Mediterranean Vision on water, population and the environment for the 21st Century

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Table of contents

List of countries and territories

The North or greater Europe:	**East :**	**South:**
Albania (AL),	Cyprus (CY)	Algeria (DZ)
Bosnia-Herzegovina (BA)	Israel (IL)	Egypt (EG)
Croatia (HR)	Jordan (JO)	Libya (LY)
Spain (ES)	Lebanon (LB),	Morocco (MA)
France (FR)	Syria (SY),	Tunisia (TN)
Greece (GR)	Territories under the Palestinian Authority: Gaza (GZ) West Bank (WE)	
Italy (IT)		
Malta (MT)		
Monaco (MC)	Turkey (TR)	
Portugal (PO)		
Slovenia (SL)		
F.R. of Yugoslavia (YU)		

Table of codes and acronyms

AEP	Alimentation en eau potable / Drinking water supply
CEDARE	Centre for Environment & Development for Arab region and Europe
CEMAGREF	Centre National de Machinerie Agricole, de Genie Rural, des Eaux et des Forêts (France)
CIHEAM	Centre International de Hautes études agronomiques Méditerranéennes
EU	European Union
ESMC	East and South Mediterranean Countries
IME	Institut méditerranéen de l'eau
IPTRID	International Program for Technology and Research in Irrigation and Drainage
GWP	Global Water Partnership
MCSD	Mediterranean Commission on Sustainable Development
METAP	Mediterranean Environmental Technical Assistance Program
MEDWET	Mediterranean Wetlands
MEDTAC	Mediterranean Technical Advisory Committee
MIO/ ECSDE	Mediterranean Information Office
0ECD	Organisation for Economic Co-operation and Development
RME	Réseau Méditerranéen de l'eau
PAC	Politique agricole commune de l'Union Européenne / EU common agricultural policy
MAP-UNEP	Mediterranean Action Plan – United Nations Environment Programme
SEMIDE	Système euro-méditerranéen d'information dans le domaine de l'eau.
UNESCO	United Nations Education, Sciences and Culture Organisation

Drainage canals and rice fields - Egypt.

Ph. : © Verseau

World Water Vision: its origin and purpose

Over the past decades it has become gradually evident for those directly involved that there is a chronic, pernicious crisis in the water world. The participants in the 1st World Water Forum in Marrakech in 1997 called for a World Water Vision to increase awareness of the water crisis throughout the population and develop a widely shared vision of how to bring about sustainable use and management of water resources.

THE WORLD WATER VISION draws on the accumulated experience of the water sector, particularly through sector visions and consultations for Water for People (or Vision 21), Water for Food and Rural Development, Water and Nature, and Water in Rivers. It draws on the contribution of regional groups of professionals and stakeholders from different sub-sectors that have developed integrated regional Visions through regional and national consultations in more than 15 geographic regions. As the Vision developed and evolved, more and more networks of civil society groups, NGOS, women, and environmental groups joined in and contributed to the consultations.

The participatory process that led to the WORLD WATER VISION makes it special. Since 1998, about 15,000 women and men at local, district, national, regional and international levels have shared their aspirations, as well as developed strategies for practical action towards the sustainable use and management of water resources. The recent availability of Internet communications made such a consultation possible in the short timeframe. This is not an academic exercise. It is the start of a movement. Over the coming months and years stakeholders will develop action plans to implement the recommendations of the World Water Commission and the strategies presented herein.

THE WORLD WATER VISION aspires to be an inspiration to women and men to overcome obstacles and achieve fundamental changes. Its message is for everybody, particularly for the leaders and professionals who have the power and knowledge to help people to turn visions into reality. It challenges those directly affected by the water crisis to initiate action and to call on their leaders to bring about sustainable water resources use and management.

The vision recognizes that is sustainable water resources use and management is to be achieved, people's roles must change. The main actors will be individuals and groups in households and communities who, with new responsibilities for their use of water and water-related services, form/are part of a collective strategy. Public authorities will need to empower and support them, and carry out the work that households and communities cannot manage for themselves. Water sector professionals and environmentalists will provide these stakeholders with the information they need to participate in decision-making and help implement their decisions. All these groups working together can achieve this Vision.

World Water Vision Unit.

Majorca, noria mechanism.

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Foreword

In 1975, when the Mediterranean countries, increasingly concerned by the damage being done to the sea, their natural link and common heritage, signed the Barcelona Convention and launched their "Mediterranean Action Plan" (MAP), they intended it to include an examination of the possibilities open to the Mediterranean Basin that would prompt a decision in favour of the sort of socio-economic development that would leave the environment unharmed.

This was the origin of the Blue Plan, a MAP regional activity centre which analyses and forecasts the relationships between the environment and development throughout the region and draws up proposals to be submitted to the different Mediterranean countries and to the European Commission. Its initial results, published in 1989, aroused keen interest in the Mediterranean area as well as at the 1992 Rio Conference. They revealed the extent to which trend-based scenarios could later give rise to problems and deadlocks and how vital it was to seek alternative scenarios more in line with the demands of sustainable development.

Prospective is an especially worthwhile and relevant discipline when applied to water, a basic element of most ecosystems and an essential asset for man and his various endeavours; but this resource is far from unlimited and must be effectively managed and preserved for future generations. This is an issue that takes on particular significance in the Mediterranean. In the majority of Mediterranean countries, water withdrawal is approaching the level of available resources, whilst demographic growth and economic changes are exerting increasing pressure on an area whose overall resources are already stretched to the limit. Consequently, we have reached a point at which traditional solutions - increasing supply - have lost any relevance they might once have had. New water policies, giving priority to better management and regulated demand need to be spelled out and brought into effect immediately.

This forward-looking initiative, conceived and implemented by the Mediterranean countries for more than 20 years, today forms the basis of work being carried out worldwide under the aegis of the World Water Council and the Global Water Partnership (GWP). The "Global Vision on Water, Population and the Environment in the 21st Century" is based on a series of regional exercises presented at the World Water Forum at the Hague in March 2000 together with two other global studies: "Mapping" (an analysis of strategic co-operation) and the "Framework for Action" (a strategic action plan).

The GWP has set up a number of technical committees to oversee the work in each of the regions. The Mediterranean Committee – MEDTAC – consists of 7 institutions or networks[1] , including the Mediterranean Water Institute, which provides the secretaryship, and the Blue Plan, which has been asked to prepare the "regional vision" presented below.

I would like to thank Jean MARGAT (advisor to the Bureau de Recherches Géologiques et Minières and Vice-Chairman of the Blue Plan) and Domitille VALLEE (Head of Studies for the Blue Plan) for their work in preparing this document, as well as all the Blue Plan members who contributed to it.

In order to obtain the opinions of the Mediterranean representatives, a number of regional meetings took place in 1999:

MEDTAC - Blue Plan

1 - IME, RME, CIHEAM-Institute of Bari, IME, METAP, MIO, Blue-Plan-MAP/UNEP.

- *Discussion of scenarios making up the regional vision of the Conference on " Water Security in the Mediterranean", Como, Italy, 15 April 1999, organised by the UNESCO with the support of the Blue Plan.*
- *Workshop on the theme "Water for Food and Rural Development in the MENA Region (Middle East and North Africa)", Bari, 28-29 May 1999, organised by HR Wallingford, CEMAGREF, CIHEAM IPTRID and the Blue Plan.*
- *Discussion: "Water for the People of the Mediterranean" at the General Assembly of the Mediterranean Water Institute, Montpellier, France, 18 June 1999.*
- *Discussion on the trends and future risks in the Mediterranean organised by the Blue Plan and held at the General Assembly of the Mediterranean Water Network and the Water Managers' Meeting, Malta, 4 July 1999.*
- *Discussion on the Mediterranean scenarios during "The 9th Stockholm Water Symposium, 9-12 August 1999.*
- *Presentation of the draft regional vision to the 2nd Euro-Mediterranean Conference on Local Water Management (Turin, 18-19 October 1999) and the 11th Meeting of the Contracting Parties to the Barcelona Convention (Malta, 27-29 October 1999).*
- *Mediterranean experts written consultation.*

Despite the short preparation period and limited means available for this exercise, we were nevertheless able to gather precious opinions and comments which allowed us to progressively enhance and develop this document, which was initially based on the work, experience and documentary resources of the Blue Plan. I would like to thank all the experts who made a great contribution to the final result.

During the different consultations, a large number of Mediterranean representatives emphasised the need to take full account of local and national visions. The regional vision is simply insufficient and one can only urge the Mediterranean countries to carry out national and local exercises enabling them to draw up action plans. These plans should be designed to provide a more operational follow-up to the decisions made in November 1997 in Tunis, when they adopted the recommendations on water demand control made by the MAP's Mediterranean Commission for Sustainable Development (MCSD). In this respect, it is very reassuring that demand control and the drawing up of both local and national scenarios are among the priorities upheld by the Euro-Mediterranean partnership (after the Turin Conference), and that these priorities may again be highlighted at the Forum in The Hague.

Michel BATISSE

Chairman of the Blue Plan
for the Environment
and Development
in the Mediterranean

Introduction

Mediterranean countries are undergoing intensive demographic, social, cultural, economic and environmental changes. Where will these changes lead? What lies ahead for the Mediterranean countries? How will they confront the ever-increasing difficulties encountered in managing water and aquatic ecosystems?

This document aims to answer some of these questions by investigating several possible future scenarios. Thus, this exploratory work seeks to highlight "**the unsustainability" of development processes**, which do not readily anticipate the risks of disruption, and to suggest the path to follow in order to shift from **unacceptable to desirable development.** This document should be used as a basis for analysing future problems and seeking appropriate solutions.

Before investigating the different scenarios for the future of the Mediterranean region, it is important to specify the context in which this vision stands.

The Mediterranean region

The Mediterranean is one of the rare borders in the world that separates two adjacent areas with opposite demographic characteristics and contrasted levels of development. This region, through its diversity, is representative of the rest of the planet and is thus a life-size laboratory for the World Vision exercise.

The Mediterranean region considered here includes 25 countries or territories bordering the Mediterranean Sea. Three sub-regions were identified in order to make comparisons easier:

- the **North** or greater Europe: Portugal, Spain, France and Monaco, Italy, Malta, Bosnia-Herzegovina, Croatia, Slovenia, F.R. of Yugoslavia, Albania, Greece;

- the **East:** Turkey, Cyprus, Syria, Lebanon, Israel, Palestinian territories of Gaza and the West Bank, Jordan;

- the **South:** Egypt, Libya, Tunisia, Algeria, Morocco.

Active regional cooperation

For thousands of years, there have been strong bonds between the peoples of the Mediterranean, due to the geography and history linked by a common sea. Despite political, economic, and cultural differences, they have understood that their destiny lies in solidarity and, in particular, that joint action is imperative to prevent the deterioration of the environment in which they live.

Since the nineteen seventies, the Blue Plan, under the auspices of the Mediterranean Action Plan of the United Nations Environmental Program, has sought to identify, through systemic and prospective analysis, the possible changes in relationships between populations, natural resources, environmental conditions and development sec-

Newspaper clipping.

Source : Jean Margat.

tors throughout this undeniably specific region. Since this time, the countries themselves have been engaged in forecasting and long-term planning efforts.

The work of the Blue Plan clearly shows that stability and prosperity in this region are based on a better consideration for environmental and water management issues as well as on closer co-operation between the Northern developed Mediterranean countries and developing countries in the South and East of the Mediterranean (Grenon and Batisse, 1989). The Euro-Mediterranean Declaration of Barcelona in November 1995, followed by the Euro-Mediterranean conferences in Marseilles (November 1996) on water management, in Helsinki (November 1997) on the environment, in Stuttgart (1999) and in Turin (October 1999) on water, are important steps in the development of this vital solidarity.

Preparing the regional vision

This vision explores several possible scenarios for water management development. Three contrasted scenarios[2] prepared at the world level by a panel of experts were submitted to the World Water Vision. They were later adapted to the Mediterranean context. The scenarios for 2010 and 2025 are the following:

1. The “Conventional Mediterranean”, where trends continue at a moderate rate.

2. The “Mediterranean in Crisis”, where trends are exacerbated

3. The “Sustainable Mediterranean”, with determined policies for sustainable development.

This vision for the future of water in the Mediterranean region is largely based on the prospective studies of the Blue Plan, published in 1989 and updated in 1996, the Blue Plan scenarios having, in many respects, prefigured the world scenarios. Moreover, this Vision also benefited from contributions of the MEDTAC networks, the Vision Unit and sectoral consultations (Water for Food, Water for Nature, Water for People);

These scenarios illustrate a variety of hypotheses for the future and the existence of various types of future development. Such a macro-economic approach inevitably blurs the very contrasted situations within the sub-regions and countries themselves. Nevertheless, it serves to highlight the stakes (whether in space or time) involved in water management for Mediterranean people.

The Mediterranean experts who met during these consultations emphasised the need to rely on local and national visions, to move beyond narrative reports, and to quantify the goals to be reached and their future impact. Such goals should be defined in the countries themselves by the appropriate government authorities and administrations, with the support of local populations and users.

We hope that this work at the regional level will stimulate similar exercises at local and national levels.

2 - This exercise used the global scenarios initially put forward by the Global Vision “ scenarios ” panel. A second generation of scenarios was developed after work on this report began, too late to be fully incorporated into this document.

Structure of the document

The study of possible future scenarios for water must not disregard either the important, permanent, specific characteristics of the Mediterranean world or contemporary trends in terms of change. Chapters 2 and 3 give a brief overview of these specific characteristics and trends. The deliberately contrasted scenarios, adjusted to the World Vision scenarios, are described in Chapter 4. To conclude, this document puts forward the main ideas and guidelines, which should allow recommendations to be made.

Bosphorus, Turkey.

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Mediterranean permanence

Projected or anticipated future scenarios for water in the Mediterranean region will in all cases be strongly influenced by the permanent physical and human features of the region, by the nature of Mediterranean water resources as well as by the dominant characteristics of water saving in this region.

PHYSICAL AND HUMAN SETTING

Mediterranean regions share between them and also with the rest of the world a series of environmental and development problems, in particular concerning the management and development of water resources and the control of water pollution. Nevertheless, there are certain major contrasts between the two shores of the basin that influence the way in which these issues arise.

Demographic burden

Population issues are the dominant factor in economic, social and environmental changes. According to United Nations (UN) estimations, the total population of the region will rise from 420 million inhabitants in 1995 to 446 million in 2000, to 508 – 579 million in 2025.

Within one generation, the total population in the Eastern and Southern countries tripled, and in 1995 it was over 223 million, whilst the population in Northern countries tends to stabilise or decrease. Nevertheless, a drop in the fertility rate has been noted in the South and the East.

We are therefore confronted with two fundamentally different dynamics. A young and rapidly expanding population in Southern and Eastern countries, and an ageing population with low growth rates in the North. In some countries, like Italy for example, upper limits have been reached and the population is now decreasing. These changes have an important impact on employment, food supply, the financing of pensions and health care charges, land use planning, environmental pressure, pollution and of course on water demand.

This demographic change is exacerbated by increasingly intensive urbanisation, causing a higher concentration of population and activity, particularly in coastal areas.

Level of economic development

There is also great economic disparity between the Northern and Southern and Eastern countries: 90% of the overall GNP of all the Mediterranean countries ($ 4000 billion in 1995) is produced by the five EU countries alone.

This situation results in sharp contrasts in investment capacities at a national level, and thus the need for the poorest countries to appeal to external sponsors. Moreover, national investors have differing approaches: in the South and East, private investment is made either in housing or in businesses abroad…

In addition, the level of foreign investment in the Southern Mediterranean countries is low and on the decline; today this represents only 2% of total worldwide direct investment made overseas[3].

3 - Comments by Ms Walker-Leigh, Malta, December 1999.

Alexandria - Egypt.

Ph. : © Verseau.

Living standards

These demographic differences go hand in hand with another equally sharp North-South contrast in terms of living standards. The per capita GDP is about thirty times higher in the Mediterranean area of France than it is in Egypt, or ten times higher in Italy than in Algeria. The gap between the North and the South-East (and some of the Balkans countries) is widening even more due to the populations' poverty level. When calculating "human poverty indexes", the UNDP established a set of criteria for developing and developed countries in which poverty groups exist. In 1997 the poverty indexes in some of the Southern and Eastern countries ran from 10% in Jordan to more than 34% in Egypt or 40% in Morocco.

This economic context intensifies the phenomenon of migration from South to North. Migration is part of Mediterranean history, but population flows were not always as significant, nor did they occur in the same directions; for a long time since the beginning of the Century, migration from South to North increased, but since 1970 this had tended to decrease and stabilise.

Physical setting: strengths and weaknesses

The common feature of the so-called "Mediterranean" climate is a dry, more or less long summer, which creates major irrigation needs. However, here too, there is a sharp contrast between the Northern coast (including Turkey), backed by temperate regions which supply it with abundant water resources, and the Southern and South-Eastern coasts, adjacent to dry and desert areas with very limited water resources (with the exception of Egypt with its Nile river feed from the tropics).

WATER ABUNDANCE AND WATER SCARCITY COEXIST IN THE MEDITERRANEAN REGION

Mediterranean water resources are limited, fragile and threatened. They are already intensely utilised, especially in the South and East, and they are often badly utilised. Natural input (renewable water resources) is shared very unequally between countries and populations: (72% in the North, 23% in the East, 5% in the South[4]). Moreover, their distribution on a domestic level, which determines each country's degree of independence as regards water resources, is also very uneven (fig. 1).

This input is also subject to a very irregular time scale, and generally tends to be very low. Mediterranean water resources are particularly sensitive to drought. During the dry years which occur approximately every ten years, natural input can be as low as a third of average input (Box 1). Also, the mobilisation of surface water requires the construction of costly regulatory storage systems (dams – reservoirs) of unequal feasibility and sustainability.

