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Economic Commission for Latin America

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THE WATER RESOURCES OF LATIN AMERICA AND THEIR UTILIZATION

A report on progress in the application of the Mar del Plata Action Plan

83-12-2219

via A White
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CONTENTS

/B. Water

Introduction

In order to assist in the development of the activities and discussions related to the United Nations Water Conference, in 1977 ECLA prepared a regional report entitled "The Water Resources of Latin America". This report has long been out of print and it was decided that a new edition was timely and could form a part of the first review of the progress made in Latin America in the application of the Mar del Plata Action Plan adopted at the United Nations Water Conference to be undertaken by the Sessional Committee on Water at the Twentieth Session of the Commission.

The Action Plan itself is a diffuse and wide-ranging collection of recommendations and resolutions covering all aspects of the development and administration of water resources. It is difficult to summarize because of the breadth and detail of its coverage. It can be said, however, that emphasis is placed on better knowledge respecting the supply of water through improvements in the assessment of the resource; on greater efficiency in use, particularly through the employment of pricing and other economic incentives for this purpose; on the evaluation of the environmental consequences of the use of the resource and related health effects, the fuller development of national policies and employment of planning in the use, management and conservation of water; on the strengthening of programmes to reduce losses from natural hazards; on improvements in public information and education programmes in water resources; and, finally, on the need to increase both regional and international co-operation in the development of the water resource.

In the years since the Conference, rapid demographic and economic growth has continued in all parts of the Latin American region. This growth has led to a continuing increase in the demand for water, particularly on the part of the metropolitan regions and the associated industrial complexes.

At the same time, the region continues to exhibit a very heterogeneous pattern of income levels and economic activity; a pattern again reflected in the nature of the demand for water. The requirements of the peasants of the Altiplano in Peru or Bolivia are very different from those of the urban middle and working classes of São Paulo, Buenos Aires or Mexico City. On the one hand, there are increasing demands for water for recreation, but it remains the case, despite the progress that has been made, that too many babies die from exposure to contaminated water. At the same time, pollution of water resources from both domestic and industrial sources grows apace. Some progress has been made in the treatment of waste water, but much remains to be done before pollution can be said to be under control.

Latin America has the most abundant water resources of any region of the globe but it also has some of the most arid zones in the world. The different combination of requirements and resources creates, therefore, very different national and regional conditions. There are, however, despite the differences, features which bring the countries of the region increasingly together in co-operative efforts to discuss and resolve the water management issues that challenge them. Perhaps the most positive feature of the years since the United Nations Water Conference has been the increase in co-operative activities in such areas as the International Drinking Water Supply and Sanitation Decade, the signing of multilateral agreements to safeguard the more important regional seas and their related resources and a general increase in activity concerned with shared water resources.

/Chapter I

Chapter 1

ASSESSMENT OF WATER RESOURCES

During the last twenty years, meteorology and hydrometry have received considerable stimulus in all the countries of the region and much has been learnt of the nature of the hydrologic systems. This stimulus has led to an appreciable increase not only in the number and sophistication of meteorological and hydrometric stations but also in the capacity of the region to survey and analyse its water resources.

In general, it can be claimed that the emphasis in recent years has been placed on the rationalization of the hydrometric and meteorological networks of the region and a deepening of the knowledge of the hydrological cycle on a regional, national and local basis, rather than simply on the expansion of station networks. Because of the nature of the distribution of the population of Latin America, however, there are important river basins in which even the basic elements necessary to calculate the water balance are not known.

A. Characteristics of the physical supply

Latin America is basically a humid region although it contains some very arid areas. In consequence, on the whole the region possesses a very abundant supply of water resources. The average annual precipitation in Latin America is estimated to be 1 500 mm, over 50% above the world average, and the average annual runoff -370 000 m3/second- is some 31% of the total world land surface drainage entering the oceans. Of the three subregions into which the region can be divided, South America, with an average annual precipitation of 1 560 mm, has the highest rainfall of any continent in the world; Central America and the Caribbean are also, however, above the world average. The distribution of precipitation is very uneven across the region and this creates some very arid areas; the Ataçama Desert, for example, is the driest area in the world. The seasonal distribution and annual variations in precipitation are also irregular in a large part of the region and there are areas which have excessive water availability in certain seasons and severe drought in others. There is also abundant groundwater, and this is an increasingly important source of supply.

1. The hydrologic systems of Latin America

The main orographical system of the region -constituted by the Andes mountain chain and its continuation northwards into Central American mountain ranges and the main ranges in southern and western Mexico- separates the Pacific and Atlantic (including the Caribbean Sea) watersheds and also accounts for the existence of some enclosed drainage basins. The basic physical division gives rise to three major types of river systems: the large systems flowing to the Atlantic Ocean and adjacent seas; the short rapid streams of the Pacific watershed; and the intermittent streams that drain internal areas. To these three types can be added the rivers of the Caribbean islands, which despite high levels of rainfall do not have large volumes of flow (see table 1).

/Table 1

Table 1

LATIN AMERICA: ESTIMATED TOTAL SURFACE FLOWS AND THE HYDROLOGICAL CHARACTERISTICS OF THE MAIN RIVER BASINS

River basin	Country	Area (thousands of km2)	Average flow of discharge (m3/sec) a/
Total surface flow	Latin America	20 492 181	370 127
Total surface flow	Mexico and Central America	2 492 784	31 572
Bravo	Mexico	238 b/	150
Usumacinta-Grijalva	Guatemala-Mexico	131	3 300
Lerma-Santiago	Mexico	127	364
Balsas	Mexico	110	387
Pánuco	Mexico	74	600
Yaqui	Mexico	50 b/	110
Papaloapán	Mexico	47	1 300
San Juan	Costa Rica-Nicaragua	39	1 614
Fuerte	Mexico	34	150
Coco	Honduras-Nicaragua	27	951
Patuca	Honduras	26	825
Ulúa	Honduras	23	526
Coatzacoalcos	Mexico	20	600
Grande de Matagalpa	Nicaragua	20	763
Lempa	Guatemala-Honduras-El Salvador	17	380
Motagua	Guatemala-Honduras	16	252
Total surface flow	Caribbean	207 528	3 175
Artibonite	Haiti-Dominican Republic	9	240
Cauto	Cuba	9	150
Yaque del Norte	Dominican Republic	8	140
Total surface flow	South America	17 795 299	335 380
Amazon	Brazil-Colombia-Ecuador-Peru-Venezuela-Bolivia-Guyana	6 059	180 000
River Plate	Brazil-Bolivia-Argentina-Paraguay-Uruguay	3 092	22 000
Orinoco	Colombia-Venezuela	982	33 000
Tocantins	Brazil	864	17 000
São Francisco	Brazil	631	3 900
Parnaíba	Brazil	352	4 800
Magdalena	Colombia	284	6 000
Essequibo	Venezuela-Guyana	155	5 000
Negro	Argentina	122	1 050
Pindaré	Brazil	94	1 100

/Table 1 (cont.)

Table 1 (concl.)

River basin	Country	Area (thousands of km2)	Average flow of discharge (m3/sec) a/
Doce	Brazil	85	1 000
Courantyne	Guyana-Suriname	79	2 300
Maroni	Suriname-French Guiana	69	2 500
Jequitinhonha	Brazil	70	450
Jaguaribe	Brazil	70	600
Paraguaçu	Brazil	60	650
Paraíba do Sul	Brazil	56	900
Contas	Brazil	55	500
Piranha	Brazil	44	300
Itapicurú	Brazil	37	350
Atrato	Colombia	36	2 700
Guayas	Ecuador	35	1 500
Baker	Chile	33	1 500
Oiapoque	Brazil-French Guiana	31	1 000
Catatumbo	Colombia-Venezuela	31	350

Source: ECLA, on the basis of national data.

Note: The geographical names used above do not imply any opinion on the demarcation of frontiers or borders on the part of the United Nations Secretariat.

a/ The volume at the outlet is estimated on the basis of hydrological information.
b/ Refers only to the Mexican part.

/The slope

The slope towards the Atlantic Ocean and Caribbean Sea is the most extensive and represents 84% of the total area of the region. Most of the main river basins, including the Orinoco, Amazon and Plata -the three largest, accounting for two-thirds of the total regional runoff- are in tropical areas covered with dense vegetation and have gradients of less than 0.5 per thousand. These rivers maintain a relatively constant flow in the lower reaches but there are great variations of flow in the tributaries. There are broad flood plain areas subject to regular flooding, as in north-eastern Argentina and Paraguay, and areas with scant drainage, as in the lower reaches of the Orinoco.

The Pacific watershed, which is equivalent to only 11% of the total area of the region, is characterized by river basins with steep gradients and many are partly bare of vegetation cover. The rivers have marked variations in flow and many of them carry large quantities of sediment.

Some 5% of the total area of Latin America has no direct drainage into any ocean. Most of these basins are found in the high central plateau within the Andean mountain system; and as they are small, have very little vegetation cover and receive very low annual precipitation, their rivers have highly irregular, and often intermittent, patterns of flow.

The majority of Latin American rivers are entirely rainfed, and it is only south of latitude 28° S that even the upper basins of rivers rising in the Andean cordillera receive a substantial quantity of water from glaciers and snow-melt. In consequence, variation in rainfall has a significant impact on streamflow, although direct impact is modified and even reduced in the complex flow régimes of the very large river systems.

The three largest river systems in the region are the Amazon, Orinoco, and River Plate (see map 1), and their combined flow represents more than two-thirds of the total runoff of the region. These systems, all located in South America, drain towards the Atlantic. The river systems on the Pacific slope of South America in contrast are very much smaller and, due to the aridity of the mid-latitude zone, account for a relatively small proportion of the region's total runoff. Still less runoff is contributed by the interior drainage basins of the Altiplano and Argentina. The region of greatest variation in stream flow, however, is the 700 000 km2 of north-eastern Brazil. The rivers of this region are characterized by extreme variation in stream flow not only between the wet and dry seasons but also from one year to another.

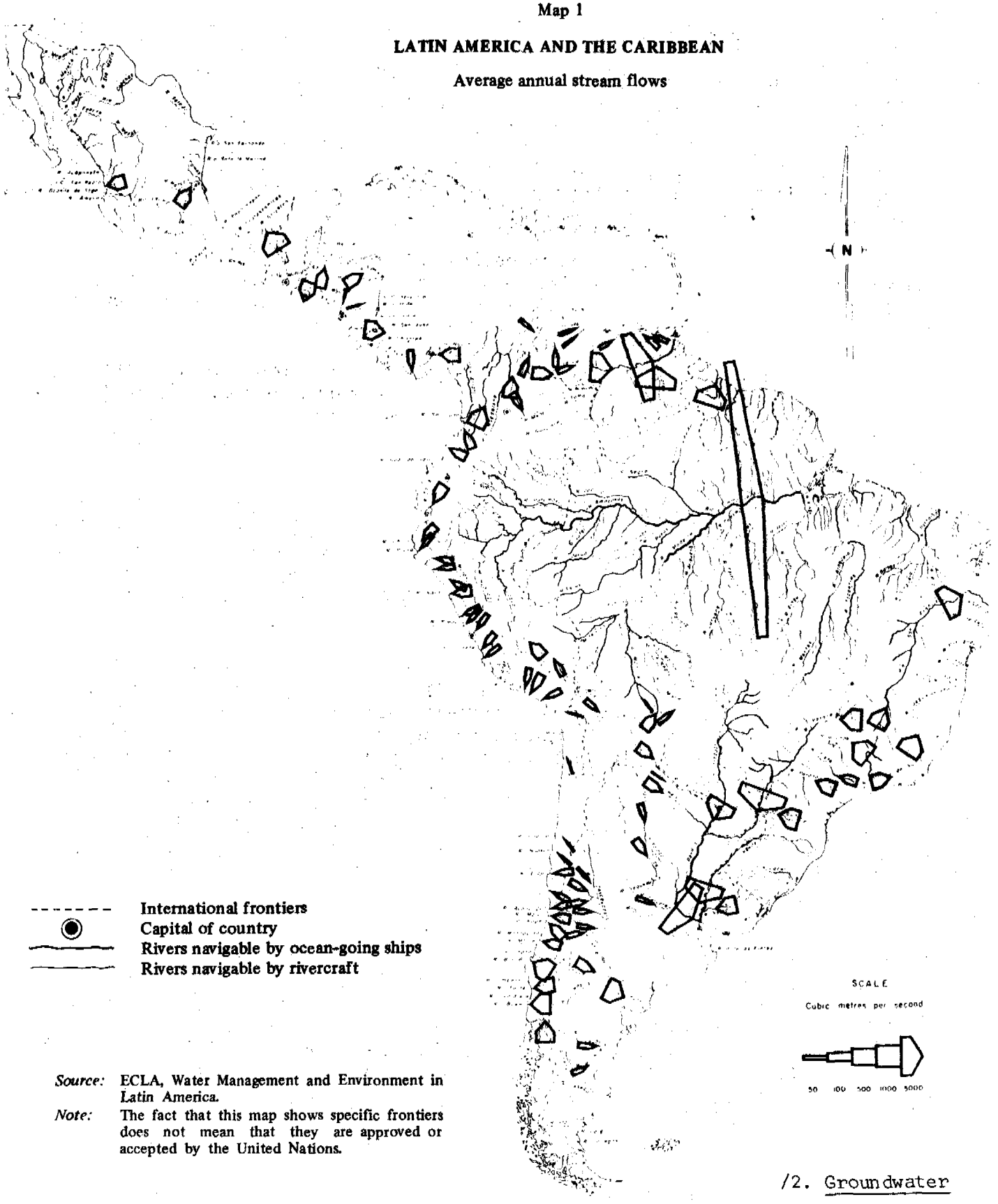
In Mexico and Central America the division of the land mass between the Pacific and Atlantic drainage basins is more even, 1.04 and 1.08 million km2 respectively, with an additional 300 000 km2 in the interior basins of Mexico. Due to the aridity of the Pacific basins the stream flow is still unevenly distributed, however, with 70% of the runoff flowing to the Gulf of Mexico and the Caribbean. The most significant contrasts appear in Mexico where the rivers of the southeast, the Papaloapán, Coatzacoalcos, Tonalá, and Grijalva-Usumacinta concentrate about half the total stream flow in less than 10% of the land area of the country.

