatively relate to others. The factors that have positive impact are the drainage basin area within a country (D), efficiency of water use (E), hydroelectricity generation (H), land under irrigation (L), human population[327] (P), surface water produced internally (S), use of water at the present (U) and economic growth (Y); and those with negative impact are ground water resources (G) and rainfall in space and time (R).

The model first group of equations comprises n individual equations for each sharing country. The second group of equations comprises m individual equations. The following are the model two groups of equations:

$$z_j = \left(\frac{x_j}{\sum_{i=1}^{m} x_j} \right)^{\alpha} \qquad j = 1,..,n \qquad (1)$$

$$W_i = \frac{1}{n} \sum_{j=1}^{n} z_j \qquad i = 1,..,m \qquad (2)$$

m Number of sharing countries
n Number of distribution factors

[327] Population are those of a whole country, and not only those who are living within a river basin. This is because people are constantly moving within their country and the government is responsible for the well being of its entire people.

z_j Share of the distribution factor j of a sharing country in total regional factor
W_i Water share of country i; i.e. average factor share across all distribution factors
x_j Distribution factor j of a sharing country

The first group of equations (1) states that the share of the distribution factor j of a sharing country, denoted by the small letter z_j, is the level of the factor x_j divided by the sum of that factor across all the sharing countries; the latter is called the total regional factor. There are n distribution factors for each sharing country and there are m sharing countries.

The sign of the parameter α indicates whether a certain distribution factor contributes positively or negatively to a country's water share. It takes the value of +1 for a positive relationship and the value of −1 for a negative relationship. When α takes unity that means all the distribution factors carry equal weights. Theoretically speaking, α can take a value of more or less than unity depending on the weights we assign to the different distribution factors. Since this weighting issue can be very controversial, it is not our intention to discuss it in this paper. Future research can shed light on how weights can be assigned to different factors[328].

The second group of equations (2) states that a country's water share, denoted by the capital letter W_i, is the average of all its factor shares across all distribution factors. In other words, a country's water share is the function of its individual factor shares.

In this model, we are not concerned with the water supply side and therefore we take it as given. The exogenously determined water resources of an international river represent 100 per cent, and as a result the individual water shares of the sharing countries must sum up to 100 per cent.

4. MODEL APPLICATION

Empirical data for Ethiopia, Sudan and Egypt is used to operationalise the model[329]. The computer software used for the model calculations is Microsoft Excel. The data we have used in this study is taken from two main sources. World Development Indicators (WDI) CD-ROM 2002, (World Bank, 2002). Food and Agricultural Organisation (FAO) Statistical Database on water resources, specifically AQUASTAT 2002 (FAO, 2002); and FAO Land and Water Bulletin 4, (FAO, 1997). The obtained results depend on the quality of the data that is used in the calculations, and therefore the results should be seen in that light. However, the contribution of this paper does not lie in the data and the results that depend on it, it is rather the

[328] The 1997 UNC is not helpful in this respect. In Article 6 (3), it states that the weight to be given to each factor is to be determined by its importance in comparison with that of other relevant factors, but how that "importance" is determined is not clear.
[329] At the UN General Assembly, Sudan voted in favour of adopting the draft resolution on the Convention on the Law on Non-navigational Uses of International Watercourses. Both, Ethiopia and Egypt have abstained. Ethiopia expressed its particular concern with Article 7 and Part III of the Convention. The former regards the "*Obligation not to Cause Significant Harm"* and the latter regards the "*Planned Measures"*. From the voting record, it is not clear why Egypt has abstained.

methodology used to arrive at these results. As the quantity and the quality of the data improve over time, more robust results will be obtained.

5. MODEL RESULTS

The results of the model are shown in figure 1 and table 1. In table 1, the plus and the minus signs, under the column heading relationship, indicate whether a certain factor is positively or negatively related to a country's water share. Regarding factor ranking, 1 indicates the top contributing factor to a country's water share and 10 is the least contributing factor. As it is mentioned before, the total water supply is fixed exogenously in this model and we are only concerned with the allocation of whatever water resources that are available and common to the sharing countries.

As it is mentioned before, in this model it is assumed that the drainage basin area within a country (D), efficiency of water use (E), hydroelectricity generation (H), land under irrigation (L), human population (P), surface water produced internally (S), use of water at the present (U) and economic growth (Y) are positively related to a country's water share; while the ground water resources (G) and rainfall in space and time (R) are negatively related to a country's water share.

As it is shown in figure 1, the common water resources between the three countries should be shared as 54% for Egypt, 23% for Sudan and 23% for Ethiopia; if the rules of international law of water sharing are applied. According to the 1959 Nile Waters Agreement (NWA) between Egypt and Sudan, 75% or 55.5 Billion Cubic Metres (BCM) out of the 74 BCM goes to Egypt, and 25% or 18.5 goes to Sudan, and nothing goes to Ethiopia since it is not part to that agreement. Assuming that about 85% of the 74 BCM is originating in Ethiopia (Swan, 1997; Waterbury and Whittington, 1998), then the water resources common to the three countries is 62.9 BCM out of the 74 BCM. Applying the water shares of this model to the latter figure, i.e. 62.9 BCM, and the NWA water shares to the remaining figure, i.e. 74-69.2=11.1 BCM, then Egypt gets 42.2 BCM, Sudan 17.5 BCM and Ethiopia 14.3 BCM respectively[330]. This leaves Egypt and Sudan with 76% and 95% respectively of their original water shares as they are determined by the 1959 NWA[331].