The scarcity and disparity of water resources are:

- exacerbated by the **different levels of usability** – and therefore mobilisation costs – and particularly environmentally sustainable usability. Water quality also differs. Only a part of natural water resources can be contained and utilised. Basin management is generally recommended but is not common practice; it is unsuitable for arid areas (with no functional basin), large karstic zones or highly fragmented basins.
- intensified by the threat and impact of human activity which disrupts water regimes and leads to a deterioration in water quality, and also by the vulnerable

4 - Countries are considered in their entirety, and since many of them stretch to the North and East beyond the Mediterranean basin and the Mediterranean climate region (Spain, France, Portugal, Turkey, F.R. of Yugoslavia...) this naturally accentuates the contrast and imbalance in resources between the countries.

nature of some chronically over-utilised resources: salinisation of coastal aquifers (Spain, Israel…), and even the disappearance of sources (Tunisia);

- made more complex by **partitions** between numerous countries (the Balkans, the Middle East, the Nile basin).

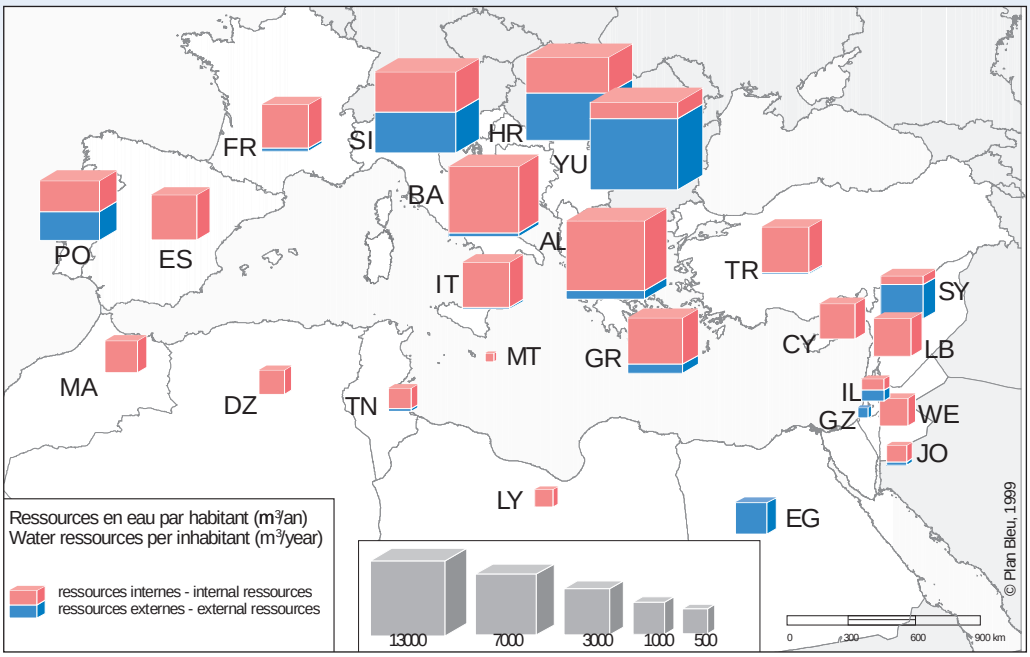


Figure 1: Natural water resources per capita in Mediterranean countries and territories (from national sources and using 1995 population figures).

Box 1: Drought: a Mediterranean speciality

Temporary droughts can be defined as lower than average precipitation of varying severity, duration and scale.
In the Mediterranean region, their consequences are particularly severe, both for:

- water resources, where they lead to a deficit in the rainwater and snowmelt input in winter and spring;
- soils and agriculture when normal summer drought is exacerbated.

Nearly everywhere, relatively severe yearlong droughts occur at least every ten years. Consecutive drought years are not infrequent in the Mediterranean. They aggravate the situation, causing water reserves in soils and subsoils to dry up.
During the last few decades, most Mediterranean countries have experienced memorable long-term droughts, for example: 1980–85 in Morocco; 1982–83 in Greece, Spain, Southern Italy and Tunisia; 1985–89 in Tunisia; 1988–90 in Greece; 1988–92 in Mediterranean France; 1989–91 in Cyprus; 1990–95 in Spain and Morocco; 1993–95 in Tunisia; 1995–96 in Sardinia; 1995–98 in Cyprus… This list is far from exhaustive.

The ecosystems formed by aquatic environments and wetlands, associated with permanent river or lake water, are just as unequally shared, rare and fragile in the Mediterranean region, especially in the South. Their ecological value – particularly that of wetlands, which for a long time were branded as unhealthy zones – has finally been recognised. However, they cannot be evaluated purely in economic terms.

The will to preserve the ecological functions of permanent water resources, which are so rare, requires an integrated approach to land use and water management at the drainage basin level. This implies that certain conditions be respected for the sustainable use of water as a resource as well as an environment for receiving wastewater discharge.

The Mediterranean area's natural water is not only threatened, it is also threatening. Floods caused by violent surges in Mediterranean watercourses, as well as landslides and mudslides caused by extreme rainfall levels, represent the main risk of natural disaster in the region. Moreover, these risks are amplified by the growing concentration of population and human activity in exposed areas. During the 20th Century, at least fifteen floods each took more than 100 to 1000 victims[5] in Mediterranean countries. Preventing these risks is a major objective of water management, along with the mobilisation of resources in a large number of Mediterranean basins.

Natural water also attacks the environment. Soil erosion caused by rainfall and uncontrolled run-off has been a constant problem in a number of Mediterranean basins, where it serves to increase the irregularity of water flow.

WATER PLAYS AN IMPORTANT ROLE IN THE LIFE AND ECONOMY OF THE MEDITERRANEAN POPULATION

Rising demands

In this context of scarcity, the Mediterranean demand[6] for water is high. Today, the region uses around 300 billion cubic metres, broken down as follows (cf. the data for each country from national sources, presented in the table in Appendix 1):

Table 1.
Current sectorial water demand in the three sub-regions.

Sub-regions	Water use sectors* (km³/year)				
	Communities	Agriculture	Industry not supplied	Energy power plants	Total
North	23	65,5	20	47	155,5
East	7,5	43	4	0	54
South	7,5	72,5	8,5	0	88,5
Total	38	181	33	47	299

*This does not include the costs of incidental development and evaporation loss from reservoirs, which is considerable, even in Northern countries (700 million cubic metres per year in France and 1,500 in Spain).

5 - A. Villevieille, *Les risques naturels en Méditerranée*, Blue Plan booklet, 10, 1997.
6 - Demand for water supply, including water losses in the transport and distribution system.

Two out of three Mediterranean countries now use over 500 cubic metres per year per inhabitant – mainly because of intensive irrigation. But these per capita demands are irregular and extremely varied – from a little over 100 to more than 1,000 cubic metres per year (see Table in Appendix I).

Generally, demand has doubled since the beginning of the 20th Century and increased by 60% over the last 25 years. These changes vary according to the different countries (Figure 2):

- Demand is growing very slowly and tending to stabilise or even fall in Northern countries (in line with demographic changes) and in some Southern countries (where demand is regulated due to water shortages – Cyprus, Israel and Malta: see Box 2).
- Demand is growing in the other countries but actually falling on a per capita basis. However in some countries demand per inhabitant is still growing – either because demand is still low (Algeria) or because water development schemes and particularly irrigation are developing more rapidly than the population itself (Lebanon, Libya and Turkey).

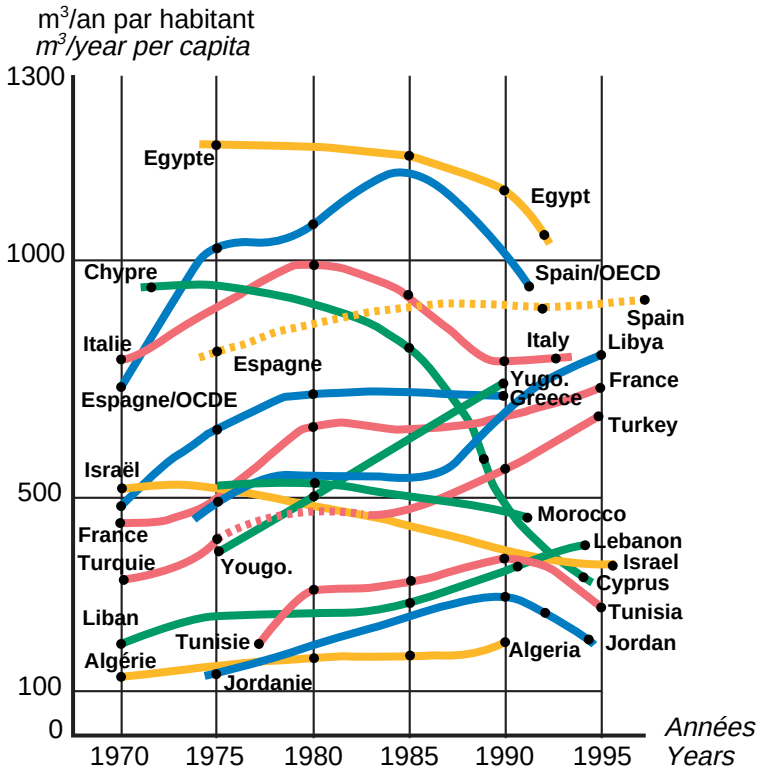


Figure 2:
Changes in water demand per inhabitant (for all uses) in recent decades in Mediterranean countries in m³/year.

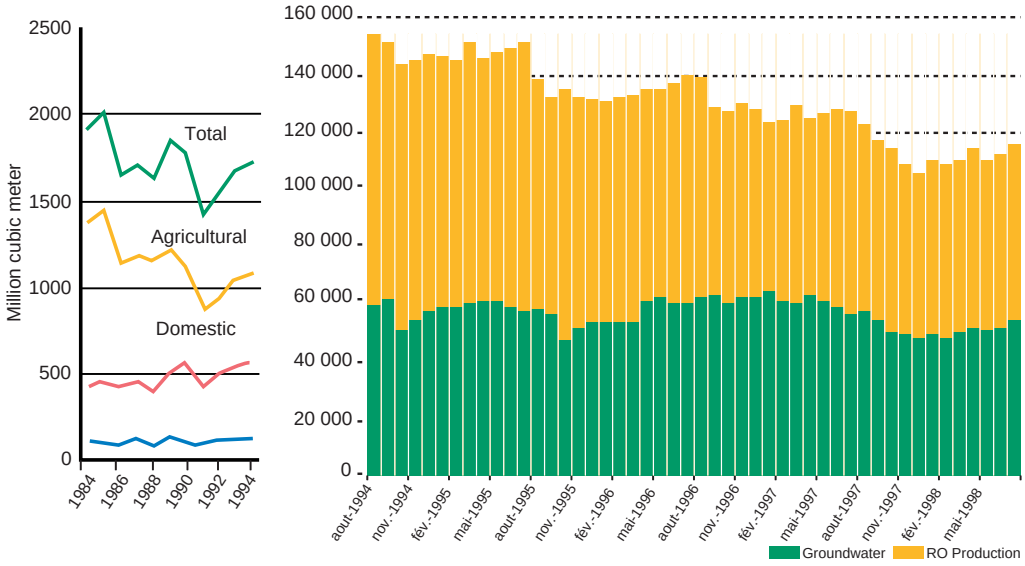
Source: based on national statistics. The lack of coherency in some national or international statistics on changes in water demand, notably in Europe, at times makes it impossible to establish a reliable time series for this index. This is particularly true of Spain, where national statistics do not correspond to those published by the OECD and are therefore presented separately.

Box 2:
An emerging trend: a fall in water demand

A decline in gross water demand (i.e. the production of water required), particularly in agricultural irrigation, began at the end of the 20th century in several Mediterranean countries whose conventional water resources were "exhausted". In Cyprus, the quantity of water used fell by more than half between 1985 (540hm3/year) and 1998 (235 hm3 /year), while in Israel demand fell from 2,000 hm3/year in 1985 to less than 1,500 in 1991, before rising to 1,700 in 1994(1). In Malta, total water production (including desalination) fell from 47.2 hm3/year in 1992-93, to 40.8 in 1997-98(2).

On the left: Israel. Changes in water demand from 1984 to 1994 (1).

On the right: Malta. Changes in water production from August 1994 to July 1998 (2).
RO: Reverse Osmosis



These reductions are due to a combination of water saving efforts, particularly increased efficiency of use and the reduction in losses during distribution. However, figures will tend to stabilise once maximum savings have been reached in terms of use and transport. This stabilisation will be followed by a period of slow growth, corresponding to the growth in non-conventional water production.

Note that these trends are apparent in relatively developed countries, able to bear the costs involved in water saving programmes and non-conventional water production. This will not be easy to transpose to other economic and social contexts.

(1) Israel Water Commission, quoted by H. J. Bruins, 3rd Conf. Internat. Gestion de las sequias, Valencia / IIIe Milenio, UNESCO, Dec 1997.

(2) Malta, Water Serv. Corp., Annual Report 1997-98.

Specific characteristics of water saving

Two **seasonal uses** accentuate the fluctuation in demand throughout the year:

- **Irrigation**, which is required nearly everywhere for agricultural production, is the **predominant** sector of use in most countries (with the exception of France and the Balkans). Overall, this represents 60% of total water use, but in the Southern countries this figure reaches 82%. The major demand for irrigation water is concentrated in a few months of the year when input is low or non-existent, increasing the need for regulatory storage.
- **Tourism**, which is steadily developing (the Mediterranean basin is the world's N° 1 tourist destination), also increases local demand for drinking water, especially in the summer (and especially in the islands). A telling example of this is Spain: the population of 27 municipalities on the Costa Brava swells from 150,000 in winter to 1.1 million in mid-August.

This high, temporary pressure on resources may lead to conflicts in water uses.

An increase in urbanisation accompanied, as often, by intensified housing and activity along the Mediterranean coast – including tourism – lead to the concentration of water demand in relatively small areas. This has a negative effect on the "empty" rural areas, with resources being diverted to built-up areas on the coast. This coastal concentration increases the final consumption of wastewater (water discharged at sea is difficult to re-use). While coastal development seems to be stabilising, the artificialisation of the coastline continues to increase.

Despite the increasing scarcity of water and the shortages already felt, water use is still far from efficient. In the Mediterranean countries as a whole, nearly half of the water supplied is lost in transport and distribution or is badly used, especially in irrigation. However, part of this loss does re-enter the system and can be used again, except in coastal zones. This is particularly true for a large part of Egypt's drainage water. However, this does not concern the coastal areas and still causes a pointless increase in the costs of mobilisation, transport and treatment (for drinking water).

In most countries the economic costs of water development and water supply (including water treatment, water protection and flood protection) already make up a significant part of national expenditure – from 1 to 2 per cent in the most developed countries (around 2% of GDP in France, 1998) and no doubt more in the other countries. These estimates could be improved through closer analysis of national budgets.

The overall " water " budget (investment and functioning) for the Mediterranean countries as a whole could presently be in the order of 75 billion US dollars or Euros per year (estimate based on partial, approximate figures).

Water as a development factor

The role of water use as **a factor in socio-economic development** depends essentially on the contributions made to development by high water-consumption sectors: in the Mediterranean region these respective contributions are not proportionate to the quantity of water used.

The most obvious distortion is that of irrigated agriculture, which in most Mediterranean countries represents most of the water used, but only a small share of GDP (Table 2).

There has been much debate on this issue, which has influenced water policies in several Mediterranean countries, from Spain to Israel. Questions regarding the allocation of resources and the generally very low cost of irrigation water have been raised.

However, this strictly macro-economic vision of agriculture should be set against social, economic and ecological considerations and the important role that this sector plays in the Mediterranean for:

- managing territories at the lowest ecological cost (prevention of natural disasters, limiting coastal urbanisation etc.);
- social stability in terms of number of jobs and regional balance (maintaining a major activity in rural areas where a large part of the population still lives (30 to 50%);
- its contribution to exports as a source of foreign currency (generally this only concerns the most productive farms, which represent only a small share of agricultural assets).

Table 2.
Some economic data on agriculture (data 1990 or around 1990).

COUNTRY	% of agricultural use in fatal water use	% of DGP generated by agricultural production (generally irrigated)	% of exports from agriculture	% of active population employed in agriculture (1997)	% of rural population
SPAIN	79	1,25	9,5	7,5	23
CYPRUS	88	5.4	21	10	46
ISRAEL	72	5		3	9
JORDAN	74	6	12	-	29
EGYPT	87	17	-	35	55
TUNISIA	86	16	-	26	43
TURKEY	72	16	15	48	31
MOROCCO	86	13	-	39	52

Source: FAO /Aquastat; Spain: Polagwat, 99 (only irrigated agriculture).

Increased dependence on imported foodstuffs

Some strategic considerations linked to food self-sufficiency can also be added to this. The nutritional intake in the region's Southern and Eastern countries (3070 Kcal) is reasonable: 56% cereals, 16% meat products and 28% other products (olives, sugar, vegetables, fish etc.). However, the intake of a large share of the population remains insufficient. In spite of sustained growth in cereal production over recent decades (2.7% per annum) the Southern and Eastern region[7] has been unable to meet the population's growing demand and has thus increased its imports. In 1995 the region was 33% dependent on the international market for its 123 M tonnes of cereal consumption.

7 - Included in the MENA region (Middle East and North Africa) in the terminology of the World Bank.

These imports make the region a significant user of "virtual water"[8] . It can be said that an estimated 40 km³ of virtual water for cereals was transferred in 1995 . It is probable that this trend will continue.

In the short term, this situation is considered as a good economic opportunity. It is based on an increase in the production of export crops (mainly irrigated), and in the import of low priced basic foodstuffs. However in the long term, this creates a certain vulnerability linked to dependence on world markets.

Water for the population

Drinking water production represents only a small part of the total quantity of water mobilised and used in the Mediterranean region: 15 to 20% in the developed countries to the North; less than 10% in countries with a high demand for irrigation water (Egypt, Libya, Syria).

The changes in production per inhabitant vary greatly depending on the country: slower increase or stabilisation, or even a decrease (France) to the North or in countries with strictly limited resources (Israel, Malta); increase in the Maghreb (where the starting point was very low); decrease in Egypt (Figure 3).

Service levels for "healthy water" are satisfactory in urban areas (100% or nearly 100% in most countries), although to the South and East the high rates quoted partly include service from water points in the vicinity and conceal frequent problems encountered in the regularity and quality of the water supply. This remains insufficient in rural areas (less than 60% in the South). Sanitation lags behind the supply of drinking water and water treatment is non-existent in several Southern and Eastern countries. The recent conflicts in the Balkans and in Algeria have caused the situation to deteriorate even further (delay in providing facilities, cholera outbreaks etc.).