/Map 1

Map 1

LATIN AMERICA AND THE CARIBBEAN

Average annual stream flows



Source: ECLA, Water Management and Environment in Latin America.

Note: The fact that this map shows specific frontiers does not mean that they are approved or accepted by the United Nations.

2. Groundwater

The total availability of groundwater in Latin America is very difficult to determine, as is even the amount extracted annually. Some countries have made inventories of wells, others have estimated the volumes of water extracted annually, but there is still much to do to establish the availability and use of groundwater in Latin America. Recent improvements in the state of knowledge of groundwater in the countries of South America has permitted the production of an indicative map of the hydrogeologic provinces of South America, but nothing similar is available as yet for Central America or the Caribbean (see map 2). Various countries have completed or have under way hydrogeologic mapping exercises, for example, El Salvador and Trinidad and Tobago. In Mexico, detailed investigations of groundwater have been made.

Despite the incomplete state of knowledge about the groundwater resource the use of groundwater is fundamental in many important areas of Latin America. For example, Havana, with a population of some 2 million, is almost exclusively supplied from karstic aquifers; in Mexico 328 000 hectares, in the North Pacific and Central region alone, are irrigated from groundwater; in Perú industry uses some 96 million cubic metres a year. In addition, the extensive arid and semi-arid regions of Argentina, Brazil, Chile, Peru and Mexico are forced to depend on groundwater owing to lack of surface supplies. It must be borne in mind that traditionally, thousands of rural communities in the Andean valleys in Bolivia, Colombia, Chile, Ecuador, Peru and Venezuela have always relied on springs for drinking water for man and beast and also to irrigate small areas of agricultural land.

The principal means of utilizing groundwater is by the drilling of wells to reach the aquifer and their subsequent equipment with pumps. The number of wells should provide, therefore, a good indication of the amount of use of groundwater. Unfortunately, information on wells is very scarce. Some basic information is provided in table 2 on the volumes of water extracted and the number of wells for selected countries.

One particular aspect of groundwater is thermal water. All along the Andean chain thermal waters are to be found in quantity. In many places spas have been created ranging from sophisticated hotels to simple reservoirs to store water. Much remains to be done, however, to develop the full tourism potential of this particular resource.

B. A review of the state of assessment of the water resource in Latin America

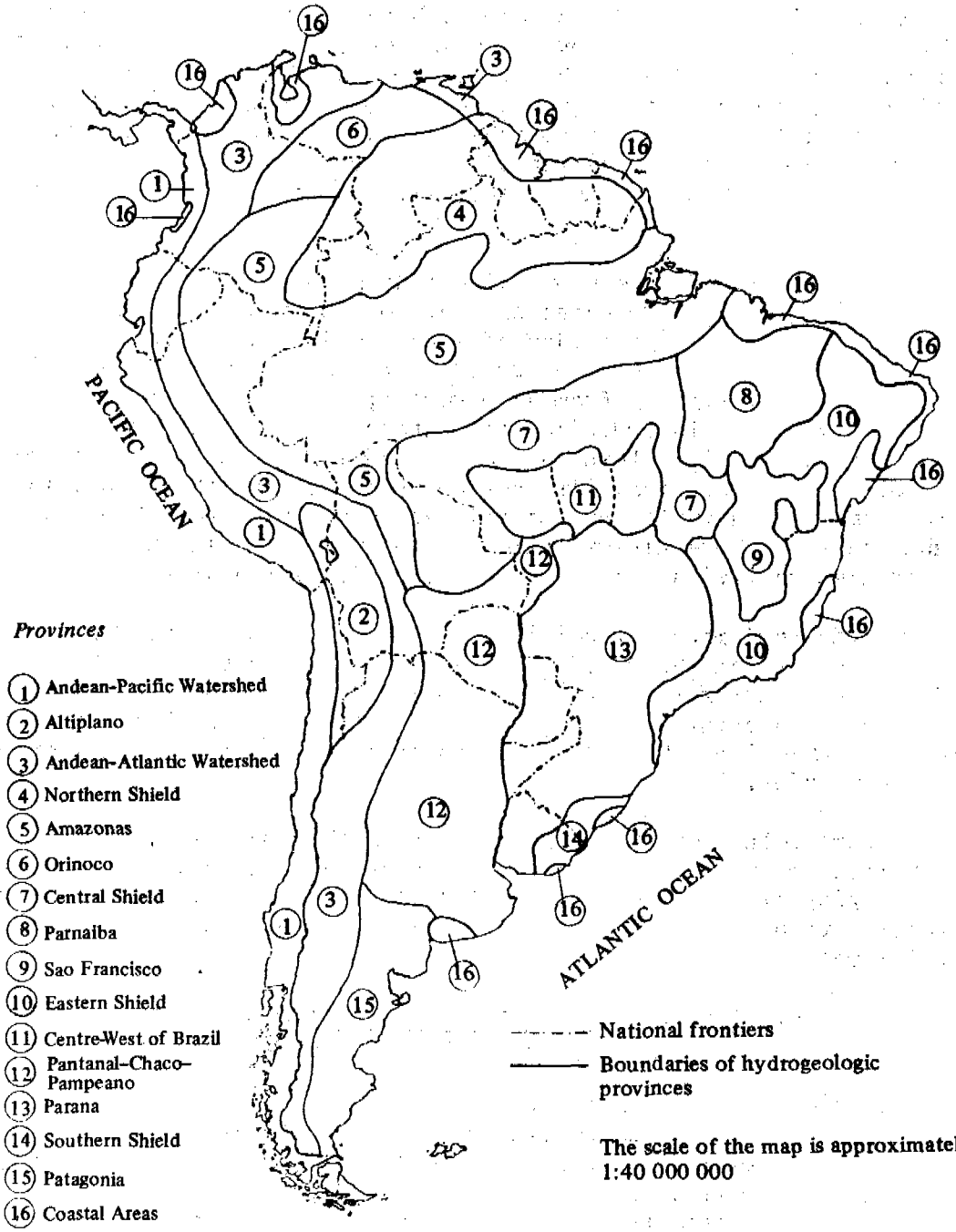
Eleven countries of the region had carried out complete studies of the hydrologic characteristics of their superficial water resources prior to the United Nations Water Conference, including Argentina, Chile, Colombia, Cuba, Ecuador, Mexico, Peru and Venezuela, as well as the countries of Central America, and five more have done so since. In some cases these national surveys have been made in connection with the production of a national water resources plan, but in others they have been the by-product of plans for the expansion of the generation of hydro-electricity or irrigation, as in Argentina, Chile and Colombia.1/

/Map 2

Map 2

HYDROGEOLOGIC PROVINCES OF SOUTH AMERICA

Diagrammatic Division



Source: UNESCO, Second Sub-regional Meeting on Co-ordination - Hydrogeologic Map of South America.

Note: National frontiers and boundaries of hydrogeologic provinces are purely indicative.

/Table 2

Table 2

LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES):
VOLUMES OF GROUNDWATER EXTRACTED ANNUALLY
AND NUMBER OF WELLS

Country	Annual extraction of groundwater (millions of m3)	Number of wells drilled
Argentina	4 700	300 000
Cuba	5 200	-
Chile a/	1 690	2 507
El Salvador	149	1 685
Mexico	16 565	-
Peru	1 289	11 290
Trinidad and Tobago	62	-

Source: ECLA, on the basis of national reports.

a/ Deep wells only.

In general, countries have developed centralized institutions to co-ordinate the inventory of the water resource. It is not necessarily the case that these institutions are responsible for the collection of the hydrological and hydro-meteorological information itself; rather they establish norms and standards for the specialized institutions such as hydroelectricity companies, irrigation authorities, water supply institutions and meteorological offices and other public and private bodies. It is, however, these centralized institutions that are responsible for the maintenance of the basic inventories of the water resource. A list of them is given in table 3.

The use of remote sensing is making it possible to increase the establishment of measuring stations in unpopulated watersheds, difficult of access. It is true that the density of measurement stations still falls short of international recommended minimums in some countries, but progress is continually being made (see table 4).

/Table 3

Table 3

LATIN AMERICA AND THE CARIBBEAN: INSTITUTIONS RESPONSIBLE FOR HYDROLOGIC STUDIES

Country	Institution
Central America and Mexico	
Costa Rica	Instituto Meteorológico Nacional
El Salvador	Dirección General de Recursos Naturales
Guatemala	Instituto de Sismología, Vulcanología, Meteorología e Hidrología (INSIVUMEH)
Honduras	Dirección de Recursos Hídricos
Nicaragua	Instituto de Recursos Naturales y del Ambiente (IRENA)
Panama	Instituto de Recursos Hidráulicos y Electrificación (IRHE)
Mexico	Secretaría de Recursos Hidráulicos (SRH)
Caribbean	
Antiagua and Barbuda	Antigua Public Utilities Authority
Bahamas	
Barbados	Waterworks Department
Belice	
Cuba	Instituto de Hidroeconomía
Dominica	Dominica Water Authority
Dominican Republic	
Grenada	
Guyana	
Haiti	Département de l'Agriculture, Ressources Naturales et Développement Rural (DARNDR)
Jamaica	
St. Vincent and the Grenadines	
St. Lucia	St. Lucia Central Water Authority
Suriname	
Trinidad and Tobago	
South America	
Argentina	Instituto de Ciencia y Técnica Hídricas (INCYTH)
Bolivia	Servicio Nacional de Meteorología e Hidrología (SNMH)
Brazil	
Chile	Dirección General de Aguas
Colombia	Instituto Colombiano de Hidrología, Meteorología y Adecuación de Tierras (HIMAT)

/Table 3 (cont.)

Table 3 (concl.)