As table 1 shows, the top contribution factor to a country's water share is the large surface water produced internally (S) for Ethiopia, the large drainage basin area (D) for Sudan and the scarce rainfall (R) for Egypt. And the least contributing factor is the availability of rainfall (R) for both Ethiopia and Sudan; and the small amount of surface water produced internally (S) for Egypt.

Positively speaking, the results of the model sound plausible. This follows from the reasonable assumptions of the model. These assumptions, which reflect a country's water need and existing water use, are supported by empirical evidence from the literature on existing treaties of transboundary water allocations. In the 49 water treaties that delineate transboundary water resources, Wolf (1998) found there are

[330] Because of rounding up, figures may slightly be different.

[331] Whittington et al. (1995) offered some thoughts about how Ethiopia, Sudan and Egypt can share the Blue Nile water resources. But they have not used any objective criteria to arrive at the water shares that they have suggested, it is just what they thought as an advantageous reallocation of Nile water resources for the three countries.

trends that needs and existing uses rather than rights and future uses are emphasised in these treaties.

6. CONCLUSION

The operationalisation of the rules of international law for the use of waters of international rivers can give these rules life and offer some insights into what these rules mean in real life situations. It can also help riparian countries understand each other positions during water sharing negotiations and help the mediators to break the deadlocks between them and narrow the gap in positions. This paper is one of the first attempts to operationalise the generally agreed upon rules of international law regarding the uses of international watercourses.
The model, which assumes that a country's water share increases with drainage basin area, efficiency of water use, hydroelectricity generation, irrigated land, population, internally produced surface water, existing water use and economic growth; but decreases with rainfall and ground water resources gives very plausible results. And these results are substantiated by the literature on existing water sharing agreements between riparian countries.

The contribution of this paper does not lie in the data or the results that hinge on it, it is rather the methodology that used to arrive at these results. As the data improves quantitatively and qualitatively over time, more robust results can be obtained. Future research is needed for the refinement of the relevant factors and the weights they carry, and may be thinking of more new relevant factors.

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***Figure 1* : Water Shares**

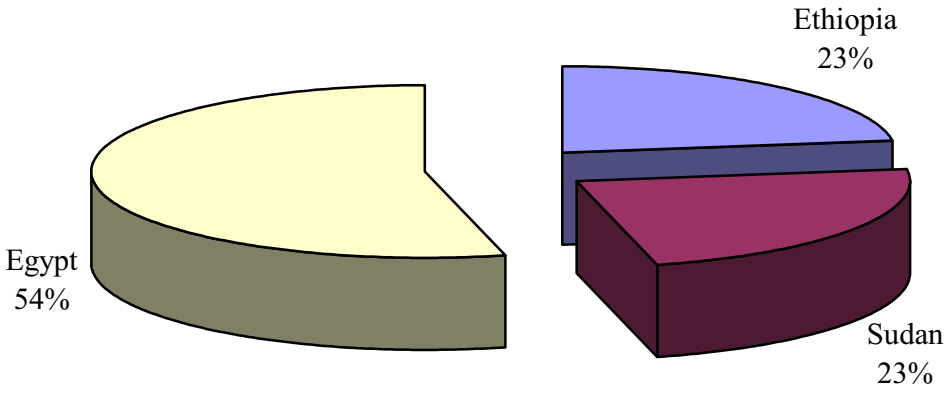

***Table 1*: Factor Ranking**

Factor	Relation ship	Ethiopia		Egypt
Drainage area within a country (D)	+	4	1	9
Efficiency of water use (E)	+	2	9	8
Ground water resources (G)	-	7	4	4
Hydroelectricity generation (H)	+	5	8	2
Land under Irrigation (L)	+	8	3	6
Population number (P)	+	3	6	7
Rainfall in space and time (R)	-	10	10	1
Surface water produced internally (S)	+	1	5	10
Use of water at present (U)	+	9	2	5
Economic growth (Y)	+	6	7	3

EUROPE'S TROUBLED WATERS
A ROLE FOR THE OSCE: THE CASE OF THE KURA-ARAKS[332]

Drs Marten van Harten[333]

1. INTRODUCTION

The current flood and drought disasters in European river basins have some traits in common: lack of transboundary water management, and the mixed heritage of the Cold War. The recent impact of the OSCE Economic Forum in the Southern Caucasus shows a good practice of addressing a worst case of water related threats to international security. It illustrates the need of third party engagement and responsive financing arrangements. A key role of the OSCE network is to facilitate citizens' diplomacy and inter-basin solidarity.