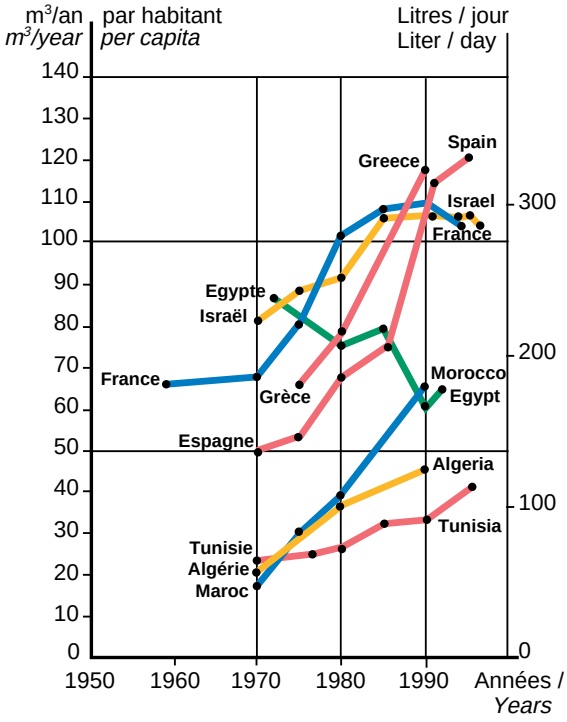


Figure 3: Changes in drinking water production per inhabitant in several countries over recent decades (in m³/yr and litres/day) (national sources)

8 - i.e. the quantity of water which equivalent agricultural production in importing countries would have consumed. (Tony Allan, Bari, 1999).

LASTING CONTRASTS: NEED FOR A VISION AT THE REGIONAL LEVEL

The Mediterranean world of water shares common characteristics, but it is also characterised by sharp and lasting contrasts.

The different forms of adaptation to either abundance or scarcity of water in Mediterranean countries came as a reaction to geographical diversity and climatic factors relating to water resources and demand. The Mediterranean world is far from being homogeneous either in terms of potentiality, water usage or resulting tensions between them, or in terms of the prevailing socio-economic or political conditions. Differences are greater than similarities, including within the largest countries, especially when a large part of the territory is situated outside the Mediterranean basin (Spain, France, Turkey, Morocco…).

Thus, a regionalisation of the different scenarios is just as important as a sectoral approach.

A North / South contrast

In the Mediterranean region, a traditional opposition exists between:

- The developed "water rich North" (globally speaking), with a low population growth and increase in water demand, exerting low to moderate (quantitative) pressure on water resources.
- The developing "water scarce South", with high demographic growth and rising water demand, exerting high to sometimes excessive pressure on water resources.

All things considered, demand is growing the least in those places where water availability is the greatest and where it is still possible to intensify outtake. Inversely, demand is growing the most in places where water resources are scarcest and most utilised.
Furthermore, water-related costs will raise the most as a proportion of the GDP in the less developed countries, those with the lowest income.
This simplistic opposition is somewhat succinct, the context and problems of each Mediterranean country being very specific and there are often, for the larger countries, differences between the regions themselves. The "North / South" contrast is even more obvious in the Western part of the Mediterranean region, less so in the East and the Middle East.

Regionalisation: a necessity

The first step towards more relevant regionalisation would depend on the State and trends in available water resources and water demands in three groups of countries. (see Table 3 and map Figure 4):

- **Group 1**: European countries rich in water (above 3000 m^3/year/cap) and where water demand is stable, or even decreasing, without quantity shortage problems (except for short periods of time and for localised areas) until 2025 and more, but having to face water quality degradation and meet the increasing needs of environmental protection.
- **Group 2**: Western Mediterranean or Middle East countries, with overall excess resources (1000 to 3000 m^3/year/cap), but where demands are more or less increasing, more sensitive to short term or structural shortages, in certain areas, with the risk of extension after 2025.

- **Group 3:** countries from North Africa, the Middle East, or islands where the resources (less than 1000 m³/year/cap) are already saturated or are becoming so (whether demands be high or low), are already experiencing structural shortages, with possible future aggravation in places where demographic growth is strong.

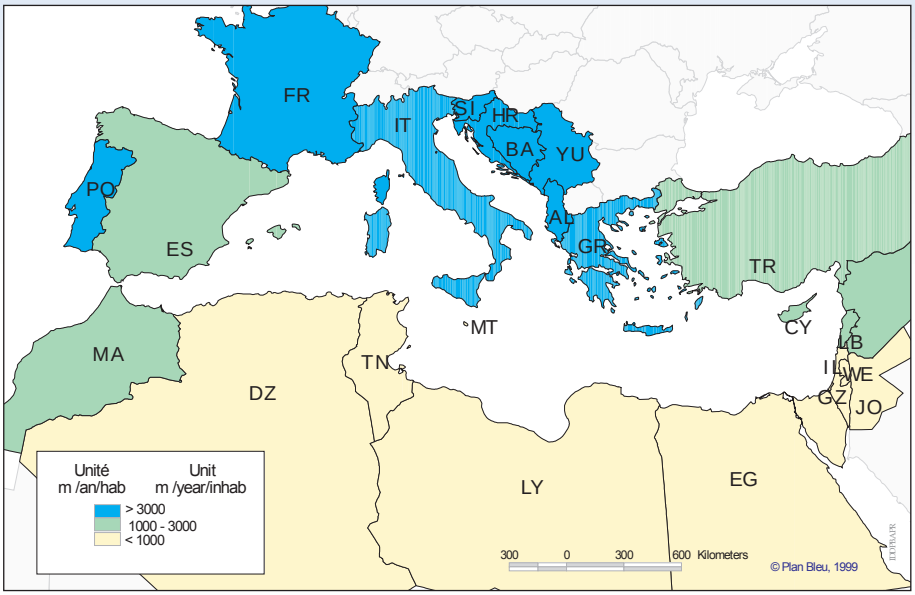


Figure 4: Mediterranean region. Classification of the countries in hydro-geopolitical sub-units.

Group of countries or territories		Population change	Water resources per capita			Water demand per capita	
			Current m³/year	Trends	Average forecast 2025 in m³/year	Current m³/year	Trends
Group 1	France, Italy, Portugal, Greece, Slovenia, Croatia, Bosnia-Herzegovinia, Albania, FR of Yugoslavia.3	Stability or decrease	> 3000 (> 20000 the Balkans)	Stability until 2025 and after	> 2000	Low to moderate 700-800 in EU 200-400 the Balkans	Slight increase or reduction
Group 2	Spain, Cyprus, Syria, Lebanon, Maroc, Turquie.	Stability in Spain growth in South and East countries	> 1000 Max: TR 3200	Stability in Spain; decline in the South and the East	ES > 3000 Southern and Eastern countries < 1000	Moderate to high 300 to > 1000	Decrease Spain, Cyprus, Morocco increase Turkey, Lebanon
Group 3	Malta, Israel, Palestinian Territories of Gaza and the West Bank, Jordan, Algeria, Tunisia, Egypt, Libya.	Moderate to high increase	500 below 100 (GZ, MT) Egypt: ~1000	More or less rapid decline	from 100 to 300 EG ~ 600 LY < 50	Low in the Levant, in Malta, in the Maghreb 100 to 400 high in Egypt and in Libya 800 to 1000	Slight to moderate increase in the Maghreb stabilisation in Israel reduction in Egypt, Libya

Table 3. Hydro-geopolitical groups of countries

However, this division into groups is not sufficient. National and even local visions are needed to build strategies adapted to future crises.

Multiple national and local contexts

In addition to these contrasted hydraulic conditions, there are multiple economic, social and political situations.

Other factors thus determine each country's strategy towards its food and water requirements:

- **Dependence on water resources**. Some countries depend on the natural resources of other countries: the case of Egypt is well known, at nearly 100%, but this also applies to Syria, at 80% or Israel at 55%. Such dependence is bound to accentuate political problems in these countries as far as sharing resources is concerned.
- **Energy dependence.** Southern countries generally have plenty of fossil energy along with a high solar potential at their disposal. This is an advantage when it comes to developing energy consuming technologies (desalination, wastewater treatment, etc.) and to ensuring the transition towards "virtual water" imports.
- **Growing dependence on foreign funding sources** for the financing of water and irrigation sectors. A lack of timely public investment (in hydraulic equipment and supply systems) and accrued debts are frequent in the South and East, much more so than in the North. For the moment, Northern developed countries have a large hydraulic capital, but they will have to finance the rehabilitation of the whole system in the future.
- **Dependence on foreign markets and in particular on food imports.** Demographics will for a large part determine other factors such as the type of economic development that Mediterranean countries will undergo and the conditions under which the association between the Southern and Eastern countries and the European Union will take place within the framework of the free-trade zone, defined at the Barcelona Conference of November 1995. It will have a major influence on the capacity for the Eastern and Southern countries to catch up and succeed in their attempts to be a part of the globalisation phenomenon.

The political context and the dynamics of social change are prerequisites to the success of any reforms of the water management framework and their social acceptability. Water demand management using only sectorial reallocation can give rise to political problems.

The visions of the future that correspond to the different scenarios should not, however, be limited to the sub-regional or national levels, where indicators are based on averages - which do not fully reveal all the problems - but they should also focus on possible **critical local situations**, or "dark areas", with priority given to prevention.

Unfortunately, such an objective of national or local disintegration cannot be achieved on the regional scale of this exercise. According to the analytical approach and the objective, several groups of countries may be used.

However, for the sake of convenience, we will refer below to the traditional **sub-regions: the North (Southern Europe), the South (Northern Africa) and the East (Middle East).**

Contemporary trends and growing problems

The identifiable contemporary trends and problems in the water sector should not become a springboard for extrapolations, which are always hazardous – even for trend-based scenarios – but rather they should serve to determine more dynamic initial conditions in order to promote a prospective approach.

STAKES

Population growth and risk of social instability

Demography and its social implications will largely determine other factors such as the type of economic development for the countries of the region.

The decrease of per capita resources indicates major pressure on the resource when it reaches less than 1000 m^3/year and a structural water shortage at less then 500 m3/year. With an uneven population growth, per capita resources tend to show the sharpest decrease in the poorer countries (all the Southern and Middle Eastern countries: Cyprus, Syria, Lebanon, Israel, Palestinian Territories, Jordan, Egypt, Libya, Tunisia, Algeria, Morocco, Malta). However, each country evolves at its own pace.

In Southern and Eastern Mediterranean countries, given the demographic pressure, the major concern is maintaining **social stability**. Maintaining a balance between urban and rural development is the objective set for current agricultural investments. This leads to a political will to expand irrigated land areas according to the resources and financial means available. e.g. Turkey (Southeast Anatolian Project) and Egypt (New Valley project).

Greater tendency to resort to food imports and concerns regarding free trade

Greater integration into the world economy is recognised as a legitimate objective. Nevertheless, for countries with fragile social and environmental stability, the evolution towards a free market economy should be progressive and controlled. The Southern and Eastern countries are in favour of regulated free trade (opening to the European market, but maintaining import barriers). This scenario will favour agricultural exports with the risk of increasing pressure on water resources[9].

In the Mediterranean region, some less populated countries (e.g. Israel, Cyprus, Malta) have demonstrated that a quick change into an urban type of service society and integration into the international market, along with a partial reallocation of water to other sectors, is possible. Yet, adhering to a time limit for integration into the world economy and the respect of certain socio-economic and political conditions are considered to be key elements.

At present, agriculture is not included in the future Euro-Mediterranean Free Trade Zone, but some bilateral agreements were reached on a product-by-product basis.

The possible extension of free trade to this sector is presently under discussion at the Mediterranean and world level (World Trade Organisation multilateral negotiations aborted in Seattle). For the Mediterranean region, this is a key issue.

9 -MENA, Consultation meeting on water for food and rural development, Bari, May 99.

Less competitive on a global scale in the production of meat and cereals, the agricultural sectors of Southern and Eastern Mediterranean countries are showing a deficit in their trade balance (except Turkey), although on the other hand, some sectors (fruit and vegetables in particular) are being exported to the European Union (e.g. tomatoes from Morocco or market garden produce from the coastal plains of Syria).

However, such agriculture fulfils a dual ecological and social function, – e.g. Turkey and Morocco with around 40% of the active population in agriculture, or Syria with more than 30% in agriculture.

The complete and abrupt institution of a Euro-Mediterranean free trade zone by 2010 is likely to have an important impact on the agricultural sector and the environment, though the trade of agricultural goods is not yet included in the negotiations. Export sectors are likely to be boosted, creating increased pressure on local water resources (temptation to resort to short term overuse). Some sectors of Mediterranean agriculture might be completely doomed, especially cereal growing and cattle breeding. This could endanger land management in the Mediterranean area and the socio-environmental equilibrium in Southern and Eastern countries, while increasing their food dependence.

For these reasons, Mediterranean states should aim for a better appreciation of what is at stake and ensure that social, environmental and food security criteria are integrated into future regional and multilateral negotiations[10].

Strong influence of international, and especially european, policies in the region

Water management institutions vary considerably across the Mediterranean region, but are generally fragmented among various public bodies. Water resource management continues to be handled by technical ministries while the supply of drinking water and irrigation water is increasingly provided by autonomous services. There is a growing tendency to privatise or to delegate drinking water services. In France and in Italy, this is an old tradition in the water supply and sanitation sectors. It is spreading in Southern countries as other sectors actively seek to improve competitiveness (electricity, gas…).

European Union directives have a major influence in the EU countries of the region, as well as in countries undergoing the integration process (Slovenia, Malta, Cyprus), or wishing to join (Turkey). The future Framework Directive for Water (which will probably be adopted in 2000) will set common rules for Northern Mediterranean countries (compulsory water management at the drainage basin level, environmental criteria, economic assessment of action, participation). In the other countries, the will to instate integrated water management is also asserted in planning documents and in water legislation.

Combined water and sanitation costs are increasing in order to pay for investments in the sanitation sector. In the Southern countries of the region, wastewater treatment technologies and regulations should be adapted to local conditions (climate, but also possible degrees of technical and financial autonomy) in order to guarantee their practicability and equipment maintenance and to avoid unjustified (and thus, unsustainable) sophistication.

The agricultural sector is influenced by the WTO agreements and European policy, with the Common Agricultural Policy in the North and all the Southern and Eastern

10 - A working party of the Mediterranean Commission for Sustainable Development is analysing the possible impact of the free trade zone on the environment.

countries linked to Europe by agricultural trade agreements and the perspective of a forthcoming free trade zone. Regional co-operation is developing around very controversial water transfer projects (France – Spain, Turkey – Israel, etc), R&D projects (Research Centre on Desalination for the Middle East, etc), projects for transferring know-how (EMWIS[11] project), preparation of joint projects (creation of the Mediterranean Technical Advisory Committee – GWP/MEDTAC, the Euro-Mediterranean Ministerial Conference on local water management, October 1999…).

GROWING PROBLEMS

Water resources already utilised to a great extent

The pressure on natural resources, which nearly everywhere remain by far the main source of supply, is high in the South and East, all the more so since these resources are poor on average, and utilisation continues to grow as long as it is not limited by resources.

Under current conditions, the exploitation index, which is calculated as the ratio between the volume of water withdrawn from the total average renewable water resources, is higher than 50% in some countries: Jordan, Malta, Tunisia, and also in the Mediterranean part of Spain. The index is higher than 90% for Egypt and Israel. It reveals intensive re-use or the use of non-renewable resources or unconventional resources. It is higher than 400% in Libya, which has only " fossil " non renewable groundwater.

The pressure indexes (Table 4 and Figure 5) would obviously be higher, (thus, more worrying), if they referred, in a more realistic fashion, only to actually utilisable resources. These resources are not estimated everywhere, and estimates are made using criteria specific to each country and not according to an international standard.

The pressure on natural resources is higher in the summer period, when natural supply is minimal, while water demands are at a maximum (irrigation, tourism). These indexes refer to the entire country and conceal, for most Mediterranean countries, more serious local situations.

Greater sensitivity to drought

Even if their occurrence remains unchanged, the sequences of long-term droughts are increasingly disastrous.

The high utilisation rate of average resources increases sensitivity to the risks of a drop in water input in times of drought, whilst at the same time safety demands and the need for a regular supply are increasing.

11 - EMWIS = Euro Mediterranean Water Information System. Project initiated by the Euro-Mediterranean Ministerial Conference on Water Management in Marseilles (Nov. 96), and whose technical unit is based in Sophia Antipolis, France.

Table 4.
Current pressure on water resources in Mediterranean countries

Countries and territories	Date of value	Indexes of quantitative pressure %			Resources available in average year km³/year [5]	Urban and industrial wastewater returned to continental waters km³/year [1]	Index of potential depletion % [2]
		On natural renewable resources		On exploitable water resources			
		Exploitation index [3]	Final consumption index [4]	Exploitation index [3]			
PORTUGAL	1995	15,0	~ 10	-	62	~ 0,5	-
SPAIN	1997	31,6	20,6	76	89,0	3,22	3,6
FRANCE	1994	21,5	4,9	-	172,0	5.3	3,1
ITALY	1993	23,5	14,5	36	143	7,7	5,4
MALTA	1995	167,0 [6]	≅ 27 [7]	146		≅ 0,007	-
ALBANIA	1995	3,3	2,1	-	41,7	~ 0,3	0,7
GREECE	1990	10,10	8,6	-	63	~ 0,1	~ 0,2
TURKEY	1997	15,2	12,6	39	171	5,5	3,2
CYPRUS	1994	27,6	24,0	40	0,6	ε	ε
SYRIA	1993	47,7 [8]	31,6 [8]	95	24,5 [8]	0,35	1,4
LEBANON	1994	26	21,2	71	3,9	0,0	0,4
ISRAEL	1996	92,4	87,5	98	0,17	ε	
GAZA	1994	217,0	132,0	217	-0,018	0,06	
THE WEST BANK	1994	24	14,3	28	0,52	0,05	~ 9
JORDAN	1994	95,5	90,0		ε	0,10	~ 98
EGYPT	1993	91,4 [9]	83 [9]	88 [9]	~16	6,5	39
LIBYA	1995	477,0	475,0	496	-3	ε	-
TUNISIA	1995	62	59,9	78	1,5	0,05	3,2
ALGERIA	1990	27,8	21,5	57	11,3	0,8	~ 7
MOROCCO	1991	47	31,7	68	20,5	0,3	~ 1,5

Sources: most recent national or international references compiled by the Blue Plan.