Country	Institution
Ecuador	Instituto Nacional de Meteorología e Hidrología (INAMHI)
Paraguay	Dirección de Meteorología
Peru	Servicio Nacional de Meteorología e Hidrología (SENAMHI)
Uruguay	Dirección de Hidrografía
Venezuela	Comisión del Plan Nacional de Aprovechamiento de los Recursos Hidráulicos (COPLANARH)

/Table 4

Table 4

LATIN AMERICA AND THE CARIBBEAN: HYDROMETRIC NETWORKS

Country	Area (thousands of km2)	Stations: Pluviometric No.	Pluviometric Density (number/ thousand km2)	Evaporimeters No.	Evaporimeters Density (number/ thousand km2)	Fluviometric No.	Fluviometric Density (number/ thousand km2)
Central America and Mexico							
Costa Rica	50.7	524	10.3	12	0.2	63	1.6
El Salvador	21.4	186	8.7	17	0.8	56	2.6
Guatemala	131.8	375	2.8	15	0.1	87	0.7
Honduras	112.1	232	2.1	54	0.5	87	0.8
Nicaragua	130.0	349	2.7	74	0.6	72	0.6
Panama	77.1	310	4.0	40	0.5	86	1.1
Mexico	1 972.5	4 576	2.3	2 610	1.3	1 300	0.7
Caribbean							
Antigua and Barbuda	0.4						
Bahamas	1.4						
Barbados	0.4						
Belice	2.3						
Cuba	114.5	2 929	25.6	57	0.5	79	0.7
Dominica	0.8						
Dominican Republic	48.7	300	6.2			80	1.6
Grenada	0.3						
Guyana	215.0	225	1.0	12	0.06	46	0.2
Haiti	27.8	60	2.2	2	0.07	11	0.4
Jamaica	11.0	395	35.9			88	8.0
St. Vincent and the Grenadines	0.4						
St. Lucia	0.6						
Suriname	136.0	191	1.4	6	0.05	98	0.7
Trinidad and Tobago	5.1	153	30.0				
South America							
Argentina	2 776.6	3 785	1.4	300	0.1	702	0.2
Bolivia	1 098.6	347	0.3	6	0.005	63	0.06
Brazil	8 512.0	4 028	0.5	68	0.008	2 412	0.3a/
Colombia (1976)	1 138.9	787	0.7	219	0.2	376	0.3(0.5)b
Chile	756.9	1 011	1.3	130	0.2	391	0.5
Ecuador (1981)	283.6	413	1.5	24	0.08	231	0.8
Paraguay (1981)	406.8	64	0.2	19	0.05	10	0.02

/Table 4 (cont.)

Table 4 (concl.)

Country	Area (thousands of km2)	Stations: Pluviometric No.	Pluviometric Density (number/ thousand km2)	Evaporimeters No.	Evaporimeters Density (number/ thousand km2)	Fluviometric No.	Fluviometric Density (number/ thousand km2)
Peru	1 285.2	790	0.6	66	0.05	391c/	0.3
Uruguay	186.9	947	5.1	19	0.1	86	0.5
Venezuela	912.1	1 377	1.5	180	0.1	700	0.8
Recommended minimum density d/			1.6		0.03		0.6

Source: ECLA, on the basis of national reports prepared for the United Nations Water Conference, 1977. For some countries, information has been updated and/or extended from other sources.

a/ Maintained by Departamento Nacional de Aguas y Energía Eléctrica.
b/ Minus Amazon Basin.
c/ 1981.
d/ World Meteorological Organization, Guide to Hydrological Practices, No. 168.

1. Recent advances in international co-operation in water resources assessment

A recent significant advance in the study of the water resource in South America has been the preparation under the UNESCO International Hydrologic Programme of a "Methodological Guide for the Elaboration of the Water Balance of South America". The purpose of this Guide is to establish, as far as is possible, standardized principles and methods that can be applied in the countries of South America to permit the calculation of the atmospheric and superficial water balances.

The Guide describes methods of evaluating the main components of the water balance, analysing the basic information required, in particular cartographical, hydrometeorological and aerological data, as well as the reliability and precision of the parameters. It presents the major hydrographic basins and watersheds of South America, and suggests the application of the superficial balance equation in open and enclosed basins, with or without sufficient data, in addition to the application of the aerological balance equation. Lastly, the Guide shows how texts, tables, figures and maps should be presented, and suggests recommendations for ensuring the use of the methodology and the harmonization of the results obtained.

The Guide has begun to be applied in water balance studies in a number of countries, including Argentina, Bolivia, Brazil, Paraguay and Peru. In Chile in 1981-1982, using the methodology recommended, the water balances for all river basins between 34° S and 42° S were calculated, verifying its applicability. It is hoped to be able to use the Guide in Central America and the Caribbean.

/Similarly, groundwater

Similarly, groundwater studies have also benefited from international co-operation programmes. The United Nations Development Programme has given large-scale support to groundwater research and development by different international organizations for many years in Latin America, and has financed projects in 21 countries of the region, as well as regional projects. UNESCO is co-ordinating a project for the preparation of a Hydrogeological Map of South America on a scale of 1:2 500 000, for publication in 1985; the progress made in individual countries up to July 1983 can be seen in table 5. Apart from this project, Mexico and El Salvador have drawn up their hydrogeological maps as part of their national plans for utilization of their water resources.

Concern for water quality and environmental protection is increasingly giving rise to further need for information on the water resource beyond the demands for knowledge required for estimating the water balance. Measurement of water quality in the most densely populated, urbanized and industrialized river basins has made considerable advances, particularly in Argentina, Brazil and Mexico. In these three countries systematic studies have been made of the pollution problems of many water bodies and elsewhere progress has been made. Much of this effort has been assisted by the programmes of the Pan American Centre for Sanitary and Environmental Engineering (CEPIS) and the United Nations Environment Programme (UNEP). An important advance has been the establishment, under the leadership of CEPIS, of a regional information system in the environmental health aspects of water management (REPIDISCA).

Table 5

SOUTH AMERICA: STATE OF PROGRESS OF HYDROGEOLOGIC MAPS

Country	Scale		Approximate date of publication
	Existing hydrologic maps (provisional)	Definitive national map	
Argentina	1: 500 000	1: 500 000	1985
Bolivia	1: 1 000 000	1: 1 000 000	1984
Brazil	1: 2 500 000	1: 5 000 000	1983
Colombia	1: 3 000 000	1: 1 500 000	1983
Chile	1: 100 000	1: 250 000	n.d.a.
Ecuador	1: 2 500 000	1: 1 000 000	1978
French Guiana	-	-	n.d.a.
Guyana	1: 500 000	1: 2 500 000	n.d.a.
Paraguay	several	1: 1 000 000	n.d.a.
Peru	several	1: 1 000 000	1984
Suriname	1: 500 000	1: 500 000	1985
Trinidad and Tobago	several	1: 100 000	n.d.a.
Uruguay	1: 500 000	1: 500 000	n.d.a.
Venezuela	1: 500 000	1: 2 500 000	n.d.a.

Source: UNESCO.

n.d.a. = no data available.

Chapter 2

WATER USE AND EFFICIENCY

The pattern of water use in Latin America, given the overall size of the region, can only be described as spatially sporadic and highly concentrated in relatively few areas. In general, the impact of human water use on the hydrologic cycle takes the form of flow regulation and changes in land use, and therefore, in vegetation cover. Much use is concentrated in coastal areas, and the coastal water systems, estuaries and bays are widely used for the reception of effluents. In contrast, only in the last twenty years have the major river systems begun to be affected by land-use changes or control structures both in upstream basins and at points of discharge. A further important general characteristic of the pattern of water use is the concentration of human activity in the relatively drier portion of the region. Over 90% of the population of Latin America live in areas which receive less than 2 000 mm average annual precipitation and three major metropolitan regions are found in areas with 500 mmm precipitation or less, i.e., Lima-Callao, Santiago and Mexico City (see table 6). The most humid areas, about 40% of the land mass, with between 1 500 mm and 4 000 mm average annual precipitation, are contrastingly much more lightly populated.

A. Overall patterns of water use

The gross geographical product of Latin America has grown at an average annual rate of 4.7% in the years since the Mar del Plata Water Conference. More important than the overall growth of the regional economy, however, from the point of view of water use, have been the changes in the internal structures of the economies of the countries of the region. These changes have continued in the direction of a growing emphasis on manufacturing industry and services in contrast to primary production, both agriculture and mining. Equally important has been the continued extension of the development or modernization process into rural areas and areas historically of very low population density. Furthermore, the population of the region is still increasing rapidly, even if at a slower pace than in the recent past -approximately by 2% per year- and reached 364 million in 1980. At the same time, the region's population, reflecting the change in the structure of the economies, is increasingly urban (see figure 1).

Mention has already been made of the concentration of high density water use; this is illustrated by the distribution of the most densely populated areas, which tend also to be the areas with the highest levels of income and economic productivity and, therefore, with the biggest demands for water (see map 3). These densely populated areas can be divided into three types. These are:

i) Metropolitan areas growing rapidly in population, through both natural increase and immigration, and in economic activity, including agriculture;

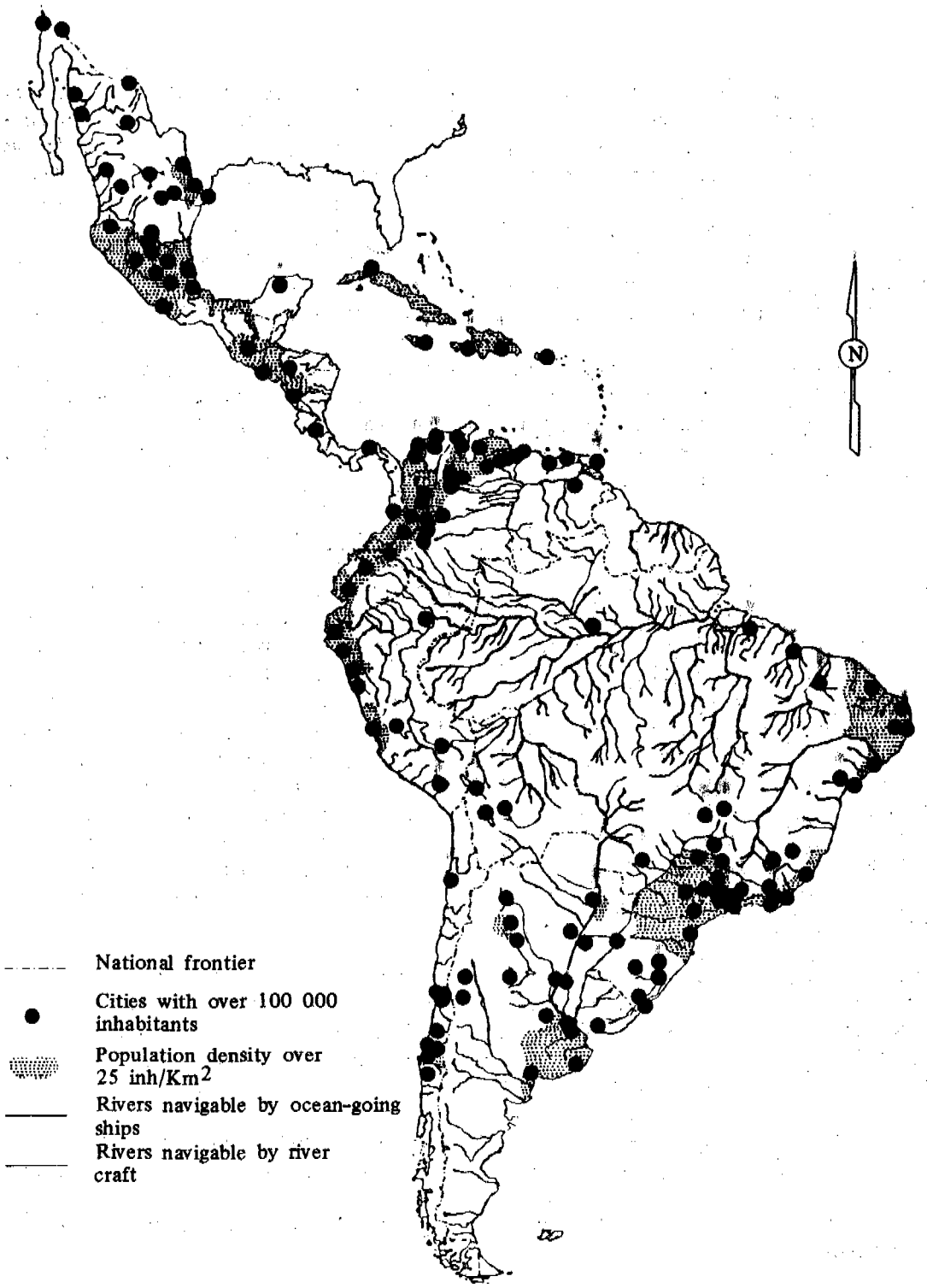
ii) Rural areas with high rates of natural population growth not outweighted by emigration;

/Map 3

Map 3

LATIN AMERICA AND THE CARIBBEAN

Location of cities with over 100 000 inhabitants, 1975



Note: The fact that frontiers are shown on this map does not mean that they are approved or accepted by the United Nations.