In policy debate on global water problems, there is a growing consensus on the principle that transboundary water resource management should be considered an international and regional public good 1). Thus the *UN Earth Summit on Sustainable Development* in Johannesburg devoted a special session on the need of new mechanisms for the provision of such a good, in the framework of the *Global Water Partnership* (GWP). However, the scope of debate tends to be limited to traditional relations between Western donor countries and development countries of the Third World. Problems in the 'new' transboundary river basins of the former Second World are still largely *terra incognita*.

The floods in the heartlands of Europe, threatening the cultural heritage of Prague and Dresden, dramatically illustrates that water disasters defy political borders as well as conventional division lines between North and South. In this respect, flood victims in the Elbe-Moldau basin share the fate of people living in the river basins of the Southern Caucasus or Central Asia who still feel the effects of the Asian drought disaster of Summer 2000.

In the emergency responses to the multi-billion floods damage, it was hardly noticed that an innovative mechanism for addressing transboundary water problems is already functional in the context of the *Organization for Security and Co-operation in Europe* (OSCE). In Prague, May 2002, the Tenth *OSCE Economic Forum* was devoted to the sustainable use and the protection of the quality of water, with a focus on South Eastern Europe, the Southern Caucasus and Central Asia. Steered by the OSCE Chairmanship and Office of the Co-ordinator of OSCE *Economic and Environmental Activities* (OCEEA), the Forum is devised as a permanent platform for early warning and confidence building.

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A key event in the Economic Forum process was the *Third Preparatory Seminar* in Baku, April 2002. For the first time since the break-up of the Soviet Union, an international high level meeting was addressing water problems in the Kura-Araks basin, shared by Georgia, Armenia and Azerbaijan 2). For estimating the results, one should take into account the extraordinary circumstances of the Seminar. First, water problems are hard to disentangle from the environmental effects of 15 years of armed and 'frozen' conflicts. Second, the scale of and urgency of the problems are in every sense of the word immeasurable. Latest measurements of water pollution and scarcity in the basin date from 1990, before the collapse of the Soviet monitoring system. In these respects the Seminar offered an occasion to Armenian, Azerbaijani and Georgian stakeholders, including first rank water experts, to restore contacts that were inhibited by blockades and burdened by experiences of war.

2. IRON CURTAINS

For understanding the obstacles to co-operation in European basins, we can draw some comparisons between the Kura-Araks and the Elbe-Moldau. Despite obvious differences, a connector is the mixed heritage of the Cold War:

- *Political*. Both basins were cut through by the Iron Curtain, fencing off the Soviet bloc from NATO allies West (Germany) and South (Turkey). Additionally, militarization of the Kura-Araks basin served the purpose of strengthening the vulnerable South Flank of the USSR in respect to the Near East. Especially since the Islamic revolution of 1976 in Iran, this became a priority internal security concern for Azerbaijan and other Muslim populated republics.

- *Environmental*. The scale of flood disaster in the Elbe-Moldau is comparable with the drought disaster in the Kura-Araks, in particularly in terms of incalculable economic and social costs to victimized people. A more poignant aspect is the lack of international and public preparedness. In both cases, early warning mechanisms of specialized agencies and environmental NGO's had failed to signal the high vulnerability of the basins to floods, respectively droughts.

- *Economical*. During the Cold War period, the Elbe-Moldau and Kura-Araks basins belonged to the highest developed industrial areas of the Soviet bloc. Especially in the Kura-Araks, water management arrangements served the needs of centralized command economy (hydro-electric power, large scale irrigated agriculture, etc.), with destructive effects for environmental sustainability and long-term water security.

- *Social-psychological.* At the level of societies, sensitivities in relations of co-operation are to some extend comparable. After the fall of the Iron Curtain, German-Czech relations continue to be burdened with deep-rooted problems of trust, touching upon the Sudeten question and the claims of hundreds of thousands of war displaced *('Heimatvertriebenen'*) and their descendants. For the Western public, this may be a key to understand Armenian-Azerbaijani relations, and the apparent intransigence of the Nagorno-Karabagh conflict, rooted in the terrors of the Soviet and pre-Soviet past.

One of the traumatic memories is mutual abuses of 'water weapons' during the armed confrontations of 1988 to 1994.

Viewed from this perspective, the Elbe-Moldau and the Kura-Araks can be both considered European basins, in the deeper sense that the problems refer to some of the darkest pages of European history. The key difference is that, while the Iron Curtain has been cleared first in Central Europe, it was fortified and extended in the Southern Caucasus.

Upstream the Kura-Araks, the 'old' Iron Curtain between NATO Turkey and Soviet Armenia now serves the Turkish-Armenian blockade. Along the Araks, military lines are marked by Turkish-Iranian and Azerbaijani-Iranian tensions, complicated by Russia's military presence in Armenia and Georgia, and the US embargo against Iran. Across the basin, a 'new' Iron Curtain of hundreds of miles of fortified trenches and minefields was built since the cease-fire in the Nagorno-Karabagh conflict, dividing the basin from the Georgian bank of the Kura to the Iranian bank of the Araks. Other pieces of 'new' Iron Curtain in the Southern Caucasus basins are the demarcation lines of the Georgian-Abkhasian conflict and, to a lesser extend, the Georgian-Ossetian conflict.