** N.B. Specific data for each of the former Yugoslavian countries after 1990 is not yet available.*

1 - Not including cooling water discharged from thermoelectric power stations.

2 - Ratio: return of urban and industrial wastewater to continental waters/flow of natural renewable resources decreased by final consumption (= availability), in %. These depletion indexes are naturally much higher if they are compared to low water flow levels.

3 - Exploitation index: annual amount withdrawn/average annual flow of total resources (natural, renewable or exploitable) in %.

4 - Consumption index: annual final consumption of water withdrawn (= net consumption per water use + waste water not returned to continental waters, discharged at sea) compared to the annual average flow of total renewable natural resources, in %.

5 - Balance: average annual flow of total renewable natural resources – final consumption (this balance includes non-returned wastewater).

6 - Compared to exploitable resources with no fresh water/saltwater imbalance.

7 - Malta: taking into consideration the return of water losses and non-conventional wastewater (desalination).

8 - Syria: compared to real resources (25.11) with reduced external resources, the exploitation index would be 55%, the final consumption index 45% and availability would be 13.8 km³/year.

9 - Egypt: indexes compared to real renewable resources (58 km³/year) and accounting for remobilisation and reusage.

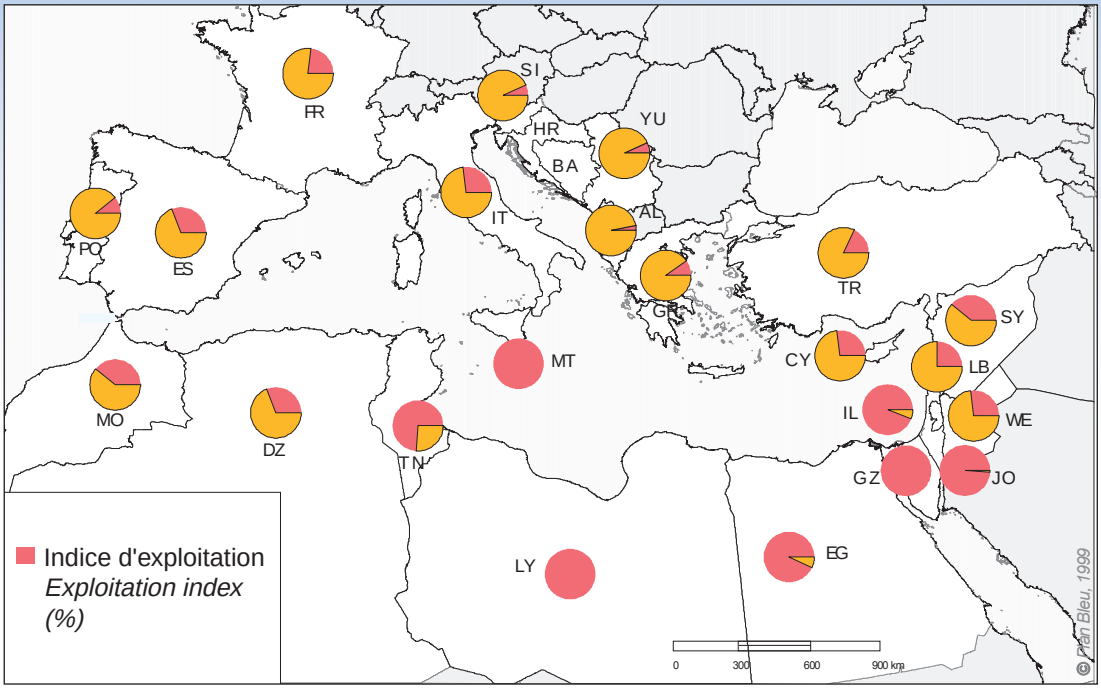


Figure 5: Exploitation indexes for renewable natural water resources (internal and external) in Mediterranean countries and territories. Current situation in %.

Rising threat to the quality of water and ecosystems

Currently in some Mediterranean countries man uses most of the resources of the natural environment to his benefit. The degradation of the ecological functions of water is alarming, as are the future risks caused by the overuse of water resources. Protected wetlands are a fundamental part of the natural landscape and fulfil numerous functions (recycling of fresh water, protection of fauna and flora, etc). In the past, wetlands were abundant in the Mediterranean basin. During the 19th and 20th Century most continental wetlands were drained either for agricultural purposes or as part of the fight against mosquitoes and malaria, or for urban development or airport construction. Today, more than half of these wetlands are lost, and in some places, this proportion is as high as 90% or more (MedWet, 1999).

Along with quantitative pressure on resources, the disposal of urban and industrial wastewater has a great impact on the quality of water resources. About 40 billion m^3 per year of wastewater is discharged from the Mediterranean region, half of this in the Mediterranean basin – see Table 4 – wastewater discharged at sea not included. Most of this wastewater is not or is insufficiently purified.

Pollution can destroy part of the resources by making them unusable, or can raise the production cost of drinking water to unacceptable levels in many countries. Groundwater is the most vulnerable, because its pollution is less reversible, and the loss of its quality could permanently affect surface running water. Surface water accumulated in reservoirs as well as in natural lakes is threatened by eutrophication. This phenomenon is activated by climate and by organic input and also increases the costs of producing drinking water.

Less industrialised, water-scarce countries in the South and East are also affected by pollution that tends to spread and increase faster than the results of any efforts made to prevent it.

Available resources, and especially of good quality, easily mobilised water, are decreasing in most Mediterranean countries and are becoming scarce especially in the South and East. The costs of mobilising them are increasing.

Potential Climate changes

Water resources of the Mediterranean countries can be also affected by climate changes caused by the greenhouse effect. The effects and extent of these changes are as yet uncertain and cannot be easily quantified nor foreseen.

A certain consensus exists however regarding a presumed increase in climate contrast. In the South, a drier climate is probable in the 21st Century and it will have the dual effect of reducing resources and increasing water demand, by intensifying evaporation and accentuating droughts. In the North, we can expect the climate to become more contrasted - with more rainfall in winter and drier, less regular summers that could influence water production and increase water demand in summer.

The present water economy is partly unsustainable in the Mediterranean region

A joint supply-oriented approach (to satisfy current increases in water demands) has increased the pressure on conventional resources. This favoured infrastructures and utilisation practices, which are partly unsustainable in the medium and long term. The development process offers the means to develop infrastructures, especially through subsidies, and in return, it contributes to the short-term development of some sectors (agriculture).

Dam building policies are widespread in the North as well as in the South and East. Irrigation is now the main objective, as opposed to hydroelectric production in the early 20th Century.

- Many countries rely first and foremost on irregular resources, which cannot be mobilised by dams in the long term since **regulatory installations are partly unsustainable.**

> *Heavy sediment loads in floods in Mediterranean countries, especially in Southern ones, result in active silting up of dams and short regulatory functions despite high planned reserves. Usual losses of effective capacity are 0.5 to 1% per year, sometimes more: 2 to 3% in Algeria where the useful life of dams of medium capacity is 30 to 50 years; 2% in Morocco where at present the reduction of regulatory capacity because of silting up is equal to an annual loss of 6,000 to 8,000 ha of irrigation potential; 1 to 2,5% in Tunisia. Algerian reservoirs had lost, before 1990, 11% of their initial total capacity, the Moroccan ones – 8% (800 million m^3) in 1990 – some reservoirs were already half silted up. In Morocco the capacity of reservoirs built before 1988 will be reduced by half by 2050.*

- The number of sites where dams-reservoirs can be built are limited and already partly developed. Their complete development and then their filling-up are foreseeable in the more or less long-term, probably during the 21st Century. Prevention (reforesting

of catchment areas, sediment traps) may at best delay the end of the dams, but will not extend their life indefinitely. Water resources that can be captured through regulation will decrease.

The 21st Century will see the beginning of the "post-dam" era in a range of Mediterranean countries.

• **Overuse of groundwater** (renewable resources) by numerous independent short-sighted institutions has developed throughout the Mediterranean region, especially in coastal aquifers where saline water intrusion after the disruption of saline/fresh water equilibrium is almost irreversible. This has happened in most Mediterranean countries: the level of coastal groundwater has fallen below sea level due to excessive pumping in Spain, Italy, Greece, Cyprus, Israel, Libya…, leading to some catchments being abandoned.

The share of total groundwater withdrawn through overuse (exceeding average natural renewal) is considerable in many Mediterranean countries: 20% in Spain (25% in the Jucar basin, 4% in the Balearic Islands), 13% in Cyprus, 24% in Malta (in 1990), 29% in Gaza, 32% in Israel (in 1994) where overuse is nevertheless balanced by artificial renewal.

• **The utilisation of the non-renewable resources** of Saharan aquifers is very intensive in Libya (providing 87% of the amount of water used), but also in Egypt, Tunisia and Algeria. These resources may last at best fifty years because of the depletion of utilisable stocks. Moreover, the quality of extracted water may deteriorate by mixing with saline water even before reserves are depleted, thus reducing their useful life.

Hence the proportion of unsustainable water over the global amount of water mobilised, that is to say "**unsustainable water production index**"[12] , cannot be ignored in several Mediterranean countries (Figure 6).

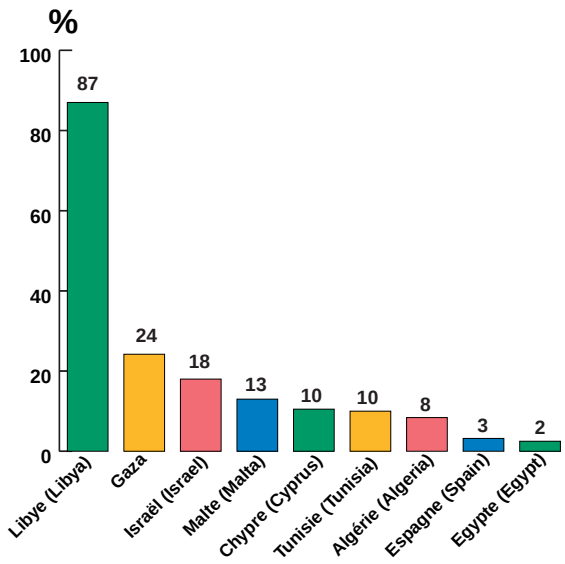


Figure 6:
Unsustainable water production index in Mediterranean countries and territories.

Source: based on the latest national available data at the Blue Plan.

12 - Unsustainable water production index in % = volume of utilisation and overuse of non renewable groundwater resources / total mobilised water quantities.

Forthcoming water shortages in the Mediterranean region?

Periodic (in times of drought) or structural water shortages already exist. These are likely to spread and to increase in the 21st Century in those places where they are already significant. This will widen the already existing gap.

Periodic shortages are more frequent and more widespread, as the mobilisation rate of average resources rises and especially as the mobilised part of irregular resources increases. Hence, water use is more and more sensitive to drought. Inadequate water management infrastructures (inability to face frequent lack of supply, obsolete equipment) can aggravate the situation. The increasing security requirements for water supply (drinking water and irrigation) tend to intensify pressure.

Widespread structural shortages during "normal" years due to excessive demand, and increased by the tendency of resources to deteriorate.

STRONG TRENDS IN WATER MANAGEMENT IN THE MEDITERRANEAN REGION

As a result of these shortages and depending on their severity, strong or emerging trends are already present and characteristic of water management in some of the Mediterranean countries.

Rise in supply

Increasing supply remains the foremost priority in these countries and the following trends were observed:

- upward re-evaluation of the amount of natural resources considered to be utilisable, in spite of the increase in related production costs;
- insistence, at times through "intensive hydraulic activity", on infrastructures and mobilisation of renewable conventional water resources at the expense of heavy impact on the environment and to the detriment of aquatic ecosystems;
- expansion and development of interregional, and even international water transfers between territories rich in water and water scarce areas (including transportation by sea);
- increased utilisation of non-renewable resources in some countries (Libya, Jordan);
- use of non conventional resources: development of wastewater or drainage water recycling (Israel, Egypt, see Box 3) and of desalination of saline and brackish water (as in Malta where at present more than 50% of water supplies are provided by this means).

Growth of conflicts of use and control of water demands

Water use conflicts are spreading and worsening, particularly between urban and agricultural uses, upstream / downstream rivalries (especially between coastal and country areas) and between those regions effected by transfer projects (Spain, Greece…). Lastly, conflicts increasingly arise due to the incompatibility of the use of water resources with environmental protection.

The rise in water use conflicts and the limited nature of resources make it essential to moderate water demand in many countries:

- a slower rate of increase in the quantity of water used, due to the limitation of supplies and failure to meet demand, or even through applying restrictions (Cyprus);
- a tendency towards improved efficiency of use, and thus water use productivity (industrial and agricultural uses), leading to reduced water intensity, although this trend is somewhat variable.

A New Trend: Giving greater consideration to " environmental demand "

The need to protect the ecological role of water in the natural environment is beginning to become part of water management priorities, particularly in Northern countries, through two complementary approaches:

- either by introducing the concept of "environmental water demand". The level of this demand can be calculated and added to human demand, as in Spain for example;
- or by means of "reserved flow levels" to be subtracted from resources, as in France for example.

Box 3: An emerging trend: use water several times

Reusing water either by re-mobilising water returned to the environment after being used, or by connecting certain uses directly to equipment that discharges properly treated wastewater, is an efficient means of reducing pressure on resources.

This reuse is being particularly developed in Mediterranean countries where resources that are still available are becoming scarce. This method allows an increase in the quantity of used water so as to satisfy growing demands without intensifying water outtake.

Drainage water is intensively recycled in Egypt, already representing more than 12 km³/year. Along with pumping of groundwater, which is swollen by irrigation water (4 km³/year) and with partial re-use of urban wastewater (0,7 km³/year), this increased to 36% the water taken from primary resources and used twice (1995 –1996, according to Amer 1999).

Urban wastewater recycling has made significant progress in Israel where 65% of discharged wastewater is already treated and re-used – mainly in agriculture – and should reach 87% in 2020. In 1997, recycled wastewater represented 14 % of all sources of supply (22% of water used for irrigation, 30% planned in 2005) (according to Shevah 1999).

Wastewater recycling has also started in Cyprus, Syria, Libya, Malta, Tunisia, Spain.

The ratio of the quantity of water used to the amount of primary outtake, which when greater than 100%, indicates what share of the outtake is used more than once, gives us the reuse index, a significant environment performance indicator. This index is close to 136% in Egypt and 114% in Israel.

Policy review: institutional and economic aspects

New water management challenges also lead to changes in the legal framework:

- changes in water legislation, with a tendency to eliminate the property or access rights traditionally accorded by Roman law and predominant in Northern countries, in favour of water use rights, which already exist in the Muslim laws of many Southern and Eastern countries.
- a tendency to give priority to public intervention and regulatory measures (Water Police) in water management.

In most Southern and Eastern countries, economic costs related to water management and supply increase in absolute values and in proportion to GDP. This will have an impact on their development and will contribute to widening the gap between North and South.

For example in Algeria, public investment in the water sector defined in the first five-year plan (1980–1984) was about 30 billion dinars (1980). In 1993 the budget allocated for drinking water and drainage equipment was 12.9 billion dinars (including the share of drinking water supply used for dams, water conveyance and systems).

According to the World Bank estimations (1994), public investments in the water sector alone represented a significant part of GNPs and of total public investments in numerous Southern or Eastern Mediterranean countries:

Country	% of GNP	% of public investment	$ per inhabitant
Algeria	3,1	12,4	78,9
Jordan	3,7	16,0	41,1
Morocco	3,1	22,5	25,9
Tunisia	3,1	22,5	34,2

Valid: 1985.

The rising cost of water resource management and services has varying repercussions in the different countries:

- a coinciding tendency for users to bear higher costs, especially when water supply is market-related (drinking water, industrial water…);
- call for private investment, linked to the privatisation of services, limited to the most profitable sectors (production and distribution of drinking water).

However, unequal priority is given to the different water sectors... Spending cuts imposed by "structural adjustments" have strong repercussions on public investment in the water sector, especially environment-related investment.

The possibilities for counteracting these trends or, on the contrary, the risks of their deteriorating, will be one of the main elements in determining the various "vision" scenarios.

Consequences for the future

Mediterranean water resources are no longer what they used to be. Sooner than climate change[13] , the impact of human activity is most likely to deteriorate water flow and quality, and thus to deplete resources, in the short and medium term.

The time has come to decide what share of Mediterranean water is to be left to nature. Water policy arbitration is now called for in order to reconcile development and environmental protection objectives, including resource conservation.

Problems are inevitably on the increase, and water use will not stay as it is. The situation can be expected to deteriorate, in the short or long term, in Southern and Eastern countries. However, geographical differences cause considerable discrepancies in how these situations change. More can be gained from better water use management than from intensifying the use of resources, which causes imbalances that render an increasing proportion of water production non sustainable.

Food security can no longer be guaranteed by self-sufficiency. The food balance depends on the rest of the economy and the maintenance of social stability.

Ph. : © Verseau.

Hebron, drinking water distribution .

13 - The serious nature of Mediterranean warming is confirmed in all these scenarios (converging towards pessimistic scenarios). Intergovernmental Panel COP –5, Bonn, 25 October to 5 November 1999.

Three Mediterranean scenarios

Three Mediterranean scenarios were considered for the Mediterranean region based on the three global scenarios of the World Water Vision Unit and revised according to the remarks made during the Mediterranean consultations.

Global demographic, economic, technological, social and political hypotheses were largely applied. Mediterranean adjustments merely modified certain hypotheses, to take account of specific natural and demographic conditions and the creation of a free trade zone. The main task was to estimate future water demand for the years 2010 and 2025. There are two sorts of scenarios:

- **Trend scenarios, in which future situations are outlined using forecasts with the following characteristics:**
  - *initial conditions:* present situations and trends
  - *projected changes* parfois, mais non nécessairement, par extrapolation des tendances actuelles,
  - *a "set" of optimistic and pessimistic assumptions,* in particular the liberal perspective of "laisser faire", with no group objectives and no major new regulatory intervention.