/Table 6

Table 6

LATIN AMERICA: MAJOR METROPOLITAN AREAS AND RAINFALL

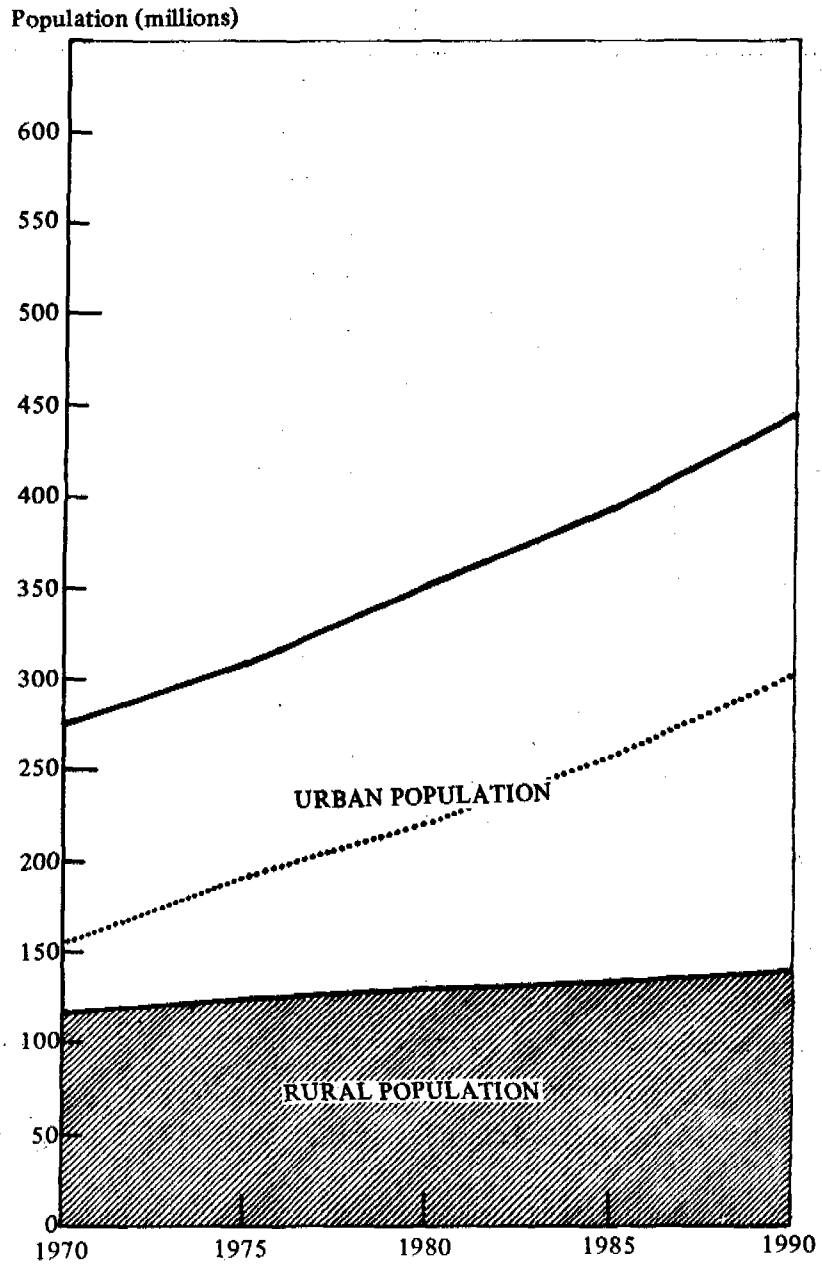
Metropolitan area	Population latest year (thousands) a/	Annual average rainfall b/ (mm)
Lima-Callao	4 715	29
Santiago	3 853	322
Mexico City	14 750	589
Monterrey	2 019	714
Caracas	2 849	820
Guayaquil	1 116	922
Guadalajara	2 468	953
Bogotá	2 855	986
Buenos Aires	9 910	992
Montevideo	1 173	1 050
Havana	1 861	1 157
São Paulo	8 732	1 270
Porto Alegre	1 221	1 291
Fortaleza	1 307	1 401
Medellín	1 159	1 410
Recife	1 433	1 437
Belo Horizonte	1 937	1 562
Brasilia	1 306	1 576
Río de Janeiro	5 539	1 590
Salvador (Bahía)	1 501	1 892

a/ United Nations, Demographic Yearbook, 1980, New York.
b/ Alberto R. Martínez, "La meteorología e hidrología para el desarrollo de los recursos hidráulicos de América Latina", CEPAL/TA/24, December 1973.

/Figure 1

Figure 1

LATIN AMERICA: POPULATION, URBAN AND RURAL, 1970-1990



Source: CELADE.

/iii) Areas

iii) Areas of concentrated growth around a particular natural resource, new ones such as Ciudad Guyana in Venezuela or older ones such as Calama in Chile.

Each of the three types is characterized by a distinct pattern of water use with a particular predominating relationship between human activity and water demand. In the first and last types, there is a common demand for withdrawal use and consumptive use of water with concomitant demands for the transport of effluents. As these areas are also areas of high income, there is a high level of demand for recreational services. This may be supplemented, particularly in areas of mineral exploration and processing, by demand for flow regulation to generate hydroelectricity. In the second type of area demand on the water resource is dominated by the need to regulate the flow régime for irrigation, for drainage or to prevent flooding and erosion. It is the combination of these different demand patterns with the distinct supply situations which creates the complex water use geography of the region.

B. The extractive use of water

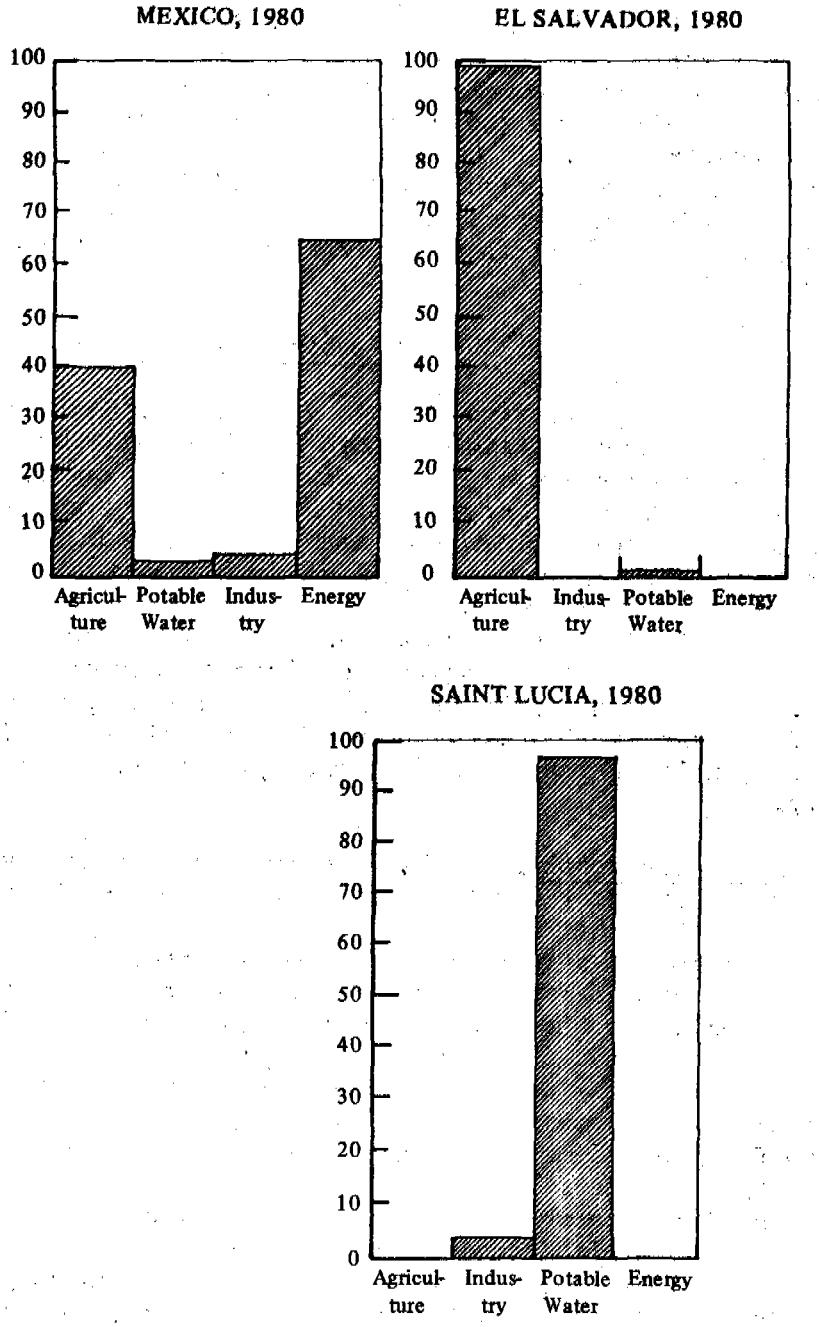
The largest volume of extraction in the region is for irrigation, which is widely practiced in many countries with extended precipitation deficits for crop production. The most widespread extractive uses, however, are for public water supply from both superficial and groundwater sources and on a smaller scale individual water supply abstractions, often from groundwater and largely for industrial purposes. There is some interesting variation, however, in the pattern of water use by country, particularly between both large and small countries in the continent of Latin America and the islands of the Caribbean. As is illustrated in figure 2, in continental countries a major proportion of water is used for irrigation and hydroelectricity. The former use is dominant in relatively poor El Salvador but the latter is of greater significance in more industrialized Mexico. In contrast, in Saint Lucia, with its large tourist industry, water is mostly used for public water supply.

1. Public water supply. Latin American governments have long recognized the importance of public water supply as a vital factor for the preservation and improvement of health, but millions of people in the region are still without access to a reliable source of potable water. Such a statement does not imply failure to recognize that considerable progress has been made. Twenty years ago, only 60% of the urban population had access to water supply and only 28% had access to sewerage, while less than 8% of the rural population had water services -at home or through public fountains- and a negligible proportion had the benefit of sanitary waste disposal. As a result of the adoption of the Charter of Punta del Este in 1961 and the fresh commitments to improve water supply and sanitation entered into at the Third Special Meeting of Ministers of Health held in Santiago, Chile, in 1972, the proportional provision of adequate services was more than doubled in the last two decades, with three times the number of urban dwellers and five times the number of rural dwellers having access to a reliable supply of potable water. By 1977, of the 325 million inhabitants of the region, 78% of the urban and 34% of the rural population had reasonable access to potable water (see table 7).

/Figure 2

Figure 2

LATIN AMERICA AND THE CARIBBEAN (SELECTED COUNTRIES): COMPARATIVE WATER USE



Source: H.M. Sánchez, *Water Consumption Patterns in the Caribbean,* 12th, Annual Caribbean Water Engineers Conference, 1981.

/Table 7

Table 7

LATIN AMERICA: DRINKING WATER SUPPLY. PRESENT SERVICE AND FUTURE DEMAND

Country	Urban areas			Rural areas		
	Population with house connection (31 Dec. 1980) (thousands)	Percentage of total urban population served	Population to be served by 1990 (thousands)	Population with reasonable access to a source of drinking water (31 Dec. 1980) (thousands)	Percentage of total rural population served	Population to be served by 1990 (thousands)
Central America and Mexico						
Costa Rica	1 041	95	1 370	761 b/	68	1 028
El Salvador	1 171	62	2 145	1 049	40	2 000
Guatemala	1 377	51	2 950	828 b/	18	2 950
Honduras	719	90	2 013	1 012	46	2 580
Nicaragua	985	67	2 140	125	10	740
Panama	838	93	1 120	602	65	945
Mexico	26 800	62	47 514	10 300	43	14 942
Caribbean						
Bahamas a/	117	98		-	-	-
Barbados a/	125	100		128	100	
Belice a/	78	98		18	27	
Cuba	5 648	91	2 115	332	10	2 445
Dominica a/	23	100		45	79	
Dominican Republic	1 642	70	2 956	897	33	1 617
Guyana	222	90	312	347	60	703
Haiti	207	17	1 831	0		5 471
Jamaica a/	620	100		1 095	74	
Suriname a/	240	100		119	66	
Trinidad and Tobago	550	79	885	370	93	407
South America						
Argentina	14 146	61	20 621	786	17	4 384
Bolivia	599	24	2 258	316 b/	10	2 181
Brazil	64 600	80	99 810	19 600	-	n/a
Colombia	11 840	74	19 440	7 110	79	9 215
Chile	8 420	93	10 451	355 b/	17	952 b/
Ecuador	1 739	47	4 744	745	16	4 266
Paraguay	448	39	1 144	192	8	441
Peru	6 227	57	11 637	1 210 b/	21	n/a
Uruguay	2 190	90	2 365 c/	12	2	19 b/c/
Venezuela	9 804	67	15 218	2 010	50	3 605

Source: PAHO, Sector Digests, December, 1980.

a/ Information is taken from the PAHO Director's Report, 1981.
b/ House connections only.
c/ 1985.