Obviously, the OSCE lacks mandate and instruments to deal with the full complex of water related security problems in this region, as the Iranian South bank of the Araks remains strictly excluded from any level of co-operation. The basic paradox in the Economic Forum process is that important transboundary rivers demarcate the OSCE space itself. As a North - South division line, the Araks resembles both the Abu Darya (Oxus) in the East, seperating the Central Asian republics and Afghanistan, and the Rio Grande in the West, seperating the US and Mexico.

Within these limits, the OSCE has a strong potential to further détente across the 'new' Iron Curtains, by reducing obstacles to co-operation on shared waters. There is a clear continuity between commitments in the environmental field in the 'old' Helsinki process since 1975, and growing priority concerns to address water related security threads in the 'new' Helsinki process of the1990's. The OSCE Seminars in Tashkent 1995-96, played a pioneering role in tackling the issue directly, as an approach to conflict prevention in Central Asia. In this process, the OSCE Seminar in Baku 2002, was an important next step for widening the regional scope of debate and action 3).

In the peculiar setting of Southern Caucasus conflicts CSCE/OSCE field presence, starting as early as 1992, predates the engagement of specialized UN, EU and bilateral agencies, which generally arrived after the consolidation of cease-fires and political stabilization in 1995. This presence has gradually expended, now including the *OSCE Mission to Georgia*, the *Personal Representative of the OSCE Chairmanship in Office on the Conflict dealt with by the OSCE Minsk Conference* and the *OSCE Offices* in Yerevan and Baku. Even more important than the political mandates is the field experience and political goodwill, gained during the past ten years.

In view of the limits of the Helsinki process, we can draw another comparison between the Elbe-Moldau and Kura-Araks basins. Responding to the *Helsinki Agreements* of 1975, the Prague *Charta '77 Appeal* became a starting point for 'détente policy from below'. People's diplomacy, most actively between citizens of

the Bundesrepublik, the DDR and Czechoslovakia, contributed to the peaceful breakdown of the Iron Curtain. The contacts between citizens - town to town, school to school, church to church - allowed dialogue on the more sensitive issues that still divide the local societies.

After the new Helsinki Agreements, the Prague Appeal of the *Helsinki Citizens' Assembly* (hCa) in 1990 promoted a wide range of civic initiatives across the new European conflict zones. In the Southern Caucasus, the *hCa Transcaucasia Dialogue* initiative connects groups in Georgia, Armenia and Azerbaijan, including Nagorno-Karabagh, since August 1992. The persistence of peoples' diplomacy in these complex societies shows the potential of 'détente policy from below', including the neighboring Russian, Turkish and Iranian societies 4).

3. REGIONAL PUBLIC GOOD

At the OSCE Baku Seminar, the local participants expressed a strong awareness of the wider regional and international context of water problems in the Kura-Araks. In particular the Azerbaijani host government underlined the importance of the rivers as part of the global heritage of irrigated agriculture and urban civilization in the 'Fertile Crescent' of the Near East, next to the Nile, the Jordan and the Euphrates-Tigris. As downstream country, Azerbaijan was also the first to ask for international assistance for restoring regional water management arrangements, during the First Water Forum in The Hague, March 2000. The Asian drought crisis, next Summer, gave an impetus to forms of co-operation at semi-official and lower political levels. Western donors and international agencies were, however, slow to perceive the reality of transboundary water problems and policy options.

Indicators of the situation are given in a study report of the *Overseas Development Institute* in UK and Dutch *Arcadis Euroconsult* for the Swedish Ministry of Foreign Affairs, which served as a reference for the Baku Seminar. As part of the Swedish *'Development Financing 2000'* project, the study started from the general policy debate, how public goods can be effectively financed. Analyzing the provision of transboundary water management as a regional public good, the study concluded that the Kura Araks stands out as a worst case, compared to other conflict prone river basins like the Mekong, the Jordan, and the Okovango-Incomati in Southern Africa, in the following respects 5):

- *Legal arrangements* for transboundary water management were lacking. The collapse of Soviet arrangements and infrastructure was aggravated by effective water blockades. A notable exception was a functional Azerbaijani-Iranian water distribution treaty, which helped to protect irrigated agriculture during the drought disaster of 2000.

- *Financing arrangements* were ineffective and counterproductive. Donors and agencies had spent multi-billion US$ for 'virtual water' (food aid etc.) and in-country arrangements, neglecting the provision of transboundary water management. Positive exceptions were mechanisms funded by the *US Agency for International Development* (USAID): the *Agricultural Co-operation and Development Initiative* (ACDI), supporting the emerging farmers' sector which served as an early action mechanism during the drought crisis in Georgia; and *Development Alternatives Inc.* (DAI), which pioneered in

furthering basin-wide water management arrangements through Trust Fund financing.