The trend approach uses variants, and is particularly influenced by demographic and economic changes. For this reason, a distinction is made between:

- a **moderate, "conventional" trend scenario** (BAU "business as usual"), basically optimistic,
- **a crisis trend scenario**, basically pessimistic.

- **An intentional scenario** in which the forecast stems from an **anticipatory** approach. A desirable situation is defined as an objective to be reached over a given period of time, in order to deduce the ways and means of achieving it and thus the decisions to be made now in order to do so.

The three scenarios for 2025 are as follows:

Two trend scenarios:

- "**The Conventional Mediterranean**" ("business as usual scenario") where current trends in economic, technological and demographic development continue. Although pressure on water resources and water systems grows stronger and environmental security is reduced in some areas, crises are generally avoided.
- "**The Mediterranean in Crisis**": deterioration of the conventional scenario with economic and political instability, less new technology transfers, reduced economic development, and an inability to adopt new strategies in water management. Structural shortages become widespread throughout the region and social and environmental security is endangered.

One intentional scenario: "**The Sustainable Mediterranean**" ("sustainable water world") where water management objectives comprise social and environmental concerns to ensure sustainable development.

The hypotheses applied to each scenario are summarised in Table 5. Calculations were made using existing national and regional studies referenced in the bibliography.

Gaza, effluent discharge in sea.

Ph. : © Verseau.

The conventional scenario is the benchmark scenario for assessing the characteristics of the other scenarios.

Before presenting these scenarios in greater detail, it should be stressed that their differences and therefore the margin of choice available will vary according to the sub-regions and countries. In particular, the Southern and Eastern countries, where the situation is currently tense, have little room for manoeuvre and this reduces the possible differences between the scenarios.

Table 5.
Mediterranean vision on water – Summary table of scenario hypotheses

Specific Mediterranean aspects which were added to the global scenarios are not given here (see the Vision scenarios report)

	Trend scenario (conventional)	Crisis scenario	Sustainable development scenario
General context			
• Population 2010 (millions) 2025	490 (UN medium projection) 544	501 (UN high projection) 579	470 (UN low projection) 499
• Urbanisation	Sustained growth (urbanisation rate 75,8% in 2025)	Even sharper growth and worsening urban poverty.	Medium, controlled growth (UN low projection)
Urban inhabitants 2010 2025	344 (UN medium projection) 423		
• Economy	Irregular growth (average to sustained, similar to current growth)	Little to no growth.	Medium to slow growth (lower than present growth rates)
Mediterranean agriculture	Growth in production in terms of absolute value but fall in proportion to contribution to GNP, in particular in the South and East. The profitability of low water-consumption crops remains low.	Growth in production in terms of absolute value and in proportion to GNP in the South and East. Fall in the profitability of low water-consumption crops. Worsening of water use conflicts between agriculture and cities.	Growth in production in terms of absolute value but fall in proportion to contribution to GNP. The profitability of low water-consumption crops is on the rise. Policy for dividing water costs between farmers and other sectors; costs reflected in agricultural prices.
Mediterranean tourism	Major increase in international tourism in the order of 3.5% per annum until 2010; better distribution of tourism profits in the Mediterranean with development of the ability to finance systems for producing non-conventional water.	Privileged development of international tourism in Northern countries with increased damage to coastlines. Stagnation in the South.	Growth in national and international tourism. Environmentally friendly tourist development creating a sustained capacity for financing non-conventional water (desalination, wastewater recycling…)
Technology	Development of biotechnology research and widespread access to information technology. Spread of GM crops, but their use is limited in Northern countries.	Widespread development but privately owned with restricted access. Some Mediterranean crops subject to competition from other parts of the world. Uncontrolled spread of GM crops.	Biotechnology research available; widespread access to information technology. Standards set for GM crop use with monitoring of environmental impact.
Sanitation	Technology exists but is too expensive for many S. and E. communities. Equipment lags behind, despite major investment and the development of wastewater recycling.	All required technology exists but remains financially inaccessible for Southern and Easter countries. Equipment lags behind and this is accentuated by the economic crisis.	Development of appropriate low-cost technology and ecotechnology. Satisfactory equipment in most cities. Agriculture uses mainly treated wastewater in some countries where water is scarce.
Desalination	Technology exists but remains too expensive. Developed in countries with very low resources. (e.g. drinking water at less than 1 $or Euro/ m^3 in Malta and Cyprus)	Experimental in most countries since costs remain high despite lower energy costs. Developed only on islands and in isolated areas.	Widespread low-cost development with lower technology and energy costs (dropping to $/Euro 0.25 per m3). Used exclusively for drinking water or high-tech industries.
Low water-consumption crops, salt and drought resistant	Massive development and spread of new varieties; expansion of potentially cultivable zones and greater yields in marginal zones.	Development of resistant varieties but spread is limited as too expensive.	As in the conventional scenario but combined with ecotechnology and the revival of agrosystems.
Trade	Continued development with no environmental regulation; Growth in crops for export, ultimately endangering Mediterranean agriculture.	Complete deregulation; Growth in crops for export to the detriment of subsistence crops; rural development and Mediterranean agriculture at risk in the South and East.	Development of regulation policies with environmental and social objectives.

	Trend scenario (conventional)	Crisis scenario	Scénario de développement durable
• Free trade	Euro-Mediterranean free trade zone expanded to cover agriculture with socially motivated customs barriers maintained in the South.	Euro-Mediterranean free trade zone expanded to cover agriculture, with no social or environmental conditions.	Euro-Mediterranean free trade zone excludes agriculture and carries restrictions.
Energy	Growth at the same rate as economic growth. No change in energy production methods in the region.	Lower growth rate.	Extension of renewable energy and low-energy consumption technology.
• Energy costs	Oil prices stabilise.	Rising energy prices.	Fall in energy prices and desalination and transfer costs.
Governance	Current policies maintained, with growing private sector participation but little local participation.	In conflict situations, local participation may aggravate conflict.	Alternative forms of government and social organisation with stronger partnerships between public and private sectors and users. Development of basin specific management in some countries.
• Water use conflicts	Localised conflicts in some shared basins.	Worsening conflicts.	No conflict. Joint management of shared resources through bilateral, regional or international agreements and conventions.
Climate change	No impact likely before 2025.	Risk of impoverished resources and rise in irrigation needs.	No impact likely before 2025.
Forecasted resources per inhabitant	46 to 48 % of the population with less than 1000 m3/year. (no deterioration specifically linked to climate change)	Climate change increases variability and reduces the inter-annual average (which signifies impoverishment of resources)	42% of the population with less than 1000 m3/an. (no deterioration specifically linked to climate change)
Forecasted total water demand. Required production in km³/an 2010 2025	358 417	~ 300 ? ~ 400 ?	268 264
Local drinking water supplies	High level of service maintained and increased security of supply in the North; progression in S and E.	Little progress in the level of service; increasing problems or poor quality in the S. and E., with possible restrictions in the N.	Full service and widespread security of supply, with greater use efficiency.
Irrigation	Development levels off and is "desubsidised", with improved efficiency in the N. Growth in S. and E., partly encouraged by export objectives.	- identical to trend-based scenario in the N. Subsidised growth with no notable efficiency gains in the S. and E., particularly in terms of a fall in imports.	Levelling off or reduced in the N. More selective growth, with major efficiency progress in the S. and E.
Water development and planning	Moderate progression in the N, high in S. and E. Major hydraulics predominate. Rise in transfers.	Stagnation due to lack of resources; lower yields. Transfers are obstructed.	Progress is halted in the N., moderate in the S. and E. Development of small-scale hydraulics. Moderate transfers.
Non conventional water production (desalination, wastewater recycling)	Occasional growth, restricted to crisis situations (mainly in the S.)	Little to no growth due to costs.	Sustained growth, encouraged by falling prices.
Demand management	Slow increase in water saving, mainly price motivated.	Little to no growth in water saving.	Substantial water savings. Quality better suited to needs.
Pressure on resources • Quantity and exploitation indexes	50 to > 100 % in : 11 countries in 2010 13 countries in 2025 Moderate or sustained local overuse.	= or > trend scenario Continued or worsening overuse. Greater use of non renewable resources in the S.; exhaustion becomes likely	50 to > 100 % in 8 countries in 2010 10 countries in 2025 Decrease or halt in overuse
• Quality	Pollution partially controlled and decreasing, in the N. more so than in the S. and E.	More extensive and worsening pollution.	Under control; widespread fall in pollution.
Policies for water conservation and quality protection	A priority in the N., secondary in the S. and E.	Not a priority.	Widespread priority.

THE "CONVENTIONAL MEDITERRANEAN" (MODERATE TRENDS SCENARIO)[14]

Features of the scenario

As far as possible, this scenario incorporates forecasts from national plans, which are considered to be high estimates. The main features of this scenario, given in detail in Table 5, can be summarised as follows:

Medium population growth (see UN medium demographic forecast) and irregular economic growth. Urbanisation is increasingly widespread.

Current modes of water consumption to be continued in developed Northern countries; transition of Southern and Eastern countries towards the same modes, especially in urban areas.

The role of irrigated agriculture remains important in Southern and Eastern countries, but will decrease in comparison to industrial and service sectors. This transition is more or less slow in different countries and progressively leads to an urban society with industrial and service domination (linked to tourism development for example) replacing the rural society (e.g. Israel, Malta, Cyprus).

Progressive globalisation of culture and trade. Gradual convergence of developing and industrial economies reinforced by the Euro-Mediterranean Free Trade Zone in 2010, the impacts of which are supposed to be positive for the economy. Nevertheless, in Southern and Eastern countries the risks for agriculture, environment and society –notably in rural areas- will be key issues, unless protective measures are taken.

The energy sources used will be essentially non renewable (oil, coal and lignite) and will be weakened by the declining efficiency of hydroelectric equipment (dams – drop in reservoir capacity).

The influence of climate change on precipitation and water resources is a growing concern. The temperature increase is confirmed and the intensification of climatic variability and of extreme phenomena (drought) is possible, but uncertain until 2025.

The countries' standpoints

This scenario is in general implicitly expressed in national policy plans that have been adopted or are being adopted in most Mediterranean countries.

These plans represent the vision of the future that water management and planning authorities have, mainly concerning the programming of equipment necessary to satisfy demand (see Box 4). Table 6 presents a selection of forecasted water demands and consequently of water production needed in most Mediterranean countries, according to planning documents.

14 - This approach was used in the moderate trend-based scenario of the Blue Plan (1989 and its updated version in 1996).

Box 4: Comments on the national planning documents

Planning approaches correspond more to the technical and budgetary programming of development and public investments (equipment master plans giving priority to major construction projects) than to complete prospective approaches. These master plans are more closely linked to forecasts and medium term economic planning rather than to environmental policies. They generally stem from an arbitration between goals and restricted financial means and give an indication as to the governments' priorities.

These master plans aim to satisfy at the lowest public cost – mainly internal- the projected water demand as a state variable with some explicit targets (rate of distribution, sanitation, irrigated surface areas...) covered by more general policies (public health, agriculture, food security, urban planning, rural housing and land planning)

The analysis of national master plans or corresponding expert studies shows diversity as well as convergence.

Diversity:

- various projections dates: 2000 to 2040,
- single or multiple hypotheses on the evolution of water demand and the actors involved,
- varying degree of regionalisation, based either on administrative districts or drainage basins, at different levels of precision,
- differences in the level of detail and comprehensiveness of financial calculations, making them difficult to compare.

Convergence:

- resource assessment based solely on averages; limited consideration given to usability criteria and variability, particularly scarcity situations (drought) and, to an even lesser extent, the likely effects of climate change.
- use of dominant water supply to meet priority demands: water supply for (mainly urban) communities, industry and tourism. On the other hand, residual resources are allocated to agriculture (in extreme cases, this includes exclusive allocation of urban wastewater to irrigation, as in Israel)
- water demand forecasts often limited or overestimated, without distinction between user demand and withdrawal,
- demand management underdeveloped
- non-existing or minimal consideration for environmental objectives.

Table 6. Water demand forecasts (various sources)[15].

Countries and territories	Years	Water demand forecast (km³/year)				Total	Reference (see bibliography in appendix)
		Sectoral demands					
		Communities	Industries non supplied	Agriculture (irrigation)	Energy (power stations)		
Portugal	2015	1,16	0,8	12,08	-	14,04	EC 97
Spain	2012	6,28	2,43	27,64	4,0	40,35	P.H. N 93
France	2010	10	6,5	8	16	40	Ag. Adour-Garonne 96
	2025	8,03	5,51	6,45	22,5-23,2	43	EC/Planist. 97
Italy	2015	7,6	13,3	26,2	~ 0,5	47,6	Conf. Dublin 90
	2015	7,9	13,3	28,6	9	58,8	Drusiani 98
	2025	4,85	3,78	21,0	8,8-9,3	38,6	EC/Planistat 97
Malta	2020	0,07	-	-	0	0,07	Riolo, CCE 90
Croatia	2005	0,78	0,45	-	-	1,23	
	2015	0,97	0,56	-	-	1,53	Hrvatska Vodopriveda 91
Albania	2010	0,83	~ 0,2	3,5	0	4,53	CCE Alger 90
Greece	2021	0,84 – 1,2	0,14 – 0,19	5,82 – 6,73	-	6,8 – 8,2	Elliniki Etair ICWS 96
	2025	1,83	0,2	6,9	-	8,93	EC/Planist. 97
Turkey	2030	25,3	10,2	71,5	-	107	Anac, Bari 99
Cyprus	2010	0,09	-	0,39	0	0,48	Lytras, CCE 90
Syria	2010	2,1	0,33	17,64	-	20,08	Wakil 93
	2015	1,87	0,29	14,24	-	16,39	Naff, AMER 87
	2020	3,16	0,47	21,0	-	24,63	Wakil 93
	2030	4,72	0,64	21,14	-	26,5	Wakil 93
Lebanon	2015	0,45	0,12	1,41	0	1,98	FAO, World Bank 94
	2030	0,72	0,49	1,7	0	2,91	Conf. Rome 92
Israel	2010	0,77	0,22	1,25	-	2,24	Schwarz 88
	2020	1,14	0,18	1,25	-	2,57	Schwarz 92
	2025	1,3 – 1,4	0,15 – 0,2	1,05 – 1,24	-	2,5 – 2,84	Tahal / Blue Plan 87
	2040	1,85	0,25	1,63	-	3,73	Schwarz 92
	2040	1,28	0,26	1,9	-	3,44	Arlosoroff 97
The West Bank	2010	0,13	0,01	0,19	0	0,33	Tahal 95
Gaza	2010	0,209	0,027	0,234		0,47	Sabbah, Issac 95
	2020	0,34	0,043	0,345	0	0,73	Sabbah, Isaac, 95
	2040	0,26	-	0,1	0	0,36	Arlosoroff 97
Gaza	2010	0,113	0,011	0,07	0	0,194	Sabbah, Isaac, 95
	2020	0,186	0,017	0,07	0	0,273	Sabbah, Isaac, 95
Jordan	2010	0,43	0,13	0,75	0	1,31	Bilbeisi 92
	2015	0,37	0,13	0,60	0	1,09	World Bank 88
	2020	0,50	0,30	0,75	0	1,55	Khouri 90
Egypt	2020	3,1	6,1	49,0	-	58,2	Attia 93
	2025	3,1	9,6 – 14,6	43,5 – 49,7	-	53,4 – 64,6	Megahed 91
Libya	2010	1,01	0,24	5,85 – 11,98	-	6,58 –13,23	Salem 92
	2025	1,76	0,57	6,64 – 17,21	-	8,97 –19,54	
Tunisia	2010	0,37 – 0,63	0,12	2,54	0	3,0 – 3,3	Hamdane 94
	2010	0,46	0,123	2,54	-	3,16	Economie d'eau 2000 – 95
	2020	0,48	0,16	2,08	-	2,72	Alouini, Bari 99
	2030	0,55	0,19	2,03	-	2,77	Alouini, Bari 99
Algeria	2010	2,0 – 3,26	0,93 – 1,45	3,74 – 5,11	-	7,11 –10,24	Garadi 92
	2025	3,1 – 4,9	1,1 – 1,9	5,7 – 8,8	-	2,9 – 15,6	
Morocco	2010	1,59	1,36	15,26	-	18,21	Conf. Dublin 90
	2020	1,98	2,22	17,0	-	21,2	Jellali 95

15 - Forecasts given in the national planning documents of main Mediterranean countries and territories or in consultancy studies

Impact on future water demand[16]

The forecasts adopted per sector of use are presented in Table 7. Priority was given to the data in available national planning documents (mentioned in Table 6). These forecasts are generally considered to be high estimates. In the absence of such forecasts, notably for 2025, the following has also been used:

- either the Blue Plan prospective calculations (1996) based on "pessimistic" high estimates, maximising all the factors that increase water demand (growth of irrigated surfaces, few water savings....). The hypotheses used for each of the Northern countries for 2025 are given in appendix II,
- or the forecasts of scenario 2 of the Vision on Water in Arab Countries (1999), based on average to high demographic forecasts and on the hypothesis of moderate growth in supply. Some of these forecasts may nevertheless be overestimated, being based above all on the concept of theoretical needs, which are impossible to satisfy (for example in Egypt).