/At the

At the end of the 1970s, however, the rate of improvement in levels of service has tended to stagnate, and difficulties have arisen with the maintenance of existing systems, particularly in some of the larger cities, for example, Havana. The proportion of the population served has even dropped in several countries -Argentina, Colombia and El Salvador, for instance- and, with a few notable exceptions, the pace of the expansion of services has slackened in the region as a whole. Even among the urban population, it is only in some of the smallest countries, such as Costa Rica and Panama, that water supply is universal, and Panama is the only country with both universal water supply and sewerage services. In rural areas it is unusual for the proportion of the population with a household supply of piped water to reach even half, except in some Central American countries and the smaller Caribbean islands, and in the region as a whole only 16% of the rural population has the privilege of a household connection to a piped water system. In the rural areas of some countries, for example, Haiti, Paraguay and Guatemala, the existence of a piped drinking water supply is almost unknown.

2. Irrigation. The ever-increasing pressure to step up agricultural production of both food and industrial raw materials, for internal consumption as well as for export, is reflected in expansion of the cultivated area on the one hand and increasing intensity of use on the other. In both cases, expansion and intensification, the means employed to achieve the goal can be irrigation. In recent years this has meant a considerable expansion in both absolute and proportional terms, of the area under irrigation in the region, and in many countries the adoption of ambitious plans for future increases.

The regions where traditionally irrigation has been practiced as the basic mode of agriculture, in some areas long before the arrival of the Spanish, are mainly concentrated in the Andean region of the Pacific coast, including North-West Mexico, the Peruvian coast, the northern trans-Andean valleys and the Central Valley of Chile and adjacent areas of Argentina. In addition, there has been in the last two decades some considerable development of irrigation in parts of central and southern Brazil, in Central America and in Cuba.

More than one-third of the total irrigated area of Latin America is found in Mexico, while there are other large areas in Brazil, Argentina, Chile and Peru (see table 8). Except in Brazil, there has been very little recent change in the irrigation area in the traditional centres of irrigated agriculture. In contrast, in some countries with little tradition in irrigation recent expansion has been on a proportionately large scale, notably in El Salvador, Cuba and Uruguay. Only some of the smaller islands in the Caribbean are without any irrigation development.

The total irrigated areas were estimated by the United Nations Food and Agriculture Organization (FAO) to be slightly more than 14 million hectares in 1980, an irrigated area being defined as agricultural land purposely provided with water, including land flooded by river waters for crop production or pasture improvement, whether this area is irrigated several times or only once during the year stated.2/

/Table 8

Table 8

LATIN AMERICA: CULTIVATED AREAS AND IRRIGATED LAND, BY COUNTRIES

Country	Cultivated area a/ (thousands of ha)	Irrigated area b/ (thousands of ha)	Irrigated area as percentage of cultivated area	Percentage change in irrigated area 1977-1980
Central America and Mexico	118 529	5 494		
Costa Rica	4 833	26	0.05	0.0
El Salvador	1 335	110	8.24	120.0
Guatemala	2 704	68	2.51	6.3
Honduras	5 157	82	1.59	2.5
Nicaragua	4 936	80	1.62	8.1
Panama	1 735	28	1.61	12.0
Mexico	97 829	5 100	5.21	2.0
Caribbean	12 177	1 393		
Antigua and Barbuda	11	non-reported	n/a	n/a
Bahamas	17	non-reported	n/a	n/a
Barbados	37	non-reported	n/a	n/a
Belice	96	1	1.04	0.0
Cuba	5 723	962	16.81	37.4
Dominica	19	non-reported	n/a	n/a
Dominican Republic	2 740	145	5.29	3.6
Grenada	17	non-reported	n/a	n/a
Guyana	1 379	125	9.06	2.5
Haiti	1 398	70	5.00	0.0
Jamaica	470	33	7.02	3.1
St. Vincent and the Grenadines	19	1	5.26	0.0
Saint Lucia	20	1	5.00	0.0
Suriname	62	34	54.84	13.3
Trinidad and Tobago	169	21	12.43	5.0
South America	572 734	7 250	0.89	4.6
Argentina	178 400	1 580	0.89	4.6
Bolivia	30 420	140	0.46	16.7
Brazil	220 950	1 800	0.81	20.0
Colombia	35 650	310	0.87	6.9
Chile	17 410	1 255	7.21	0.6
Ecuador	5 180	520	9.65	2.0
Paraguay	17 520	60	0.34	9.0
Peru	30 520	1 190	3.90	0.8
Uruguay	15 729	80	0.51	33.3
Venezuela	20 955	315	1.50	2.6
Total Latin America	703 440	14 137	2.10	7.0

Source: FAO Production Yearbook, Vol. 35, 1981.

a/ Categories Arable and Permanent Crops and Permanent Pasture, 1980, as estimated by FAO.
b/ As estimated by FAO.
n/a = not available.

/enthusiasm for

Enthusiasm for irrigation as a means of increasing agricultural production has somewhat waned in the last few years. Considerable doubt has been cast on the real economic viability of many projects because of their heavy subsidization by the State. Increasingly it has been recognized that the transport of water through the building of the physical infrastructure is not sufficient, in itself, to obtain the hoped-for gain in production and productivity. Water and soil management are equally important and poor management has led to low returns and, on frequent occasions, loss of soil productivity through salinization and waterlogging which have become a major difficulty in project development. Emphasis is increasingly being placed in many countries of the region, encouraged by the international agencies involved, on improving the use made of the irrigation infrastructure already in place.

At the same time, however, supplementary irrigation in more humid areas of the region is becoming increasingly common, often on the basis of the individual initiative of farmers.

3. Industrial use. In general, there is little information available in the majority of countries of Latin America on industrial water use. Consequently, the information available is either conjectural, based on changes and trends in the structure of industry in the different countries of the region, or is derived from limited and sporadic studies.

Given the precarious nature of many of the region's public water supply systems, in relation to both the quantity and the qualities of the water delivered, there is a high proportion of self-supply amongst Latin American industries. A study in Mendoza, Argentina, which has a relatively reliable public system, found that only 5% of industrial demand was satisfied from the public water supply system, and that this water was supplied largely to the canning and soft drink industries. In the case of smaller industrial consumers the source of supply is normally groundwater, but the larger consumers -oil refineries, iron and steel works and the like- draw water directly from superficial sources. In the more arid regions and on the smaller Caribbean islands where fresh water supplies are very limited, sea water is used for cooling.

The total amount of water used by industry is considerable. For example, in Mexico in 1980 the total amount extracted by industry was estimated to be 5 800 million cubic metres a year -exceeding by some 40% the extractions for public water supply. The largest industrial users of water in Mexico in 1980 were sugar-refining and the chemical industry, followed by the manufacture of pulp and paper and oil-refining.

As can be expected, industrial use is highly concentrated either in the major metropolitan centres or in particular regions of heavy and agricultural processing industries. For example, in Chile industrial water use is concentrated in the Maipo, Marga-Marga, Bío-Bío and Aconcagua river basins and of these, the first two and the last are contiguous.

/In the

In the region as a whole similar concentration of the industrial use of water can be seen, with the highest concentration of industrial demands around São Paulo, along the Paraíba River valley to Río de Janeiro in Brazil, in the Buenos Aires, Córdoba, Rosario and Santa Fe region of Argentina and in the Valley of Mexico (see map 4).

C. Instream water use

The major instream or flow use of water in Latin America is for hydroelectric power generation. Other uses include navigation, water-based recreation, the maintenance of natural habitats for fauna and flora, fishing, including some types of aquaculture, and last, but of increasing significance, the dilution and transport of wastes.

In recent years, instream use of water has increased even more than withdrawal or extractive use in the region, particularly on the La Plata-Paraná system but also on many smaller streams, even in the smaller countries and some of the Caribbean islands. On the larger systems, there are numerous examples of the same river, often the same water, being used several times in sequence. There are instances, on the Pacific coast, of even short streams supporting repeated uses with the typical pattern of hydroelectric power generation, water supply or irrigation followed by waste dilution and transport, with some navigation in the lower reaches, and perhaps in addition recreational and fishing use at different points. A schematic representation of use on the Maipo River, Chile, is given in figure 3, and provides an illustrative example of the sequential use of a river system.

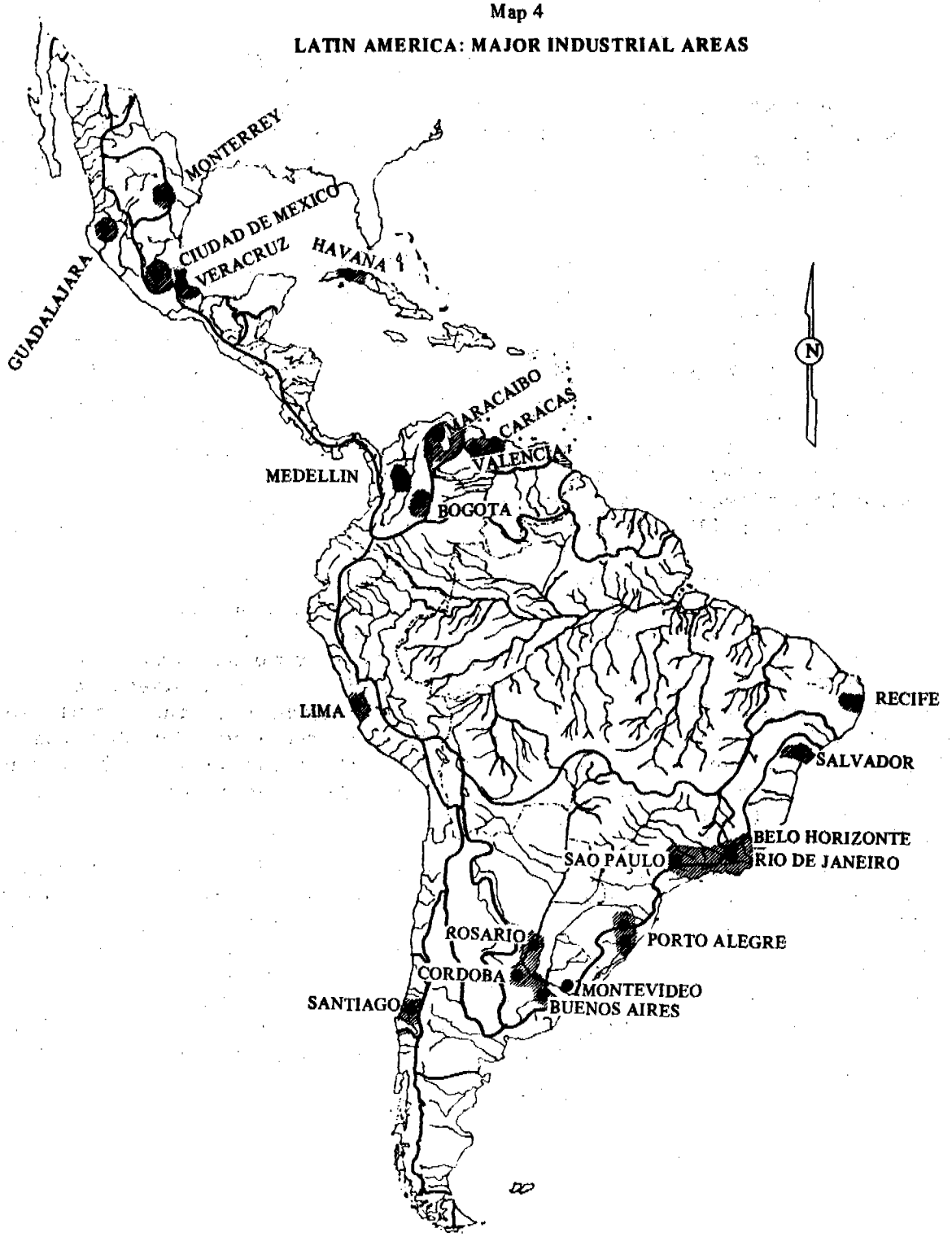
The Maipo river, however, unlike many rivers of Latin America, has little in the way of flow regulation structures. The regulation and control of rivers has increased greatly in recent years and this tendency is expected to continue. The natural flow conditions of all the major river systems, except the Amazon, have been substantially modified by the construction of dams, dykes, locks and other means of flow regulation. The most notable instances of the recent expansion of flow regulation and control are to be found on the river Paraná within the River Plate system; the river São Francisco in Northeastern Brazil; the river Caroní within the Orinoco system in Venezuela; and the short rivers of the Pacific coast from Ecuador to central Chile.