- *Civil society* played a key role in initiating transboundary arrangements, but was impeded by the blockades. Promising were the initiatives of *Regional Environmental Centers* (REC's) in Tbilisi, Yerevan and Baku, supported by the EU, for transboundary monitoring of water problems. At the grass-roots level, the hCa Transcaucasia Dialogue promoted a *'Trust Zone'* across the neighboring districts of Georgia, Armenia and Azerbaijan, including a joint proposal to restore water supply channels across the Armenian and Azerbaijani military lines.

- *Policy options* were extremely precarious, due to numerous political restrictions of mandates. The study recommended that European institutions should make proactive use of legal instruments like the *EU Water Framework Directive*. The Kura-Araks was seen as a clear example of the need to establish an *International Shared Waters Facility* (ISWF), for enhancing co-ordinated action of donors and specialized agencies.

4. THIRD PARTY ENGAGEMENT

Seen from this perspective, the OSCE Baku Seminar was a decisive breakthrough in two respects. In the plenary part, the visible presence of delegations of OSCE participatory states (24 of 55) enabled multi-stakeholder dialogue, including direct Armenian-Azerbaijani contacts. And in the closed workshops and informal fringe meetings, the participants widened the range of feasible policy options.

The significance of the international presence could be felt in the streets of Baku. Led by a political NGO, *Free Karabagh Movement*, demonstrators held a picket in front of the conference building but were dispersed by the police. According to local human rights observers, the striking feature of the protest was its peaceful character and the absence of anti-Armenian slogans. The demonstrators, mostly Azeri displaced people and veteran combatants from Nagorno-Karabagh, had announced in advance their intention to offer a petition to the Seminar participants about their land and water claims.

As it worked out, nationalist media highlighted the incident and the confused information induced both the Azerbaijani and Armenian delegations to take a tougher public stance. This did, however, not impede the practical work but rendered public presentation of Seminar results more difficult. In hindsight, in particular the Western participants missed an opportunity to listen to the displaced people as a civic stakeholder in the dialogue. Considering the high sensitivity of the Karabagh conflict, the restraint showed by the Azeri demonstrators was remarkable, especially if compared with the violent 'antiglobalist' protests that usually accompany high-level environmental meetings in Western cities. Paradoxically, the demonstration should be considered a positive signal of public acceptance of the Economic Forum process.

The constructive atmosphere of the work itself was furthered by the presence of committed external water experts, invited by the Vienna EEA office. In particular, the presentations by Prof. Aaron Wolf of *Oregon State University*, and Dr. Shaminder Puri of the *International Hydrologists Association* (IHA) shaped a

framework for comparative analysis, that helped to de-politicize the debate on the water problems in the Kura-Araks. By sharing practices from basins like the Colorado or the Indus-Ganges with the local experts, these were encouraged to move from mere exchange of information to discussion on common standards for information gathering. More than any détente on the official level, this confidence building step is crucial for overcoming obstacles to effective transboundary water management.

One of the basic lessons from the Baku Seminar was that local participants of the Economic Forum process do not need third party mediation. The external water experts did not act as mediators but as respected colleagues, applying the same working standards in the Kura-Araks as in any other river basin. They also granted continuity of the joint work, offering access to such important resources as the *Transboundary Freshwater Database* of Oregon University and the IHA *Joint Aquifers Commission*. As an immediate result, a project for water quality monitoring will be implemented after the Prague Economic Forum, with funding of the *NATO Science for Peace* Program and OSCE. In the same spirit, a study project was adopted, led *Helsinki Technical University* and support of the Third World Water Institute in Mexico, for joint analysis of the regional water security problems.

In this respect the OCEEA played an innovative role by facilitating inter-basin sharing of knowledge. The potential inputs were still higher as more experts were committed to take part, in particular from the Nile basin, which is considered a best practice of transboundary water management in a comparable complex of unsettled conflicts. The only constraint was the Seminar budget. In this respect, the donor countries that take part in the Economic Forum should consider the low costs of these inputs, compared to the high benefits of mutually accepted working standards.

5. CIVIC MONITORING

Benefits of the Economic Forum process can already be felt in the Kura-Araks basin at two levels: as inputs in the current programs of the major specialized agencies and as visible improvements in the situation of people.

Compared with the failed donor politics during the drought disaster of 2000, we can observe significant steps forward. The leading agencies are investing millions of US dollars and Euros in transboundary water management arrangements, with mandates that tend to be complementary 6). The mentioned USAID/DAI project is entering its operational phase, focused on water quantity monitoring. Various *EU Technical Assistance to the CIS* (TACIS) projects are being initiated, with a focus on water quality. And a comprehensive package of projects has been prepared for the *Global Environment Fund* (GEF) and the *UN Development Program* (UNDP), based on wide regional consent including Iran as full participant, and Turkey as observer. Also co-ordination has improved. The EU/TACIS project on Joint Rivers in the NIS, run by Arcadis Euroconsult, serves as an informal focal point for inter-agency consultation. Still, the agencies tend to underrate the OSCE/EEA inputs.