Countries and territories	Sectorial demands in km³/year								Total demands km³/year	
	Communities		Agriculture		Industry		Energy			
	2010	2025	2010	2025	2010	2025	2010	2025	2010	2025
PO	0,72	0,9	5,64	5,3	0,5	1,0	3,5	4,0	10,37	11,2
ES	6,28	7,0	27,6	25,7	2,43	3,0	4,0	5,0	40,35	40,7
FR	7,90	9,6	6,0	5,8	5,0	5,9	27,0	28,7	45,9	50,0
IT	7,60	5,2	30,7	31,7	13,3	7,0	0,5	0,5	52,1	44,37
MT	0,04	0,04	0,005	0,006	0	0	0	0	0,044	0,046
SI,HR,BA,YU,MC	2,8	3,7	1,1	1,4	6,0	8,0	10,0	12,0	19,9	25,1
AL	0,83	0,8	1,9	1,9	0,2	0,3	0	0	2,93	3,0
GR	1,50	1,8	7,7	9,0	0,18	0,2	0,12	0,2	9,50	11,2
TR	17,8	23,6	28,1	30,7	5,0	7,0	5,0	10,0	55,9	71,3
CY	0,1	0,1	0,5	0,8	0	0	0	0	0,593	0,9
SY	2,1	3	17,6	25,2	0,3	0,37	0,1	0,1	20,1	28,67
LB	0,40	0,52	0,92	1,10	0,10	0,14	0	0	1,42	1,76
IL	0,77	1,4	1,25	1,24	0,22	0,20	0	0	2,24	2,84
GZ, WE	0,32	0,53	0,30	0,42	0,04	0,06	0	0	0,66	1
JO	0,43	0,57	1,75	2,40	0,13	0,20	0	0	2,31	3,17
EG	5	6,0	75,0	95	10	14	0	0	90	115,0
LY	1,0	1,76	9	11,9	0,24	0,57	0	0	10,24	14,2
TN	0,42	0,53	3,37	4,23	0,16	0,26	0	0	3,95	5,02
DZ	4,1	6,05	3,6	4,64	0,95	1,4	0,2	0,2	8,85	12,29
MA	1,6	1,57	15,3	17,19	1,4	1,51	0	0	18,3	20,27
Total	61,71	74,67	237,335	275,626	46,15	51,11	50,42	60,7	395,657	462,036

Table 7. Moderate trend forecasts for water demand in Mediterranean countries and territories for 2010 and 2025.

Sources for the calculations used in Table 7 are given in Appendix III

16 - Water demand: understood as the quantity of water withdrawn or "produced" to satisfy demand taking into account losses in transport or storage and their possible reduction.

The figures in Table 7, illustrated in Figure 7, can be summarised as follows (km^3/year):

	Reference year	Forecasts	
Sectors	1990	2010	2025
Communities	38	62	75
Agriculture	181	237	276
Industry not supplied	33	46	51
Energy	47	50	61
Sub-regions			
North	155,5	181	186
East	55	83	110
South	88,5	131	167
TOTAL	299	395	463

These demands could therefore show a 32% increase by 2010 and 55% by 2025, less so in the North than in the South and East. The growth of demand for industry and communities would be higher than for agriculture, which would nevertheless remain the foremost consumer (Figure. 7).

The required water production would then increase by 96 billion m^3 per year by 2010. To cover drinking water needs alone, an additional 24 billion m^3 would have to be produced by 2010 and 13 billion more between 2010 and 2025.

The present trends in the changes in total demand per inhabitant would persist: stability and a slight decrease for the North, decrease in most of the Southern countries where the population would grow faster than the quantity of water used (Egypt, Morocco), mainly due to the saturation of conventional resources (Cyprus, Israel, Jordan, Tunisia). Predictable growth rates (Algeria – which starts at a very low level - Lebanon, Turkey, Libya) would start decreasing by 2025.

The demand for drinking water per inhabitant would also change in line with current trends: stability for the North or in countries faced with a shortage; growth in the countries of the South and East, along with the improvement of the distribution system while maintaining this demand well under those of the North and limiting the increase with higher tariffs. Things would improve in Egypt.

The extension of **irrigated surface** areas would continue with better water usage efficiency. In fact, in most of the medium and long term water development master plans of Mediterranean countries – South and East- and even for Spain, a more or less sharp drop of the share going to agriculture is apparent (Figure 8). Resource allocation and corresponding investment in water development are revised, to the detriment of agriculture, if not in terms of absolute value then at least as a proportion of mobilised water volume.

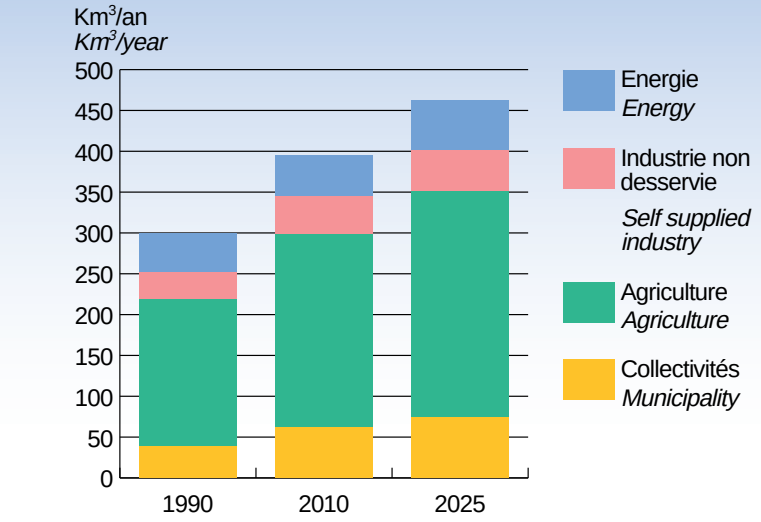
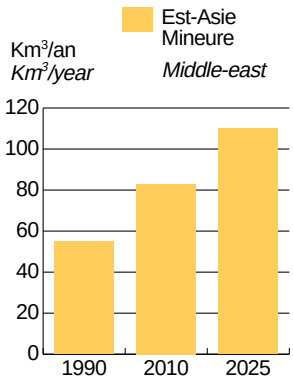
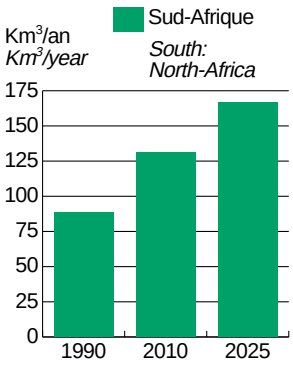
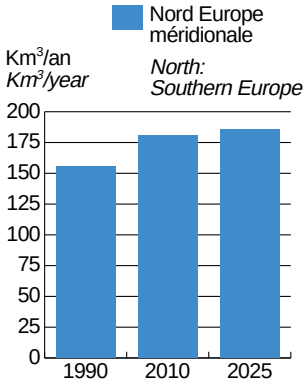


Figure 7:
Trend forecast for total water demand in each sub-region and sectoral water demands in the whole Mediterranean region (conventional scenario).







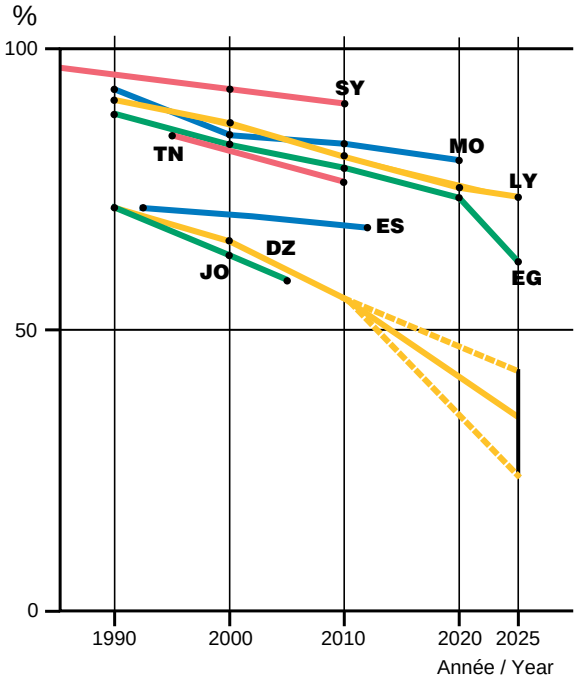


Figure 8:
Projected share of irrigation requirements within total water demand (according to national plans) in several Mediterranean countries.

Impact on water supplies and management strategies

Faced with these increasing demands, **the supply approach would remain dominant** in order to satisfy public and industrial demands: new infrastructures, intensified utilisation of natural resources (renewable or not) and extended water transport networks would be implemented in all the countries in which there would be an important quantity of exploitable water available, the latter being assessed according to technical and economic criteria (internal costs). On the other hand, for agriculture, there is a trend to re-allocate the outstanding amount of resources available and to adapt demand.

The use of unconventional water production (desalination, wastewater recycling) may cover 5 to 10% of water demand in 2025. This would have a noticeable effect only as conventional water resources become rare and also according to their micro-economic competitiveness. In Israel, the rate of re-use, mainly by non-food farming, is to be raised to 80% by 2000. In Cyprus, recycled volumes could treble or quadruple by 2010. In Egypt, drainage water recycling is likely to double between 1990 and 2025, just as urban wastewater recycling could be multiplied by ten in 2025.

By considering only urban wastewater, the increase in community water demand gives a measure of the considerable flow rates expected from this new resource. But the delays in equipping communities for urban sanitation and wastewater treatment in the South and East (except in Israel), will postpone wastewater recycling in towns. As of today, a large proportion of investment must be steered towards the development of sewage networks and facilities aimed at treating water discharged by unequipped urban areas.

Infrastructure and water mobilisation costs would generally increase according to the decreasing yields of many facilities as well as to the need for more effective treatment, notably of drinking water. Not only financial costs, but also energy costs imposed by pumping (water transfer, utilisation of deeper underground water) and by treatment (desalination).

Demand management efforts would become significant or even paramount only in crisis situations of structural shortage, in order to prevent shortages in cases of limited supply. These efforts would especially encourage greater efficiency in water use with rising production costs, by improving efficiency, or would postpone major investment. In the agricultural sector, real investment in water savings will prove difficult to mobilise and irreconcilable with the will to develop water use as a production factor.

Growing Pressure on water resources and the environment

Consequently, **quantitative pressure** on natural water resources would tends to stabilise in the North, but would increase greatly in the South and East.

Starting in 2010, eleven countries would use more than 50% of their renewable resources.

In 2025 this index will exceed 100% in 8 countries, and more than 50% of these resources in 3 other (Fig. 9). This would mean excessive utilisation, but also either intensive re-use, or calling on non-renewable or unconventional resources (more expensive).

Thus, the countries and territories of the South and the South-East, where the annual resources are often less than 500 m3 per capita, are the most threatened by shortage: e.g. Israel, Gaza, Jordan, Libya, Malta, followed by Syria, Cyprus, Tunisia and Algeria.

Naturally, this quantitative pressure on resources **would affect their quality** in the North as well as in the South and East: increasing amounts of wastewater disposed of in the environment, unevenly purified, or of drainage water having leached through salty soil; continued impact of various human activities on surface and groundwater quality.

Localised, better controlled pollution would stabilise or cease, but extensive pollution, in particular agricultural pollution, is likely to spread and deteriorate.

In the North, the fight against water pollution would be a priority that could be solved more or less efficiently, but this would be only a secondary goal in the South and East where sanitation and water treatment will progress slowly and will not follow the rise in demand.

Efforts to protect water quality would generally remain selective with the main objective being to preserve already used resources, notably for drinking purposes, and to protect the environment.

The protection of aquatic ecosystems and wetlands would progress slowly and would depend more on local and private initiatives than on an overall policy. This would rarely take priority in the event of conflict.

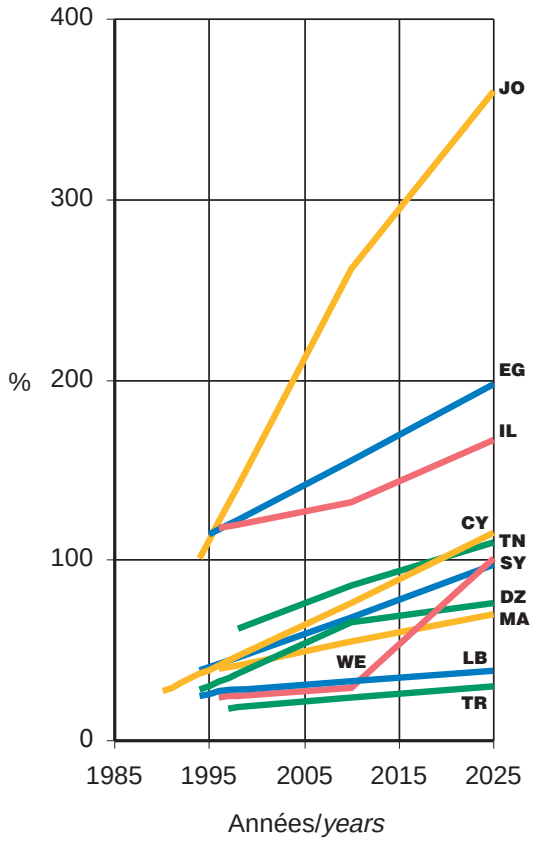


Figure 9:
Projected growth of the ratio demand/ water resources[17] in Southern and Eastern Mediterranean countries (moderate trend scenario).

(Gaza and Libya are not mentioned since their indexes, way over 100, are off the scale).

17 - Ratios: total water demand / natural water resources.

MEDTAC - Blue Plan

Impact on society

As on the world level, there would be an increased polarisation of wealth and growing inequality of access to national resources in the Mediterranean region.

Basin institutions, with the participation of users' organisations, would be maintained and may expand as basin-specific water management develops. However, the level of management participation for certain social categories would remain insufficient, often being restricted to a technical level and rarely reaching a decision-making level.

The number of users' associations would increase in the agricultural sector, with progressive State withdrawal. However, the poorest farmers could suffer if there is no control over the appropriation of production means and territory by a small number of private operators. The migration of rural populations to urban areas would also increase despite major irrigation projects in some countries.

Financial and economic consequences

To provide drinking water and sanitation to an extra 120 million inhabitants (mainly urban), which is the projected increase in the Mediterranean population by 2025, and to make up for currently insufficient facilities, the amount of overall investment required could be as much as 400 billion Euros, i.e. approximately 15 billion per year, mainly needed in Southern and Eastern countries.

Figures for the investment required in other sectors (agriculture, energy…) are much more unpredictable. The related **economic costs** might rise in all water related sectors, less quickly than economic growth in the North, but faster in the South and in the East (for example in proportion to GDP). In fact, in these countries demand is growing faster and the policies and objectives to make up for lost time weigh down the agendas.

There will be a common trend to cover an increasing part of these costs directly by users with a more important cost recovery plan even though it will not be easily feasible in different sectors (easier for the drinking water supply sector than for irrigation).

The principle of "the polluter pays" becomes more widespread but in some cases deviates towards the "grouping together" of shared costs. This trend has already been observed where the level of licence charges is not high enough to be a real incentive.

Local authorities will increasingly delegate drinking water distribution to private companies in those sectors that are the most profitable (urban water supply, notably when huge infrastructures already exist). For sanitation, which is most often left to the public sector, the trend will be more moderate. The role of private operators may expand to cover delegated management of resources (water planning and transport).

Private participation is guided by profitability, creating the risk of exacerbating unequal access to resources and leading to less social equity in a conventional format (in particular, more serious lagging behind in rural areas).

This scenario avoids or at least delays a crisis by developing vital equipment and infrastructures for the population, but it maintains unsustainable development processes, increasing social and environmental instability versus the choice of medium term economic security.

THE "MEDITERRANEAN IN CRISIS" (UNDESIRABLE SCENARIO, EXACERBATED TRENDS)

Here, the forecasts apply pessimistic estimates – even if they are not logically related - notably by maximising those factors that exacerbate tension between water supply and demand (Table 5).

Main features of the exacerbated trend scenario:

This is an exacerbation of the previous trend scenario. These estimates concern:

- Demographic changes: maximum growth according to the United Nations high estimates of demographic change; chaotic urban expansion.
- Economic context: minimum growth, even negative; impoverishment and growing gap in development between the North and the South; free market without taking into account environmental and social objectives.
- Possible events that for the most part are not dependent on decisions and that might have a negative impact:

- climate changes depleting natural water resources (more frequent droughts, or even structural climatic changes);
- natural disasters that damage water supply and water system infrastructures;
- political crises and armed conflicts disrupting or destroying infrastructures, that could lead to upsurge of water related diseases (cholera, etc).

Similar to the initial "exacerbated trend scenario" of the Blue Plan (1989), this scenario presents a globally undesirable and unacceptable future that should be avoided. It is the antithesis of the sustainable development scenario. Some recent events in the Mediterranean region (the Balkans, Algeria) have given a preview of some of the hypotheses in this scenario.

Consequences for water demand and supply

Under the effects of poverty and an economic slowdown, water demands would stagnate or decrease in the North, and would increase less in the South and East, despite the growing demand resulting from demographic growth.

This demand would not be completely satisfied because of the slow growth of water production, but despite this, water loss and waste would not diminish. Water saving efforts would develop little, except in the event of supply restrictions and increases in water prices. The supply approach would be dominant and mainly based on the utilisation of conventional resources, which is nevertheless slowed down by lack of investment capacity. New equipment would be limited to the most profitable short-term operations without taking into account their external impact (environmental and social). In particular, in the most Southern countries, the decline in the regulatory capacity of dams due to their silting up, would not be balanced by new dam-reservoirs.

Because of lack of funds, infrastructure maintenance would be neglected. The rate of drinking water services for urban and rural populations in Southern countries would

progress little or could even decline, and the same would apply to the collection and treatment of wastewater. Breakdowns in drinking water distribution whether in terms of regularity or quality would occur more often, even in the North.

Periodic shortages – including local shortages for Northern countries - would become more frequent, and structural shortages would extend to the South as well as in the Southern regions of Northern countries (Spain, Italy…), mainly due to breakdown or disruption of distribution.

Social consequences

Conflicts over water use rights would increase and aggravate: between sectors, especially between community water supply and irrigation; between regions or basins (reluctance and resistance of the actors of the "supplying" territories, claims and pressure from "demanding" territories) and between countries with shared water resources (cross-border waterways or aquifers). International conflicts over water are frequent in the Mediterranean region, in the East (the Jordan basin, the Nile basin, the Euphrates…), in the North (the Balkans) or even in the West (Iberian basins shared between Spain and Portugal). These conflicts could not be resolved in the absence of an international legal framework. Some bilateral agreements may not be respected.

Environmental consequences

Pressures on the resources would increase more slowly, but would remain high in the South and East where the intensification of water outtake would generally take precedence over the use of non-conventional resources, too costly, or over demand management efforts.

- The overuse of underground water would continue until depletion or deterioration in the quality of resources (marine invasion of coastal groundwater has already started).

- Deterioration in water quality will progress because of stagnation or a decline in sanitation and wastewater treatment and the extension of diffused pollution, as well as greater risks of industrial accidents.

Environmental protection would not be a priority. Aquatic environments would be depleted and wetlands would regress and even disappear.