The numbers of control structures and reservoirs have grown continuously in the last 40 years, but the rates of expansion in control capacity have been irregular, although the physical storage capacity built has increased in each of the four decades (see table 9). The average annual rate of expansion in the erection of structures has decreased, after reaching a peak in the 1950s, but the average size of reservoir has increased from under 80 million cubic metres prior to 1942 to more than 500 million cubic metres in the five years 1972-1977. Over the same period of time, Latin America's share in the world total of large dams was doubled (see table 10).

/Map 4

Map 4

LATIN AMERICA: MAJOR INDUSTRIAL AREAS

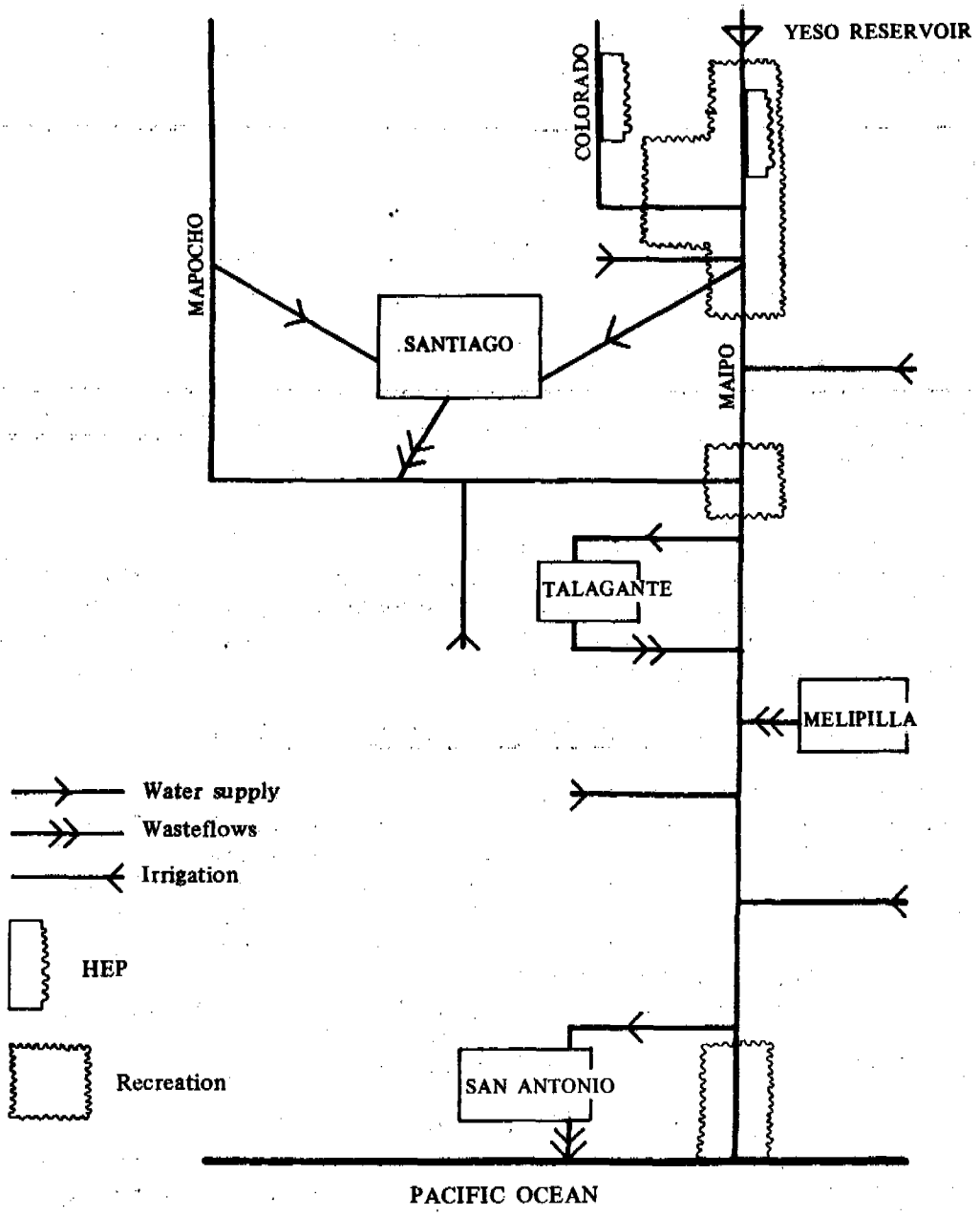


Source: Based on research for a study entitled 'Location and technology of industry in Latin America and their impact on the environment'.

/Figure 3

Figure 3

WATER USE, RIVER MAIPO, CHILE



/Table 9

Table 9

LATIN AMERICA: GROWTH OF RESERVOIR CAPACITY AND NUMBER OF LARGE DAMS, 1942-1977

Pierod of construction	Reservoirs			Dams		
	Millions of m3 built	Cumulative total	Average annual growth rate	Number	Cumulative total	Average annual growth rate
Before 1942	15 170	15 170	-	191	191	-
1943-1952	23 124	38 294	9.7	103	294	4.4
1953-1962	83 585	121 879	12.8	213	507	5.6
1963-1972	126 779	248 654	7.4	277	784	4.4
1972-1977	81 280	329 938	5.8	162	946	3.8

Source: International Commission on Large Dams (ICOLD), World Register of Large Dams, Paris, 1979.

The countries with the largest number of dams are Mexico and Brazil, which between them account for 70% of all the large dams in the region. This does not entirely reflect the extent to which total streamflow may be controlled, as smaller structures tend to be of equal, if not more significance, but there is no overall information on the numbers or characteristics of such small structures.

1. Hydroelectric power generation

The successive increases in the price of oil during the 1970s had a delayed but noticeable impact on the production of hydroelectricity. By 1980 over half the total installed electricity generation capacity of the region was in hydroelectric generating plants and in some countries, including Brazil, Paraguay and Costa Rica, the proportion was even greater (see table 11). During the years 1976-1980, hydroelectric generation increased at an average annual rate of more than 8%, somewhat less than the historical rate, but the growth occurs over an increasingly larger base: a rate of increase that is relatively uniform throughout the region, with the exception of some of the Caribbean islands, which have only limited possibilities for hydroelectric power generation, or none at all.

It was estimated in 1979 that the region as a whole possessed a hydroelectric potential, whose utilization was technically and economically feasible, of some 617 550 MW, taking a plant factor of 0.53.3/ By 1980, approximately 8% of this potential was being used. In only a few countries -El Salvador, Mexico, Chile and Brazil- was more than 8% of the respective national potential being harnessed in 1980. The coming on stream of the generating station at Itaipú will in itself present the use of 2% of the total regional potential and the generating stations

/Table 10

Table 10

LATIN AMERICA: NUMBER OF LARGE DAMS, BY COUNTRIES

Country	Number of dams	Height of dams in metres			Number constructed between 1972 and 1977
		15-30	30-60	>60	
South America and Mexico					
Argentina	77	25	36	16	15
Brazil	415	317	82	16	43
Chile	59	43	9	7	6
Colombia	28	10	13	5	4
Ecuador	4	2	1	1	1
Mexico	429	300	99	30	73
Paraguay	2	-	2	-	1
Peru	54	48	3	3	n.d.
Uruguay	5	1	2	2	2
Venezuela	52	31	16	5	10
Central America and the Caribbean					
Antigua	1	1	-	-	-
Costa Rica	3	2	-	1	-
Cuba	49	35	14	-	n.d.
Dominican Republic	6	-	3	3	6
El Salvador	4	2	-	2	1
Guatemala	-	-	-	-	-
Haiti	1	-	1	-	-
Honduras	2	2	-	-	-
Jamaica	2	1	1	-	-
Nicaragua	4	1	2	1	3
Panama	5	2	1	2	1
Suriname	1	-	-	1	-
Trinidad and Tobago	4	4	-	-	-
Total Latin America	1 207	827	285	95	166
Percentage	100	68.0	24.0	8.0	14.0
World otal	29 588	23 636	4 676	1 276	743
Percentage	100	80.0	16.0	4.0	2.5
Percentage share of Latin America in world total	4.1	3.5	6.1	7.2	22.3

Source: International Commission on Large Dams (ICOLD), World Register of Dams, second updating, 31 December 1977, Paris, 1979.

/Table 11

Table 11

LATIN AMERICA: INSTALLED HYDROELECTRIC GENERATING CAPACITY

Country	Installed capacity 1976 (thousands of KW)	Installed capacity 1980 (thousands of KW)	Percentage of total installed electricity generating capacity 1976	Percentage of total installed electricity generating capacity 1980
Argentina	1 745	3 269	17.7	27.7
Bolivia	241	243	60.4	56.5
Brazil	17 675	27 267	83.9	85.9
Chile	1 461	2 306	54.9	61.2
Colombia	2 305	3 175	85.2	65.3
Ecuador	145	297	22.9	26.4
Mexico	4 251	5 321	34.6	30.8
Paraguay	265	300	79.3	81.1
Peru	1 406	1 861	55.9	58.3
Uruguay	236	371	33.9	44.4
Venezuela	2 245	2 920	43.4	32.0
Costa Rica	239	445	58.9	69.9
El Salvador	109	244	31.5	49.3
Guatemala	119	125	31.3	21.9
Honduras	69	110	43.4	54.2
Nicaragua	103	103	33.4	27.1
Panama (incl. Canal Zone)	216	316	30.5	41.3
Cuba	44	46	2.6	1.9
Dominica	3	4	50.0	57.1
Dominican Republic	150	150	17.6	16.4
Haiti	47	50	52.8	41.3
Jamaica	17	20	2.4	2.8
St. Vincent and the Grenadines	2	2	25.0	22.2
Suriname	180	200	49.9	47.6
Total Latin America	33 273	49 145	48.1	52.5

Source: United Nations, 1980 Yearbook of Energy Statistics, New York, 1981.

/at Salto

at Salto Grande, Yacyretâ, Middle Paraná and Corpus, also on the Paraná-River Plate system, will together represent the utilization of a further 2% of the potential, while a similar proportion of the regional potential is already harnessed on the Upper Paraná and its tributaries in Brazil.

In the last decade, the installed generating capacity more than doubled; in this decade it is expected to triple (see figure 4) and to increase by a further 50% by the end of the century. The Organización Latinoamericana de Energía estimates that by the year 2000 installed capacity will reach almost 200 000 MW. Of the expected increase, almost half will be installed in Brazil and a further fifth in Argentina. In both countries, the largest proportion of the capacity will be placed on the rivers of the Plate-Paraná system, ensuring a high degree of regulation of the flow of the second largest river system in the region.

In Latin America, excluding the Caribbean islands for which information is not available, over the period 1980-2000 the total generating capacity to be installed will be, according to estimates three times greater than the capacity existing in 1980. Again the largest proportion of increases is to be found in the Paraná-River Plate basin in Paraguay and Argentina, although in Argentina much of the estimated increment is conjectural, whereas in the case of Paraguay the bulk of it is under construction. Other large increases are anticipated in Ecuador and Venezuela, in the latter case with approximately half already under construction (see table 12).