One of the immediate effects of confidence building at semi-official expert level is cost saving. Much of the program budgets of the specialized agencies spent for the transaction costs of reaching agreements. The $4 million size USAID/DAI project shows a still unique example of furthering initial water management arrangements,

through a painstaking process of identifying projects and implementers, engaging them in bilateral dialogue settings that avoid the sensitive issues, and shaping conditions for future bilateral co-operation. In the experience of DAI, TACIS and UNDP program officers, the critical point in building effective arrangements for water quality and quantity monitoring is to get undisputed figures. As the Arcadis Euroconsult team leader underlines*: "They still don't trust each other's sources of information without need of outside authorization".* In this particular respect, the engagement of Economic Forum participants in consensus building on standards is invaluable.

Additionally, we can observe that the strong field presence of the OSCE in the Southern Caucasus is still hardly used by the agencies. Again, the USAID/DAI project illustrates how the early warning capacity of the network of OSCE missions could help to reduce political and financial risks in practice. As a result of the first phase of the project, local subcontractors of DAI have identified districts where effective transboundary water management could start at bilateral level, with active multi-stakeholder participation. Experiences gained at the Alazani river, shared by Georgia and Azerbaijan and the Khrami-Debed river, shared by Georgia and Armenia, should shape optimal conditions for future arrangements in rivers, shared by Armenia and Azerbaijan. This cautious approach allows optimal political feasibility, but also entails risks related to the complexities of the project context.

The Alazani basin, close to the Russian /Dagestan border, is directly affected by the proliferation of the Chechnya conflict. Moreover, much of the environmental damage is caused by the spread of landmines. Upstream districts of the basin, densely populated by Chechen refugees, are practically a 'no go area' for international agencies, except for observers of the OSCE Mission to Georgia. Actually, Georgian-Russian tensions over the presence of Chechen fighters in Pankisi Valley are a matter of high level concern of the OSCE political bodies.

In the Khrami-Debed basin, close to the Turkish border, Southern Georgian districts include Javakheti, populated by ethnic Armenians and Meskheti, an area of prospective return of 'Meskhetian Turks', one of the deported peoples under Stalin's regime. Local land and water disputes touch upon national security concerns in Tbilisi and Yerevan, linking suspicions of alleged 'separatism' and the presence of Russian military bases. Tensions are further aggravated by the construction of the main oil pipeline between Baku and Ceyhan, bypassing Armenia for political reasons. The extreme sensitivity of the situation is a concern of the subject of the *OSCE High Commissioner for National Minorities* (HCNM), and projects for reduction of tensions are devised through the Georgia Mission.

Obviously, political monitoring mandates of the OSCE in these areas are restricted, and personnel capacities are limited to engage in environmental monitoring. But informal consultation with OSCE field officers could serve early warning on project risks, posed by the close inter-relations of local sensitivities and international politics. Moreover, technical monitoring of environmental and water problems by local expert networks as furthered by DAI and other agencies could be complemented with civic monitoring of the social and political tensions. For example, district offices of the hCa Transcaucasia Dialogue in Vanadzor (Northern Armenia), Ganja (Western Azerbaijan) and Telavi (Eastern Georgia), supported by the *Dutch Interchurch Peace Council* ((IKV), offer a strong potential for monitoring social tensions, parallel to the OSCE network.

6. WATER FOR WEAPONS

Even more than early warning, the key role of the OSCE network, and of the EEA mechanism in the Human Dimension offices is early action. A pilot project in Georgia, parallel to the Economic Forum, shows the potential of this mechanism.

As part of its political mandate, the OSCE Georgia Mission is counteracting the spread of weapons in the separated South Ossetia region. In this notorious area of trafficking and illegal arms trade, the OSCE refuses to buy up weapons and seeks alternative ways to compensate the people. As an example, the handing in of 38 anti-tank missiles was rewarded with three old computers of the Georgia Office, for use in local schools. An innovative step, early 2002, was a Water for Weapons project, providing the public good of effective water supply.

In Liakhvi valley, a minor branch of the Kura shared by Ossetian and Georgian villages, the OSCE Mission facilitated the cleaning of irrigation channels by local companies. The US$ 10.000 size project, sponsored by the UK Embassy /DFID fund, was extremely cost effective, as most was spent for operational costs (fuel etc.). After three months, sustainability was fully granted by inputs in kind of the villagers themselves. The main role of the OSCE Mission and Office was to assist in the legal arrangement, which demanded consent of the Georgian government, the South-Ossetian authorities, and the mixed Russian-Georgian-Ossetian *Peace-keeping Force*. Also, the OSCE took care of the handing in of weapons.

The financing of such initial arrangements comes close to a Trust Fund mechanism, as recommended in the above mentioned study report. In the view of OSCE officers in Georgia, this practice could be consolidated as a Rapid Reaction Fund, managed in close contact with the EEA Office in Vienna. The need of such a Fund is enhanced by the actual tendency in donor politics, to diminish Embassy funds in favor of longer term macro projects. In the context of complex conflicts and highly localized tensions, timely responses to political opportunities, and immediate visibility of results are crucial.