Financial and economic consequences

Water rights markets, which would develop locally, would not be regulated and would benefit the urban sector or high profit, short-term agricultural ventures. The privatisation of water services would expand without specific social or environmental constraints and without State regulation or control.

Lastly, **economic costs** related to water would undoubtedly be lower with a slower overall growth rate than in the moderate trend-based scenario, but seemingly **a heavier burden on public budgets** and revenues. No efforts would be made to update facilities or address future requirements (especially sanitation systems and the extension of drinking water distribution networks).

In the whole, with this "push back" scenario, a lesser development rate would be more harmful to the environment and the social equilibrium.

THE "SUSTAINABLE MEDITERRANEAN" (SUSTAINABLE DEVELOPMENT SCENARIO)[18]

The Mediterranean vision for sustainable development for water, population and the environment could be expressed thus: "**A peaceful future where socially, economically and environmentally sensitive water allocation and management supports people's well-being with safe, permanent and fair access to safe water for everyone.**" (Bari, May 1999, Seminar: Water for Food in the MENA region).

Taking this direction would imply an intentional, voluntary approach and the definition of quantified objectives in the different hypotheses (Table 5).

Features of the scenario.

Conditions required

This scenario assumes various favourable conditions:

- minimum population growth (see the United Nations low estimates of demographic change) and controlled urban development. In comparison with the moderate trend scenario, this scenario introduces strong social, cultural and behavioural dimensions in water management.
- moderate economic growth, more sustainable, since there is less consumption of resources (especially non renewable one) and less pollution.

Systematic introduction of environmental and social criteria. These are defined and quantified case by case, to be integrated in development, natural resource management and commercial strategies. Contractual specifications and regulations would force private firms to respect environmental and social constraints. On this basis, a regular assessment of water sector performance and general economy performance would be carried out by the State.

Definition of quantified objectives. The core water policy objectives would be to avoid disrupting the balance between water supply and demand, which would have a negative impact on development, while stabilising pressure on the environment at an acceptable level. This would imply:

- identifying on a case by case basis the acceptable level of pressure on natural water, with quantity and quality objectives aimed at preserving renewability of resources as well as preserving aquatic environments: making social choices involving a broad participation of all the different actors through discussions and arbitration.
- adapting the different forms of development, in particular in countries with scarce or soon to be exhausted water resources; the economic sectors would strive to improve water use performance (*"more jobs per drop, a better $ per drop ratio, more crop per drop, more users for the same resource and less drops per unitary production"*[19] *…*).

Means for a sustainable development scenario

To reach this goal, **water resource and demand management would be considered as a whole.**

Management aimed at preserving the ecosystem and natural water resources would consist, according to the countries or territories and the conditions prevailing, in:

- limiting the pressure increase on natural surface and groundwater – when and if possible based on socio-economical and technical criteria- at a maximum acceptable level, notably by not submitting the natural environment to an abusive impact and by limiting non-sustainable approaches regarding irregular surface water.

18 - This sustainable development forecast was already adopted by the initial Blue Plan "alternative" scenarios and was taken up again in many of the low estimates of the 1996 update.
19 - Tony Allan, Consultation Water for Food, Bari, May 1999.

- stabilising pressure at its present level (in countries where there is very little leeway)

- lowering pressure by reducing outtake and stopping the continuous over use of renewable groundwater reserves and by intensifying wastewater treatment (in those countries featuring non-sustainable production Fig.6).

Consequently, beyond the stage where the expected stabilisation level in pressure on conventional resources is reached (already reached in the two last instances) **any demand for additional water** would be **satisfied with non-conventional resources** (wastewater recycling, desalination), or even water imports.

Demand management would first aim to delay the need to turn to new supply sources – generally more costly - but also to modify the relationship between the different user sectors. This consists in:

- Limiting the increase and even lowering the demand through water saving incentives, by improving efficiency and reducing waste (very high in Mediterranean countries and a very competitive "source" compared to conventional resources still available and non conventional resources) (Box 5).

Box 5: possible gains through water savings

Reducing by half the volume of water withdrawn and lost, unused or misused in all sectors would represent some 75 km³/year as of 2025. This corresponds to what will be needed in terms of new water production to cover 4/5 of the projected demand in 2010, for the moderate trend scenario. This comparison is somewhat harsh but it applies to most Mediterranean countries taken individually, notably those with the scarcest resources.
This would delay the arrival of disruption and overcome the hurdle of demographic transition in some countries.
Conclusion of the Fréjus workshop of the MCSD (Mediterranean Commission for a Sustainable Development), September 1997.

- Water saving efforts would concern all sectors: the urban sector (reduction of losses in distribution, leakage and poor user efficiency, development of recycling techniques in concentrated housing areas), the industrial sector (through recycling) agriculture (reduction in transport losses, gains in irrigation efficiency, re-use of drainage water). They would also include a better adjustment of the volumes of water used including for domestic use (Box 6).
- Reviewing resource allocations to the benefit of more value-added uses, those capable of withstanding the growing direct and external costs of water production (drinking water supply for communities and tourism). This would entail implementing structural changes for the different economic sectors using water so that the scarceness of resources in southern Mediterranean countries does not hamper their development.

Irrigation of course would be the most affected, both in terms of volume of water consumption and expected water savings, but socially this is also the most sensitive.

Efficiency gains and the reduction of resource allocation would be inseparable from incentive policies (measures effecting farmers' incomes and agricultural prices), which would facilitate the payment of water costs and water saving measures, and offer compensation (tax, converting activities…).

Here, water policy would be particularly inseparable from agricultural and rural development policies, and from general socio-economic policies.

Thus, for water policies compatible with sustainable development, demand management would be as important as resource management or more generally supply management. Such an objective would however require arbitration between the different objectives that might be incompatible at times, e.g.:

- Maximising the productivity of the quantity of water allocated to irrigation, with no reduction (subject to pressure on behalf of the market) and preserve a minimum standard of living for the active rural populations.

- Invest in agricultural water savings and allocate water resources preferably to the most advantageous economic sectors.

These policies would be based on broad participation by all users in the decision-making process and management. This implies decentralised management at the level of hydraulic units (drainage basins, aquifer systems, etc.) or any other relevant management units, with ad hoc participatory institutions.

Box 6: drinking water and domestic use

In communities, there will be a noticeable increase in the total water demand per inhabitant, principally in Southern countries. At the same time, drinking water standards will become stricter (cf. the new European Union directives), thereby increasing drinking water treatment costs.
In such conditions, for how much longer will it be feasible to distribute more and more costly drinking water for domestic uses, which for the most part, do not require such a high quality of water?
Is this economic wastage? The question can be raised, particularly in low income communities, as to whether production and distribution of high quality drinking water, reserved for noble uses (food and drink), should be separated from water of sufficient quality for other domestic uses.
Should we consider distributing drinking water using containers, at the same time moderating the treatment of water distributed for domestic use, or even encourage recycling, particularly in large buildings?

Lastly, sustainable development policies would imply imposing more restrictive environmental protection conditions on all trade agreements and the delegation of public services to the private sector. This implies strengthening the role of the public sector as a regulatory body.

Implications for water production and pressure

How would water demand and production evolve?

Contrary to the trend scenarios:

- on the one hand, the gap between water demand and production would be reduced thanks to gains achieved in the efficiency of transport and use for all sectors;
- on the other hand, outtake would coincide less and less with total production due to the development of non conventional resources, especially in several Southern and Eastern countries; zero growth or even local decreases in withdrawals would not be incompatible with a moderate growth in demand.

The figures given in Table 8 for 2010 and 2025 per sector of use cover:

- figures from certain national planning documents which correspond to a sustainable development outlook (Israel, Tunisia); or
- for the Northern countries, the Blue Plan's efforts to bring water demand forecasts up to date (1996), which roughly corresponded to the sustainable development scenario's objectives. However, the hypothesis used, which also minimised all the demand factors, no doubt represented the absolute minimum of future water demand; or
- for most of the Southern countries, figures from scenario 3 of the Vision on Water for Arab countries (1999), based on the hypotheses of both growing supply and a moderate fall in demand (corrected to fit United Nations low population forecasts).

The figures in Table 8, illustrated in figure 10, can be summarised as follows (in km^3 /year).

	Previous reference	Projections	
Sectors	1990	2010	2025
Communities	38	48,4	59,4
Agriculture	181	184,4	193,3
Industry not supplied	33	35	38,1
Energy	47	40	36,2
Sub-regions			
North	155,5	134,5	116
East	55	70,5	91,5
South	88,5	103	119
TOTAL	299	308	327

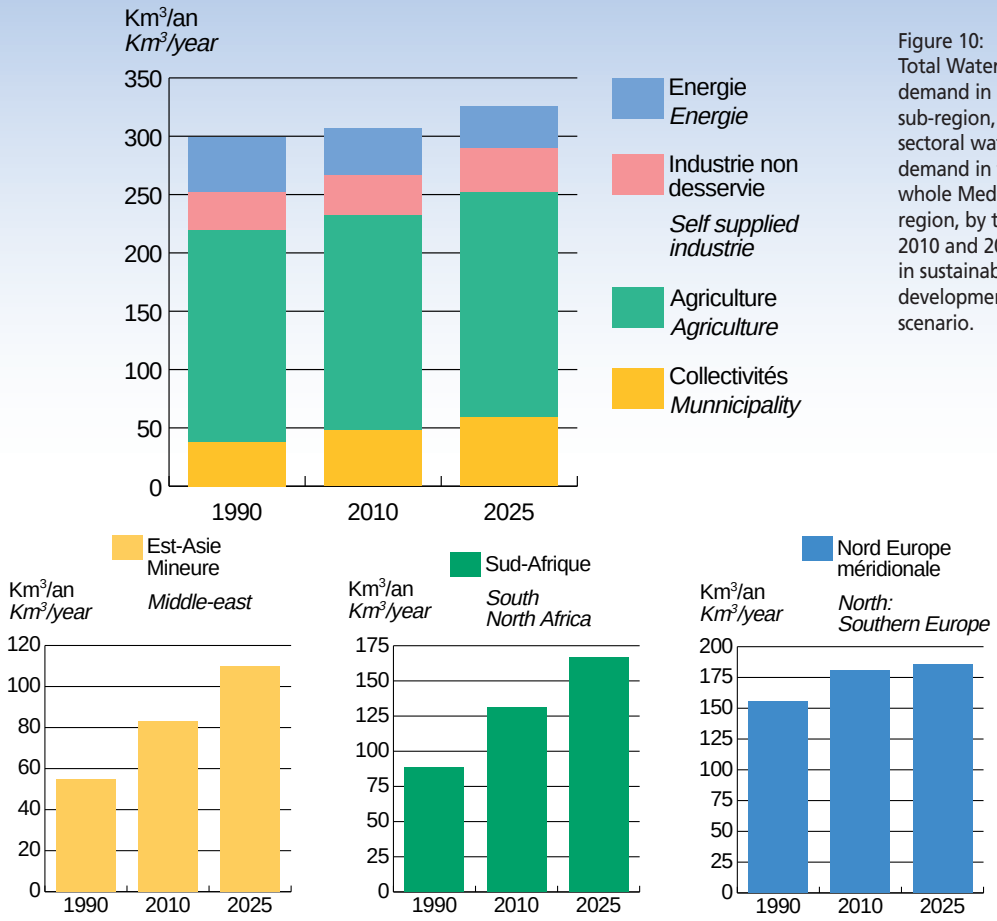


Figure 10:
Total Water demand in each sub-region, sectoral water demand in the whole Mediterranean region, by the years 2010 and 2025, in sustainable development scenario.

In this perspective:

- global demand would be somewhat stable until 2010 , and then increase up to 2025;
- a stable growth rate of community demand (+27% in 2010, +56% in 2025, and industry +6% in 2010, +15% in 2025) would be balanced by a slow yet steady growth in the demand for agriculture (+2% in 2010, +7% in 2025);
- a sizeable decrease in the Northern countries' demand (-25% in 2025) would come as a contrast to the strong increase in countries of the East and South (+66% in 2010, +34% in 2025).

These are obviously very optimistic forecasts. Indeed, current estimates of water demand (cf. table in Appendix I) are already higher than those calculated here for 2010 and even for 2025 in all the Northern countries. This implies a turnaround in current trends and a drastic fall in water demand, which cannot be achieved by population decrease alone, thereby supposing a firm intention to change.

On the other hand, even if minimised, future water demand will be higher than at present in all the Southern and Eastern countries.

Moderately increasing and stable demand would help limit or halt the progression of water development projects, even more so since the feasibility criteria of such equipment, taking better account of the external impact on the environment, would be more restrictive. More specifically, to better master irregular water, conventional techniques which have become less effective (scarcity of potential dam sites, silting up of reservoirs) would be replaced by the development of artificial underground water

recharge coupled with a more active use of some aquifers while putting and end to harmful overuse. Moreover, the capture of relatively fresh water could develop around the numerous coastal or underground sources found in the Mediterranean.

Non-conventional water production would increase:

- development of the **regeneration and reuse** –mainly for agriculture- of urban waste-water and drainage water, to better limit the pressure of irrigation on conventional resources and limit competition between urban and agricultural demand while ensuring a better distribution of the financial participation in treatment costs;
- progress made in **desalination** techniques, encouraged by substantial reductions in treatment costs in most of the Southern countries and islands.

Table 8.
Water demand in Mediterranean countries and territories in 2010 and 2025 according to the sustainable development scenario

Countries and territories	Sectoral demand (km³/year)								Total demand km³/year	
	Communities		Agriculture		Industry		Energy			
	2010	2025	2010	2025	2010	2025	2010	2025	2010	2025
PO	0,52	0,6	4,5	4	0,3	0,5	3	2	8, 32	7,1
ES	5,0	4,5	19,5	17,2	2,0	2,3	3,5	3,0	30,0	26,95
FR	5,9	5,4	4,7	4,0	4,8	5,1	22,0	17,8	37,4	32,3
IT	6,5	4,5	21,6	17,2	7,0	5,0	0,5	0,3	35,6	26,98
MT	0,04	0,038	0,004	0,004	0	0	0	0	0,042	0,042
SI,HR,BA,YU,MC	1,2	1,8	0,8	0,8	5,0	5,0	8,0	8,0	15,0	15,3
AL	0,5	0,6	1,0	1,3	0,15	0,2	0	0	1,65	2,1
GR	1,0	1,0	5,1	4,0	0,13	0,14	0,1	0,1	6,33	5,24
TR	15,2	23,6	23,8	28,5	4,0	4,0	3,0	5,0	46,0	61,1
CY	0,1	0,06	0,4	0,3	0	0	0	0	0,44	0,36
SY	1,0	1,26	17,2	20,7	0,3	0,47	0	0	18,5	22,4
LB	0,4	0,48	0,78	0,82	0,1	0,14	0	0	1,28	1,44
IL	0,6	1,3	1,10	1,05	0,15	0,15	0	0	1,85	2,50
GZ, WE	0,16	0,26	0,28	0,40	0,01	0,05	0	0	0,45	0,71
JO	0,34	0,5	1,3	2,0	0,12	0,2	0	0	1,76	2,7
EG	4,0	5,0	60,0	65	8,6	11,4	O?	O?	72,6	81,4
LY	0,9	1,5	5,85	8,7	0,20	0,5	0	0	6,95	10,7
TN	0,4	0,5	2,5	2,05	0,12	0,17	0	0	3,02	2,72
DZ	3,5	4,9	2,8	3,1	1,1	1,5	0	0	7,4	9,5
MA	1,0	1,5	11,0	12,0	0,8	1,3	0	0	12,8	14,8
Total	48,36	59,4	184,4	193,3	34,9	38,13	40,1	36,2	299,3	326,7

Sources for the calculations used in Table 8 are given in Appendix III

Even with optimist estimates, the **pressure on natural water would remain high** in the **Southern** and **Eastern** countries with current cases of extreme pressure being relieved where a balance is reached, either in terms of quantity or quality.

The exploitation indexes for renewable resources would have a sizeably lower growth rate, remaining in the upper range in those countries where the indexes are already high: they would still be over 50% in 8 countries by 2010 and in 10 countries by 2025, but never exceed 100% (except for the specific cases of Jordan and Libya due to the importance of fossil water exploitation, and in the Gaza strip).

Nevertheless, this quantitative pressure would tend to stabilise after having reached the limits of utilisation potential and the neutralisation of land use impacts. For its part, water pollution (even diffused) would regress thanks to more active and preventative measures even though this still differs according to country or sector: generally speaking, sanitation and the treatment of urban and industrial wastewater would improve; the impact of farming practices would be reduced (even though this would not by widespread).

The preservation of natural aquatic zones and wetlands (which have become rare in many Mediterranean countries) as well as sources of supply, would become a priority objective thanks to a better understanding of the useful role played by such zones, and thanks to the efforts made to enhance them.

Impact on society

Most water and agricultural development policies would be influenced by European directives and international conventions. Water would be managed at the level of hydrological units (drainage basins, aquifers) when and where physical conditions make this possible, with the active participation of the direct and indirect actors.

User participation in water management, particularly through basin institutions, would become widespread, and would partly compensate for the increasing costs users will have to carry. Partnerships between public and private sectors and users associations would develop in the irrigation sector and in the water distribution and urban sanitation sectors.

This participation would occur on all levels (from decision making through to technical management) and implies greater responsibility being taken by the direct and indirect actors, and in particular users.

Public authorities are more present and apply more restrictive conditions and controls to private sector intervention.

Financial and economic consequences

The related economic costs would generally increase more than in the trend scenario due to the more rapid rise in supply costs (despite the low demand growth rate) and greater and more efficient efforts to ensure the protection and conservation of natural water resources. This increase would be in line with that of the economic growth rate and undoubtedly higher in the Southern and Eastern countries. They would be a heavier burden on public and private budgets.

In fact, one price to pay for sustainable development is the recovery of cumulated investment delays and environmental damage caused by “conventional” policies in the past. Public budgets will probably have to finance this “debt” in order to avoid placing an additional burden on users, already involved in financing future investments.

Part of the investment could come from private sources, if the sector is profitable enough and the government should set the terms and conditions of this in the delegation specifications.

Cost sharing in all sectors of use between users and communities would remain open as a function of socio-economical policies. The tendency would be to recover all costs for drinking water and sanitation with partial recovery for rural and agricultural sector, at least for operation and maintenance costs, and the reduction of subsidies, which would only be maintained to guarantee the social functions of water.