2. River transport

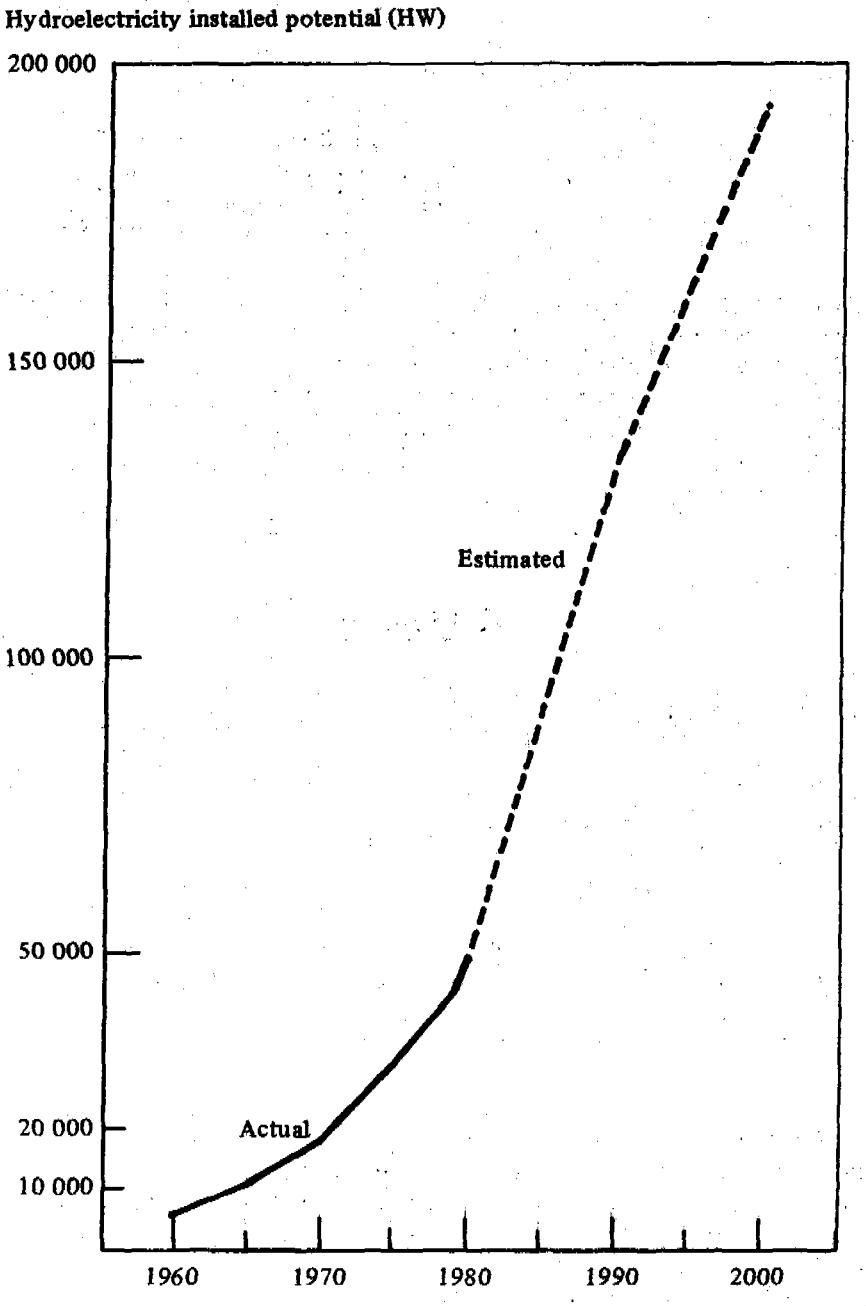
The largely coastal location of most human activity in the region has led to little development of navigation on the rivers of the region and there is a complete absence of the canal systems found in both North America and Europe. The major river systems, particularly the River Plate-Paraná, the Amazon, the Orinoco and the Magdalena-Cauca are important for water transport. These river systems are used for both inland navigation and for inland continuation of ocean navigation. For example, the Paraná-La Plata system is navigable for vessels drawing up to 12 feet for over 2 400 kilometres from Buenos Aires, up to the port of Corumba, Brazil. In addition, there is barge navigation up to the rapids at Apipe, just below the border city, Encarnación-Posadas, and when the dam at Yacyretâ is completed a by-pass canal will permit navigation to Foz de Iguazú. From Foz de Iguazu connection will be possible to the inland navigation system of southern Brazil.

On the Amazon, ocean-going vessels reach Iquitos in Peru, and there are more than twenty river ports receiving ocean-going traffic on the Amazon and its tributaries in Brazil. In recent years, a limited barge navigation system, based in Iquitos, has been developed to supply the hinterland, but the bulk of the traffic remains downstream on the Amazon, both overseas and to neighbouring areas of Brazil, particularly Manaus.

/Figure 4

Figure 4

EVOLUTION OF HYDROELECTRIC GENERATION CAPACITY



Source: ECLA, on the basis of official information.

/Table 12

Table 12

LATIN AMERICA (SELECTED COUNTRIES: ESTIMATED INCREASES IN HYDROELECTRICITY GENERATION CAPACITY, 1980-2000 a/

Country	Capacity in MW			Total increase forecast 1980-2000	Percentage of capacity existing 1980
	In construction 1980	Projected to be operating by 1991	Forecast 1990-2000		
Argentina	3 519	4 131	17 797	25 447	778
Bolivia	-	262	660	922	379
Brazil	21 725	17 333	21 316	60 374	221
Chile	790	1 075	3 560	5 425	235
Colombia	3 655	2 925	6 323	12 903	406
Ecuador	533	930	300	1 763	594
Central America b/	1 174	1 781	1 418	4 373	326
Mexico	1 726	2 740	- c/	4 466 d/	84 d/
Paraguay	6 300	1 350	-	7 650	2 550
Peru	660	1 328	3 904	5 892	317
Uruguay	930	-	711	1 641	442
Venezuela	7 126	5 191	3 785	16 102	551
Total 17 countries	48 138	39 046	59 774	146 958	300

Source: ECLA, on the basis of official information.

a/ Only public service capacity.
b/ Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama.
c/ No information available for projects beyond 1990.
d/ To 1990 only.

/On the

On the Orinoco and Magdalena-Cauca access of ocean-going vessels is more restricted, being confined to the ports around Ciudad Bolívar, some 400 kilometres upstream on the Orinoco, and to the mouth of the Magdalena, up to the port of Barranquilla. There is some inland navigation on both rivers but on a more limited scale than on the Amazon and Paraná-River Plate systems.

In recent years, the development of river transport has suffered severely from inadequate institutional and legal mechanisms, particularly on the Paraná-River Plate system where five governments are involved. This has led, in view of the competition from highway transport, particularly as road systems have expanded and improved, to a considerable decline in the importance of river traffic. Unfortunately, perhaps as a reflection of the neglect of this activity, there are no statistics available on the use of rivers for transport.

The most important navigational use of fresh water within the region, although far from being river transport or inland navigation, is the Panama Canal. It too is suffering competition from alternative transport modes.

3. Recreation

In water management in Latin America, recreation is a much neglected use of water. It is not, however, a use neglected by the population. The recreational use of water bodies is as popular within the region as in other parts of the world. The type of use and its extent are limited by accessibility. The latter in turn depends not only on location but also on levels of income. Not surprisingly, therefore, recreational uses are heavily concentrated in water bodies close to the larger metropolitan areas and in water bodies in higher-income regions. In many cases, the two are coincident.

Unfortunately, there are no general statistics on water-based recreation in Latin America. There is information in some countries on tourism but most recreation demand is local and not reflected even in national statistics on tourism. An impression of the magnitude of existing demand can perhaps be gained from estimates made of the use of the beaches of Buanabara Bay by the inhabitants of Rio de Janeiro. It was estimated in the mid-seventies that the average number of visitors to the beaches averaged one million per month.4/

The location of some centres of water-based recreation and areas of intense demand is indicated on the map of water and recreation (see map 5). What is perhaps most noteworthy is the area of the region which remains outside reasonable daily access from major concentrations of urban population.

4. Commercial fishing

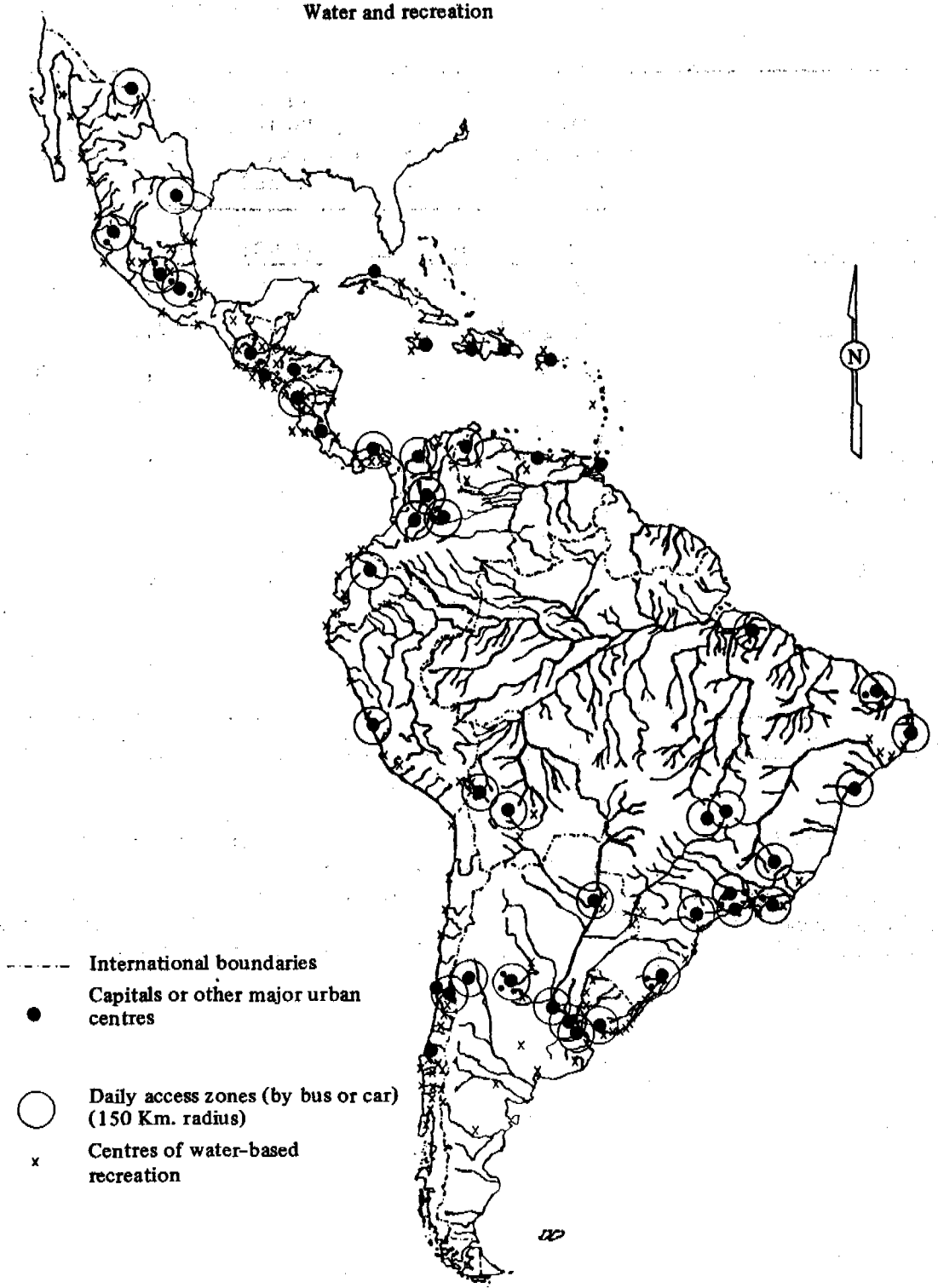
Commercial fishing in inland waters in Latin America is insignificant when compared to the increasing importance of sea or ocean fisheries: less than 0.3% of the total catch. The growth rate of commercial production was notable, however, in the last decade, averaging 5.6% a year for the region as a whole. In the years 1970-1980 the total regional catch reached 287 760 tons (see table 13). Much of the growth in production arises from the seeding of many streams.

/Map 5

Map 5

LATIN AMERICA AND THE CARIBBEAN

Water and recreation



Source: The fact that this map shows specific frontiers does not mean that they are approved or accepted by the United Nations.

/Table 13

Table 13

LATIN AMERICA: NOMINAL CATCHES IN INLAND WATERS

	Average 1971-1972 (thousands of tons)	Percentage of total	Average 1975-1976 (thousands of tons)	Percentage of total	Average 1979-1980 (thousands of tons)	Percentage of total
Latin America	167 350	100.0	263 491	100.0	287 760	100.0
Brazil	82 850	49.5	159 142	60.4	148 351	51.6
Colombia	51 050	30.5	46 756	17.7	47 719	16.6
Mexico	9 500	5.7	17 925	6.8	33 200	11.5
Venezuela	6 100	3.6	7 142	2.7	14 160	4.9
Peru	2 750	1.6	6 529	2.5	13 045	4.5
Argentina	6 000	3.6	12 457	4.7	11 367	4.0
Cuba	800	0.5	1 750	0.7	5 870	2.0
Bolivia	2 050	1.2	1 900	0.7	4 000	1.4
Paraguay	2 350	1.4	2 700	1.0	2 700	0.9
Others	3 900	2.4	7 190	2.8	7 548	2.6

Source: FAO, Yearbook of Fishery Statistics, Catches and Landings, Vol. 50, 1980.