Although the OSCE Offices in Yerevan and Baku lack a mandate, a Rapid Reaction Fund could be most relevant for the zone of the Nagorno-Karabakh conflict, as well. For instance, in 2000 the above mentioned HCA Trust Zone initiative, the proposal for rehabilitation of water supply across the military lines was endorsed by local authorities at both sides. The mutual interest was obvious: the upstream Armenian district was affected by local floods and erosion, the downstream Azerbaijani district by drought and crop damage. Through the OSCE network, also the governments expressed interest, showing goodwill by humanitarian demining. But donor mandates fell short to sponsor the US $ 30.000 costs, and the political momentum passed.

7. BEYOND ALARMISM

During the preparations of the coming Chairmanship of the OSCE, the Dutch government expressed its strong concern with new economic and environmental threats to future peace and security in Europe: «*OSCE's network of field missions should be more attentive to these sources of conflict, thus further expanding*

OSCE's broad security concept» 7). In the context of the Southern Caucasus, two milestone events illustrate how this works in practice: the earthquake of 1988 and the drought of 2000. From both experiences we can learn about environmental causes of conflict escalation and proliferation, and about the risks of 'doing nothing'.

The earthquake disaster of December 1988 in Armenia's Northern districts (Gumri /Vanadzor) served as a catalyst of growing violent clashes between Armenians and Azerbaijani over Nagorno-Karabagh. More than the devastation as such, the chaos and confusion in the aftermath had a strong psychological impact, displaying the total breakdown of Soviet mechanisms for emergency aid and reconstruction. During subsequent hunger winters in Armenia, piece-meal international assistance failed to fill the gap, apart from Diaspora solidarity. Similar processes could be observed in Azerbaijan and Georgia, where widespread ecological damage (deforestation, water and soil depletion etc.) had been directly caused by Soviet mismanagement. In the three republics, this factor favored nationalist calls for economic self-sufficiency, viewing armed control over the water-rich regions of Nagorno Karabagh, resp. Abkhasia, as vital security interests. Indeed, neither the Soviets nor the West seemed to offer alternatives.

In the setting of 'frozen' conflicts, the drought crisis of Summer 2000 posed immediate threads of re-escalation and international proliferation of violence. The effects were most conspicuous in the relatively stable districts of Eastern Georgia, at the epicenter of the disaster zone. In July, the Georgian Ministry of Agriculture alerted the international community, pointing at the imminent destruction of over 300.000 farms and peasant households that would add to the current mass unemployment, food insecurity and social dissatisfaction. Western diplomats expressed concerns about probable peasant revolts and bread riots that might revive latent power struggles in Georgia. Ecological migration would aggravate the ongoing refugees crisis, and provoke a myriad of local land-water disputes, upsetting precarious ethnic-religious balances in the tense border areas.

Specifically, it was feared that uprooted peasants in the predominantly Muslim populated villages of Eastern Georgia would become targets for extremist propaganda and terrorist recruitment from Chechnya. Also in the arid districts of Western Azerbaijan, hundreds of thousands of displaced persons shaped a large potential for mobilization of irregular forces for the armed reconquest of Nagorno-Karabagh. The proximity of areas of tension in Eastern Turkey, Northern Iran and Central Asia – all located in the drought belt – enhanced the danger of growing inter-linkages with the hotspots and 'low intensity' conflicts of the Near East /Middle East.

This peculiar thread to international security risks is highlighted in recent publications on post-Cold War conflicts. Most explicitly, Robert Kaplan sketches a worst-case scenario of all-out terrorist warfare over scarce environmental resources, especially water. From an alarmist perspective, Kaplan assumes that the Helsinki ideals of democracy and human rights are 'illusionary' in the face of this danger, and recommends unilateralist US/Western geopolitics as the only alternative 8). However, the real development confirmed the conclusions of Aaron Wolf and other experts, that overt water conflicts are exceptional in vulnerable river basins. In the aftermath of the drought disaster, armed escalation and proliferation was still avoided by a combination of factors:

- At governmental level, the crisis tended to enhance political willingness of low-key co-operation for mitigating the effects;
- At the level of civil society, social cohesion and communal good-neighbor relations persisted in the disaster zone, posing constraints to extremist propaganda and recruitment.
- FAO donor appeals, although late and unbalanced (excluding Azerbaijani districts) offered visible protection to the emerging rural middle class of market oriented farmers 9).

From these past experiences we can draw the positive lesson that the key environmental thread to security is not water scarcity or damage as such, but the break of confidence in the provision of regional and international public goods. In the context of the Southern Caucasus the international and European community arrived late for gaining the trust of people. As an early player, the OSCE network of field offices best positioned to signal the risks of 'doing nothing', and the chances of preventive action. Obviously, a next drought disaster would bring Kaplan's worst case scenario of re-escalation of conflicts and proliferation of terrorist violence much closer. At the other hand, the effective provision of the public good of transboundary water management in the Kura-Araks would directly enhance international and European credibility 10).