The principle of the polluter pays would become more widespread and apply to all water users. The incentive factor would be reinforced by a rise in licence charges and grants.

To avoid wastage, a "waster pays" principle could be introduced to apply to communities, industrial and domestic users and the agricultural sector. This "wastage" charge would be linked to grants to assist water saving efforts.

Ultimately, the sustainable development scenario does not eradicate water scarcity (essentially in the South and East and in many islands) any more than the other scenarios do, and scarcity could even be increased by conservation objectives.

This approach differs from the conventional scenario:

- firstly in the way that it confronts the risk of shortage, with reinforced integration of educational, cultural and environmental investment in water management:
  - by better adapting demand, optimising use and reducing some uses,
  - by excluding non-sustainable supply.
- secondly, the State will have to invest more (more taxes and use of public spending to correct past mistakes and ensure equal public access to water).
- lastly, the State's role as regulator and controller is strengthened, with the essential participation of the private sector in some aspects of water management (distribution, sanitation, dam and sinking management, etc...) In fact, private sector intervention is subject to increasing constraints (environmental and social objectives). This may make some markets less attractive for the private sector.

The outcome of this would be to minimise the impact of development on nature – which otherwise would be directly passed on to future generations as a "debt" - and thus making today's users pay as they benefit from economic development.

Conclusion: a major issue for the Mediterranean

The Mediterranean Vision on Water, Population and the Environment in the 21st Century seeks to imagine several different possible future scenarios and to underline the importance and feasibility of a sustainable development scenario.

What are the differences between the scenarios?

According to the different hypotheses used, the three scenarios lead naturally to differences in their results, which are more or less marked according to the subjects, countries and time scales, and indicate the degree of freedom and scope for choice that the actors, i.e. today's decision makers, have.

Leaving aside the water crisis scenario, the main differences between the conventional scenario and the sustainable development scenario involve:

- the extent to which the environmental and social functions of water are taken into account: limited in the conventional scenario, great in the sustainable scenario;
- the unequal growth in water demand, more moderate in the conventional scenario;
- the risks of water use conflicts: more preventive measures in the sustainable development scenario;
- the future of irrigation in the South and East: a more moderate growth in the sustainable development scenario, with provision of adequate social compensations;
- pressure on the environment, which is higher in the conventional scenario;
- overall costs: higher but better distributed in the sustainable development scenario;
- effects on the social stability of political and economic choices relating to water: risk of social crisis in the conventional scenario;
- the respective roles of public and private actors, better balanced in the sustainable development scenario (Table 9);
- the possibility of a water crisis: avoided in the sustainable development scenario and, at best, delayed in the conventional scenario.

In general, the future situations explored by the scenarios would be more contrasted in the Northern countries than in the Southern and Eastern countries, which are under greater pressure.

Advantages of the sustainable development scenario

The main advantages of the sustainable development scenario, over the conventional scenario (and a fortiori over the crisis scenario) are:

- Greater social and geographical equity in the share of resources and costs:
- Transition from irrigated agriculture, better accompanied with adequate compensations;
- Greater inter-generational equity;

Table 9.
Water policies in the different scenarios.

The most important differences in the hypotheses used in the different scenarios concern the implementation of water policy and the distribution of roles between public and private sectors and users.		
	Conventional scenario	Sustainable development scenario
State, communities, public firms	• Disengagement from water supply, water treatment and management of big aquatic areas. • Little control,	• Considerable effort made by the State to reduce delays in investments (strong pressure on public budget and taxes). • Firm environmental objectives that limit access to and outtake from certain resources.
	• Expenditure: increasing • Increasing management of drinking water supply by private firms in urban areas; • Little investment in sanitation and the distribution of health water in rural areas.	• Expenditure: increasing rapidly • Less private sector management • Operating costs and provision for future equipment recovered from users • Public-private investment in water treatment and water supply in rural areas.
Private sector	• Increased participation in water supply and sometimes in water treatment and agri-cultural water management. • Growing interest in resource management (dams, pumping etc.)	• Growing public-private partnership in water supply sector in urban and rural areas, and even in large irrigated areas. • Conditional delegation of responsibility to private firms or users associations (conditions of performance, social and environmental objectives).
	• Expenditure: increasing • High recovery rate through tariffs applied to water supply in urban areas	• expenditure: increasing rapidly • more social differences in cost recovery; obligatory investment in sanitation and rural areas • Huge environmental constraints.
Users	• Participation in basin committees (if they exist). • Users associations in agricultural sector. • Urban consumers association for protection of their water access rights.	• Participation in basin, aquifer commit-tees, or other management units. • Public-private partnership – users asso-ciation for managing certain irrigated areas. • Conditional delegation of responsibility to users associations (conditions of per-formance, social and environmental objective)
	• Expenditure: increasing, but without any guarantee nor extension of service.	• Expenditure: increasing, through tariffs, but with guarantee of service and pro-vision for future needs.

- Fewer conflicts, both between sectors of use – notably between community supply and irrigation – and between regions and countries. Solidarity and cooperation take precedence over conflict.
- Development and environmental protection objectives are better balanced, with better conciliation between economic, social and environmental imperatives in defining the water use efficiency.

How to move towards the sustainable development scenario?

The management of tomorrow's water resources must prevent disruption of the balance between supply and demand, leading to local or regional water scarcity. This will be possible in those Mediterranean countries under threat, particularly all the countries in the South stretching from Spain to Syria through:

- supply management, combining (to various levels according to the countries) a more active conservation of resources (especially their quality) with transfers (including international ones) and also an increase in non conventional water production;
- demand management promoting better appreciation of water, developing water savings, avoiding net wastage, and modifying the relationship between the different water use sectors.

A major aspect in demand management in the Southern and Eastern countries involves reducing the share of resources allocated to irrigation for the benefit of urban demand. These reductions can be partly compensated for through efficiency gains in irrigation and rainfed agriculture and through the re-use by agriculture of urban and drainage wastewater, with a view to impede the growth rate of low value-added agricultural food production. Assisting farmers to maintain agricultural prices or facilitating redeployment could help prevent the risks of social crisis in the rural areas.

Resource allocation arbitration must reconcile environmental and social criteria, which should take priority over economic profit criteria. The success of such compromises is linked to the participation of the different actors and will ensure that the major investments required in the future will be properly applied. The higher added value for water using production activities, is no more important than the preservation of the other functions of this resource - notably that of maintaining the services rendered by the natural ecosystems and thus the quality of life in the Mediterranean region, for the present and future population as well as for tourists.

The strengthening of the Euro-Mediterranean partnership, which should ensure that it limits environmental impacts and tensions related to the management of natural resources, will have to pay special attention to all issues concerning water. In this respect, given the weight of irrigation in the region and the social and environmental concerns linked to agriculture, the evolution of the regime of agricultural exchanges will have to be carefully monitored, particularly in the frame of the future Euro-Mediterranean free trade area to be set up by 2010.

The foodstuffs security objective will be depending more and more from trade, notably Euro-Mediterranean. In order to reach this objective, the countries will have to balance the foodstuffs imports and high value-added product exports (agricultural sector and, more and more industry and tourism); this will considerably effect the choice of water resource allocation.

In the Mediterranean, the future of water management will be neither entirely State run

nor entirely private, but it will have to stem from a partnership between the public and private sectors and users, calling for innovative co-operation mechanisms.

Mediterranean people must be prepared to face the growing burden of water on public as well as private budgets. Integrating social and environmental concerns into water policies will have a high cost in the short term (higher in the conventional scenario), but will avoid much higher costs in the longer term.

Development will be sustainable only if it changes.

In the Mediterranean region, in order to achieve sustainable development, a veritable social and cultural transformation has to take place in order to change managerial methods and consumer behaviour, which have been introduced only rather recently in a region long time known for its traditional mastership of water issues.

Thus, actions and investments should focus more on:

- changing individual and collective behaviour in current water use both by individuals (including tourists) and institutions: public awareness, education, increasing the capacity of all actors;
- community participation and management: decentralisation, structural reinforcement of institutions, transfer of management skills to the appropriate level and community management...
- promote non-conventional resources (recycling and desalination);
- environmental and social performance of resource management, particularly in agriculture, stressing reduction of water losses in the networks, and especially improved demand management;
- co-operation, especially for joint water resource management within shared basins, water transfers, research and development, intervention plans, organisation of exchanges of food and energy supplies, etc…

Water constitutes a vital issue for the Mediterranean people, in the South and East in the firs place, but also in some countries of the North. This precious resource is threatened today by negative trends. It has become the physical factor that limits and will limit even more development in the entire basin.

Water policy, but also economic and social policy must integrate environmental objectives.

In the water field, the time has come therefore in the Mediterranean to “change the scenario”.

Appendix I: Current water demand in the Mediterranean countries and territories (according to national sources)

Countries and Territories	Date of value	Gross water demand* in km³/year								Total per capita demand (on the date of value) m³/year	
		Sectors of use									
		Communities, Drinking water supply		Agriculture irrigation		Industries non supplied		Thermoelectric Energy (cooling)	Total		
Portugal	1995	1,02		8,57		0,78		0,48	10,85	1105	
Spain	1997	4,667		24,09	1	1,647	1	4,915	35,323	908	2
France	1994	5,93		4,97		3,95		25,81	40,67	720	
Italy	1993	7,9		20,3		7,5		8,79	44,6	775	
Malta	97-98	0,0408		0,0066		0,0005		0	0,048	155	
Slovenia	1994	0,247	7	0,0034	7	0,07	7	0,95	0,495 8	245	9
Croatia	1996	0,38		0,001		0,097		0,24	0,764	153	
Bosnia-Herzegov.											
R.F. Yougoslavia (Monténégro+Serbia)											
Macédoina											
Ex-Yougoslavia	1990	1,94		0,9		5,8		7,2	17,34	729	
Albania	1995	0,4		1,0		-		-	1,4	413	
Greece	~1990	1,15		5,66		0,14		0,08	7,03	700	
Turkey	1997	5,5		~26,0		4,0		-	35,5 11	661	
Cyprus	1998	0,06 à 0,065		0,16 à 0,17		ε		0	0,230 à 0,235	323	
Syria	1993	0,53		13,6		0,28		0	14,41	1150	6
Lebanon	1994	0,37		0,88		0,005		0	1,25	390	
Israel	1996	0,597		1,275	16	0,137	17	0	2,009 18	353,4	
Palest. Auth. The West Bank	1996	~ 0,065		~ 0,1		~ 0,005		0	0,17 22	115	
Palest. Auth. Gaza	1994	0,048		0,081		0,002		0	0,131	140,5	
Jordan	1994	0,19		0,66		0,04		0	0,89	203	
Egypt	1995-96	4,54		54	23	7,5		0	66	1064	6
Libya	1995	0,364		3,376		0,145		0	3,885 14	809	14
Tunisia	1996	0,365		2,429		0,055		0	2,829	248	14
Algéria	1990	1,12		2,7		0,48		0,2	4,5	180	26
Morocco	1998	1,1		10,18		0,2		0	11,48 28 29	462	

(*) Including losses.

Water production / sources of supply in km³/year																			
Countries and territories		Outtake								Imports			Non conventional production						Sources
		Surface water			Underground water			Total					Desalination			Wastewater regeneration for reuse			
Portugal		7,35			3,5			10,85			0			0			0			EC, 1997
Spain		29,69			5,522			35,21			0			0,019	3		0,096	3		Libro Blanco
France		39,64			6			40,67			0			0			0			Min. Env. 96
Italy		34,2	4		10,4			44,6			0			ε			0			Benedini 96
Malta		ε			0,025			0,025			0			0,0225	5		0,0016	6		WSC 98, Rio 96
Slovenia					0,176	7	13	0,495	8	8	0			0			0,0025	10		Workshop Fréjus 97 Stat. Year Book 94
Croatia								0,764			0			ε			0			Ostovic/Fréjus 96
Bosnia-Herzegovina											0			0			0			
F.R. Yougoslavia (Montenegro+Serbia) Macedonia											0			0			0			
Ex-Yugoslavia		16,85	4		2,25			17,34			0			ε			0			Nuri
Albania		~ 0,77			~ 0,63			1,4			0			0			0			Workshop Fréjus 97
Greece		5,03			~ 2,0			7,03			0			ε			0			Conf. Rome 92
Turkey		29,55	11	12	6,0			35,5			0			ε			0			
Cyprus		0,085	4		0,125	13		0,215			0			0,013			0,012	5	14	Tsiourtis 99
Syria		12,24	4		1,8	14	15	14,04			0			0			0,37			FAO 97
Lebanon		0,85			~ 0,4			1,25			0			0			0			
Israël		0,57	14	19	1,17	14		1,57		14	0,07		20	0,02	10		0,27	21		Min. Env. 99
Palest. Authority	Cisjordanie	ε			0,17			0,17			0			0			0			F. Daibes-Murad 98
	Gaza	ε			0,13			0,13			0			0			0			Al Jamal 96
Jordan		~ ,36			~ 0,48			0,84			0			0,009			0,045			Source ? (Doc. Marseille)
Egypt		47,7			5,3	4	4	53			0			0,03			0,7	24		Amer, 99
Libya		0,17			3,65		4	3,82		14	25	0			0,069	2		0,069	2		Salem 99/FAO98
Tunisia		1,154			1,675	4		2,829			0			0,0083			0,011			DGRE 99
Algeria		2,2	4		2,3	27		4,5			0			0,064	26		-			Conf. Rome 92-Hadji. FAO 97
Morocco		10,95	9		2,68	9		13,63		9	0			0,0034			0,05			DGH, DRPE, 99

Notes
1 +,034 livestock
2 year 1998
3 year 1992
4 With sources
5 FAO 97
6 year 1993
7 ECE/IEDS Database
8 source ?
9 year 1991
10 year 1994
11 Min. Env. 98
12 At. Fréjus 97 – year 97 – with sources
13 No sources
14 year 95
15 2,5 with source ?
16 reuse (of which 0,3 brackish water
17 0,025, brackish water
18 2,031 ?
19 of which <- NWC and Yarn.
20 year 1990 – Yarnouk
21 Σ
22 with ~ 0,04 colons isr.
23 With reuse drainage water
24 '+12,6 drainage water
25 3,675 (supply < demand)
26 year 1990
27 of which 0,4 non renewed
28 Σ
29 . year 1991 = 11,8

Appendix II. Variables, water demand factors

The following table gives estimations of the main variables (demand factors) used for forecasting water demand in 2025, for the 1996 Blue Plan exercise. The demand factors vary according to the high and low growth estimates which approximately correspond to the Vision's "conventional" (moderated trend) and "sustainable development" scenarios.

These estimates mainly concern the Northern countries which did not have any available national forecasts. For the Southern and Eastern countries, the available national forecasts were applied or adapted.

The results of this exercise were presented in the reference document "Water in the Mediterranean region", produced for the Euro-Mediterranean conference on water management, Marseilles, Nov. 1996.

Countries and territories	Scenarios	Community drinking water supply			Irrigation		
		Demand per inhabitant (production m³/year)	Service levels (%) (1)	Distribution yield (%)	Irrigated areas 1000 ha	Water demand for crops m³/an.ha	Average efficiency (%)
PO	T	75	90	80	800	4000	80
	D	60	85	85	630	3600	90
ES	T	130	95	80	4000	4000	90
	D	110	90	85	3500	3500	90
FR	T	108	100	72	1650	2300	90
	D	68	100	80	1400	2000	90
IT	T	urb 120 rur 65	100	85	4000	3800	70
	D	urb 120 rur 70	100	85	3000	3500	80
SI,HR, BA, YU MC	T	120	90	70	200	3200	70
	D	90	80	80	180	2800	80
AL	T	urb 90 rur 50	100	70	700	3100	70
	D	urb 60 rur 30	80	80	500	2900	80
GR	T	120	90	62	1700	2300	70
	D	110	80	82	1300	2000	80
CY	T	80	90	70	100	4400	80
	D	70	80	80	50	4000	90

T: Trend, high estimate ;

D: Sustainable development, low estimate.

1. The low estimation of service levels would be better suited to the crisis scenario. It was too pessimistic for the sustainable development scenario.

Appendix III. Sources for the figures in Tables 7 and 8

Countries or Territories	Table 7 : moderate trend-based		Table 8 : sustainable development	
	2010	2025	2010	2025
PO	A	B	B	B
ES	A	B	B	B
FR	A, B/agriculture	A, B/agriculture	B	B
IT	A, B/agriculture	A, B/agriculture	B	B
MT	A	A	B	B
SI, HR, BA, YU, MC	B	B	B	B
AL	A, B/agriculture	B	B	B
GR	B	B	B	B
TR	A(1), B	A(1), B	A(1) ; B (4)	A(1) ; B (4)
CY	A, B/agriculture	B	B	B
SY	A	C, A/local authorities	D	C, B (5)
LB	A, D/agriculture	C	D	C
IL	A (2)	A (2)	B	A
GZ, WE	A	A	D	C
JO	A	C	D	C
EG	A/local auth, C	C	D	C
LY	A (3)	A (3)	D, A/agricult.(6)	C, A/Agricul (6)
TN	D	C	A (7)	A (8)
DZ	D	C	D	C
MA	A	C	D	C

Sources

A. National source (planning document or consultants' surveys, details given in the bibliography)

B. Blue Plan calculation (1996), high estimates for Table 7 and low estimates for Table 8.

C. Forecasts from the Vision on Water in Arab Countries (1999), prepared by the UNESCO's Cairo office, currently being published: Scenario 2 for Table 7 and Scenario 3 for Table 8.

D. Calculation for 2010 of the average between the 1995 situation and the forecast for 2025, taken from the Vision in Arab Countries (1999): Scenario 2 for Table 7 and Scenario 3 for Table 8.

Notes :

(1). Calculated using variables put forward by Anac (1999)

(2). High estimate

(3). With average forecasts for agriculture

(4). Blue Plan Calculation for Industry and Energy

(5). Blue Plan Calculation for communities

(6). Low estimate of the Salem forecasts (1992)

(7). Forecast " Economie -eau 2000 "

(8). Forecast Alouini, Bari (1999)

List of tables

List of figures

Liste des encadrés

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