8. INTER-BASIN SOLIDARITY

The recent *UN Earth Summit* in Johannesburg underlined the growing consensus, North and South, on the principle that transboundary water management is an international and regional public good. Measured by this standard, the OSCE Economic Forum process in the Kura-Araks can be considered a best practice in a worst case situation. A key of confidence building through the Vienna EEA mechanism is third party engagement, for sharing knowledge and experiences between conflict prone basins. The Netherlands, as the next OSCE Chair, is in a position to foster the effectiveness of this approach in various ways:

- To further co-ordination between the OSCE Economic Forum and specialized programs like EU/TACIS, GEF/UNDP and USAID/DAI, for furthering transboundary water management, including the Southern banks of the Araks river.
- To support the creation of International Shared Water Facility, in the framework of GWP, making good use of the field expertise gained by the OCEEA.
- To facilitate follow-up OSCE Seminars in the Southern Caucasus region, as a protective international setting for détente through direct semi-official contacts;
- To encourage specialized agencies to make good use of the early warning capacity of the OSCE network, complemented by civic monitoring;
- To strengthen the early action capacity of the OSCE Network by a Rapid Reaction Fund, in co-ordination with the OCEEA.
- To follow up early actions, such as the OSCE Water for Weapons project, with transboundary projects at the level of civil society.

In the latter respect, we can also draw a general lesson from the CSCE/OSCE process. Civil society in the Kura-Araks basin offers a strong potential for 'détente

policy from below', comparable to the active people's diplomacy across the Elbe-Moldau that preceded the fall of the 'old' Iron Curtain. The recurrent droughts and floods offer a basis for inter-basin solidarity between the affected societies. To address root causes of man-made environmental disaster remains finally the responsibility of citizens.

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2) Aaron Wolf, *'The Importance of Regional Co-operation on Water Management for Confidence-building: Lessons Learned'*, key address OSCE Third Preparatory Seminar in Baku, 15-16 April 2002, available through the Vienna EEA Office, website www.osce.org/eea.

3) Cf. *'The OSCE and the Environment 1975-2000, an Annotated Documentation of Selected Commitments, Decisions, Conclusions and Recommendations, elaborated in the framework of CSCE/OSCE Negotiating Bodies and Seminars'*, paper Center for OSCE Research (CORE), ibidem.

4) The concept of 'new détente policy' was adopted since 1995 in a range of informal high-level conferences on the Southern Caucasus, parallel to the diplomatic peace negotiations in the frame of the OSCE *Minsk Conference*, facilitated by the German foundations Friedrich Ebert Stiftung and Friedrich Naumann Stiftung (FES/FNS). A recent breakthrough of citizens'diplomacy was the Fifth General Assembly of International hCa in Baku, October 2000, devoted to '*Dialogue between Cultures and Civilizations*' with sessions on human rights, religion, environment, oil policy, etc. For the first time since ten years, a large delegation of over 50 Armenian society representatives took part, including 12 from Nagorno-Karabagh, with special permission and security guarantees from the President of Azerbaijan. For current events in the Caucasus and other conflict regions, hCa Electronic NewsSheet, edited by hCa France - Assemblée Européenne des Citoyens, Paris, email aec@globelnet.org.

5) Case study *'Transboundary Water Management', op. cit. note 5).* The study served as a reference for the Baku Seminar. Local experts showed peculiar interest in the methodology of comparative case study research, and the focus on analysis of financing mechanisms which values the inputs of riparian actors in functional water management arrangements.

6) Main documents in *'Water Management in the South Caucasus'*, USAID/DAI Seminar on Water Policy Issues, Tbilisi, July 2002. The reader also contains a comprehensive map of the Kura-Araks basin. Website www.wateriqc.org.

7) Cf. *'Reviewing OSCE: food for thought and some possible steps forward'* Dutch-German proposal, presented at the Round-table conference of the *Netherlands Helsinki Committee*, April 2002.

8) Cf. Robert Kaplan, '*The Coming Anarchy, Shattering the Dreams of the Post Cold War'*, New York (Vintage) 2000, p. 19f: *«It is time to understand 'the environment' for what it is: the national-security issue of the early twentieth century. The political and strategic impact of surging populations, spreading disease, deforestation and soil erosion, water depletion, air pollution, and, possibly, rising sea levels in critical, overcrowded regions like the Nile Delta and Bangladesh – developments that will prompt mass migrations and, in turn, incite group conflicts – will be the core foreign policy challenge..»* This alarmism is contradicted by Wolf, op. cit. note 2.

9) This was a priority concern of USAID /ACDI, as voiced by a senior officer in Georgia: «During the past years, donors have spent US$ 6 billion for keeping people 'Internally Dependent Persons', while our small credits for independent farmers have a pay-back rate of almost 100%.

10) A European approach to regional stabilization, including Russia, Turkey and Iran, is advocated by the Center for European Policy Studies (CEPS) in *'A Stability Pact for the Caucasus',* Brussels 2000. This document still lacks however a view on environmental and water issues. Interesting for assessing the social potential for such an approach is the early CEPS study of Shireen Hunter, *'Post-Soviet Transition in the Transcaucasus'*, Brussels 1994. She emphasizes the continuity of basically Iranian traits of the regional political culture: *".. in many ways the Communist system was also built on these traditional patterns and thus perpetuated the group-based system of political organization and essentially personal system of allegiance*."