The production of fresh-water fish is concentrated in a few countries; around half comes from Brazil, but important increases in production occurred in Cuba, Mexico, Peru and Venezuela in the last decade. In addition, a number of countries reported commercial fresh-water fish production for the first time during the 1970s, including Belice, Chile, Costa Rica, Guyana, Jamaica and Uruguay.

Chapter 3

ENVIRONMENT, HEALTH AND POLLUTION CONTROL

It has become increasingly recognized in Latin America that large-scale water development projects have important environmental repercussions and that they may also have unforeseen adverse consequences for human health, beyond the effects associated with the use of water in the home. It is also widely acknowledged by the governments of the region that water pollution is increasing, both from domestic and industrial wastes and from the use of fertilizers and pesticides in agriculture.

A. Environmental aspects of water use management

Large projects for the control and regulation of river flows or other hydrologic phenomena are among the most impressive evidence found in the region of the increasing mastery of the environment for the purpose of development. Undeniably, the construction and operation of these control structures, their attendant works and related economic and social developments are fundamental exercises in environmental management.

In Latin America, with certain noteworthy exceptions, a comprehensive view of water resource project management in this environmental sense has not been manifested Instead projects are undertaken as a series of individual steps, the objectives and timing of which do not necessarily interrelate. In consequence, management decisions are confined to a number of measures either individually isolated one from another or restricted to specific stages of the project or aspects of the use of the water resource. In practice, this limited view of water resource projects as tools for environmental management has led to heavy concentration of financial and human resources in the construction stage of project development, or to a predominant allocation of resources to specific uses, particularly the generation of hydroelectricity. This has redounded to the detriment both of project operation and of more comprehensive action to take advantage of the development opportunities offered.

On the other hand, it cannot be denied that vast experience is available in the management of water resource projects, but this experience is for the most part limited to the design, construction and operation stage. When it comes to the management and conservation of natural resources and, in general, to the environmental management required to meet the needs of the people settled within the zone of influence of such works, it is a different matter. There is a need to broaden the view taken in the region of the goals sought by the construction of such projects in order to obtain results which better meet the total needs of society, or, in other words, to use the projects as mediums for environmental management.

In the case of many unusually large works, project identification, appraisal and execution have been so dominated by their technical and hydraulic aspects and their constructional features that other important activities needed to benefit the population which the works were intended to serve have often been postponed or completely omitted. This has been noted in a number of studies which draw attention, for example, to the substantial inequality in terms of time and magnitude between

/investment in

investment in the execution of large dams for regulating water resources for irrigation, and investment in the physical development of land and human settlements in the areas which stand to benefit from the regulated flow. In addition, there is usually a radical difference between the working conditions and facilities made available to those responsible for construction, often foreign consortia, and the very limited conditions accorded to those responsible for operating the water system once it is built, always local employees. It is necessary therefore to bear in mind that hydraulic works are only one aspect and phase of management of the environment.5/

In this connection, a recent seminar organized by ECLA and attended by managers of large water resource projects reached, inter alia, the following conclusions:6/

a) The so called "environmental dimension" is commonly misunderstood in water resource development projects. In most projects "environmental management" activities are dealt with separately from others which are called "project implementation" action. This is particularly so in the construction of engineering works, even though the latter clearly form part of environmental management;

b) The area of influence of the management of a project should include, at least, the total catchment area of a basin, or system of basins, including those areas towards which the water is drained, both surface and underground. If this area is subdivided into smaller operational areas for political or administrative reasons, the necessary co-operation and co-ordination machinery should be established

c) The chain effects (in the ecological and productive sense which result from decisions taken on the implementation of large water resource development projects should be identified. Given the dynamism of this task it is necessary to keep constant vigilance over the environment and have a decision-making structure that can take the necessary measures for controlling such chain effects. Such vigilance requires in turn the prior specification of a suitable set of indicators to quantify the changes occurring in the environment;

d) A management structure should be created that is capable of simultaneously conducting short-term and long-term planned action during the different stages of project development. The structure of management should be varied according to whether the project is in the study or preliminary stage, the construction or intermediate stage, or the operational stage. The greatest needs for improvement in the administrative processes are at the operational stage. The management structure established for project execution must be subtantially changed in order to adapt itself to operation. The period of transition between the intermediate or construction stage and the operational stage requires adequate planning, financing, and preparation;

e) Financial support is a key factor in guaranteeing the success of any project. The greatest financial problems occur at the operational stage, and lack of financial support creates difficulties for proper environmental management. The costs and benefits related to the totality of the environmental system should be taken into account, not only those of the hydrologic system. As far as possible the action and respective chain effects affecting the environmental system should be determined in advance, to permit economic evaluation. It is necessary to

/consider the

consider the long-term effect of the water resource development project and the incorporation of the economic effects which are now called "indirect", as well as the internalization of greater environmental management alternatives in the design and technical and economic evaluation of projects.

B. Water and health

Water-related diseases are of considerable significance as causes both of sickness and of death in almost every part of Latin America and the Caribbean. Perhaps the most serious danger to human health is the occurrence of enteritis and other diarrhoeas. These diseases, although declining in incidence, as shown in table 14, are a major reason for the continuation of high infant mortality rates in many countries of the region, and a principal cause of death amongst children under 5 years of age in all the countries of the region reporting to the Pan American Health Organization. There is little doubt that so high a rate of morbidity for these diseases can be related directly to deficiencies in domestic water supply.7/

At the same time, there is a general relationship between these diseases and the existence of high rates of poverty in the region. Access to public services, including water supply and sewerage, is much lower amongst the population living in poverty than among the population as a whole. A recent study estimated that with the exception of Argentina, and possibly Uruguay, not less than 20% of households are poor in any country of South America, and in many, such as Brazil, Colombia and Peru, this proportion rises to more than 40%.8/ A considerable interrelationship exists, therefore, between water, health and poverty: a relationship which, despite many efforts, has not yet been successfully reflected in the policies adopted with a view to the provision of safe drinking water and adequate sanitation.

Waterborne diseases other than diarrhoeas are also significant in the region, particularly other forms of dysentery -amoebic and bacillary- which are prevalent in all the tropical countries; infectious hepatitis, even more widespread in occurrence; and typhoid fever, which is found in nearly all countries. The last-named is particularly prevalent in South America, and although the incidence of typhoid fever tended to decline in the 1970s, it has increased in ocurrence in recent years, possibly reflecting a neglect of environmental health in some countries.

There is a further important group of diseases that can be related not to the contamination of water supplies or food but to changes in hydrologic régimes. In general these diseases, which are largely transmitted by insect vectors living in particular water environments, are restricted to tropical areas. The diseases of this type reported in Latin America are dengue, which has recently reached a period of extreme activity, yellow fever and malaria. Only the temperate regions are free from them. There is no specific information on the relationship between the ocurrence of these diseases and any particular water management action, but the potential connection should be borne in mind.

Finally, schistosomiasis or bilharziasis, is endemic to extensive areas in the humid tropics of South America and the Caribbean. It was estimated that more than six million people were infected in the 1970s, largely in rural areas.9/ The occurrence of the diseases is under-reported, but is relationship to the construction of reservoirs and especially drainage and irrigation networks, which provide the

/Table 14

LATIN AMERICA AND THE CARIBBEAN: DEATHS FROM ENTERITIS AND OTHER DIARRHOEA DISEASES
(Rates per 100 000 by age group) a/

Country	I Less than 1 year b/		II 1 to 4 years		I c/	II c/
	Rate	Percentage of all deaths	Rate	Percentage of all deaths	Percentage reduction over rate 1973-1976	Percentage reduction over rate 1973-1976
Argentina (1978)	394.4	9.7	19.9	9.0	53	48 88
Bahamas (1979)	370.2	10.4	n.d.	n.d.	-	-
Belice (1978)	1 076.7	28.0 */	n.d.	n.d.	0	-
Colombia (1977)	880.5	22.3 */	98.8	22.0 */	-	6
Costa Rica (1979)	196.4	8.9	11.3	8.7	71	69
Cuba (1978)	158.2	7.0	4.2	4.7	36	-
Chile (1979)	274.6	7.5	8.7	5.8	61	53
Dominican Republic (1978)	508.4	16.3	45.9	15.1 */	36	49
Ecuador (1978)	1 587.3	24.6 */	227.5	28.2 */	(+2)	25
El Salvador (1974)	1 276.1	23.9 */	182.1	29.9 */	-	-
Guatemala (1978)	1 345.4	18.6	408.6	31.2 */	34	44
Guyana (1977)	1 182.6	25.4	117.9	34.9 */	-	-
Honduras (1978)	519.5	19.3 */	92.8	19.4 */	37	63
Mexico (1976)	1 369.7	24.0	118.9	24.5 */	-	-
Nicaragua (1977)	1 229.0	35.0 */	n.d.	n.d.	19	-
Panama (1974)	293.7	9.3	76.8	16.5 */	4	19
Paraguay (1978)	2 433.3	26.6 */	198.7	40.1 */	(+46)	(+8)
Peru (1978)	1 027.8	20.4	134.2	26.0 */	31	19
Saint Vincent (1979)	655.3	17.7	n.d.	n.d.	-	-
Saint Lucia (1978)	579.7	20.9	n.d.	n.d.	-	-
Suriname (1978)	327.9	7.5	n.d.	n.d.	-	-
Trinidad and Tobago (1977)	583.2	27.0	43.1	32.3 */	27	0
Uruguay (1978)	428.3	11.2	7.2	6.6	(+18)	0
Venezuela (1978)	569.6	16.8	36.5	15.0	20	22

Source: PAHO/PASB; Health Conditions in the Americas 1977-1980.

a/ Rates only given if diarrhoeas are among the five principal causes of death in age group.
b/ Rate per 100 000 live birtns.
c/ Numbers in parenthesis indicate rate of increase over rate 1973-1976.
*/ The principal cause of death in the age group.
n.d. No data.

/relatively slow

relatively slow-moving water environment where the snail flourishes, has been well documented in Africa, and it seems likely that similar circumstances may exist in Latin America.

Control in disease transmission is a relatively straightforward process where such transmission is through domestic water supply or food. Even so, this does not mean that it is easy to implement such control. Mucho more complex, however, is the control of diseases transmitted through other members of the ecosystem. The chain of actions and reactions is often very lengthy in the latter case, and difficult to master, especially when the means to do so are not well understood. For example, the recent dengue epidemic which began in 1978, and which was spread by man reinfecting the mosquito A. aegypti and then in turn being reinfected, occurred despite extensive control programmes in many countries.

C. Pollution control

An eloquent index of the economic development achieved in Latin America in the last quarter of a century is the emergence of water pollution as a significant feature of the use of the region's water resources. Unfortunately, there is virtually no systematic evaluation on a regular basis of the evolution of water pollution or of the resultant impact on the region's rivers and lakes.

Some idea can be gained of the current demands for the use of watercourses for waste disposal and transport through the estimated waste loads generated by metropolitan centres, but this provides only a very partial index of pollution (see table 15). In few cities are there waste treatment plants for treating domestic or any but the most toxic industrial wastes. In many metropolitan centres even patterns of waste flows are only partially controlled through interceptor sewers and scientifically located outfalls. For example, such a situation, now being resolved, existed in São Paulo, Brazil, where by the mid-1970s only 35% of the metropolitan area was served by sewerage systems and in the rest water was removed by direct runoff or percolation from too densely packed septic tanks or latrines into the water courses crossing the urbanized area. Of the estimated waste load transported by the sewage system only 5% was treated prior to discharge. The result was a significant degradation of the watercourses of the metropolitan area, most of which were in a predominantly anaerobic condition for much of the year. This may have been a case of exceptionally severe pollution, but nearly all metropolitan areas are characterized by gross water pollution of their fresh watercourses and of neighbouring coastal waters.

Demands on the water resources adjacent to metropolitan regions for the disposal and transport of waste and the potential, at least, for pollution can be expected to expand enormously by the end of the century. Population growth itself, great as it is, with many of the major metropolitan regions expected to more than double their populatin, will be only one factor. Equally significant will be the increased flows through the sewerage systems as connection is extended to a larger proportion of the populatien. At present, in many metropolitan regions less than half of the popultion is served by sewerage systems.

A further significant contribution of waste flows in most metropolitan areas is industry. An example of the type of industrial waste flows emanating from a large South American metropolitan region -Santiago, Chile- presented in table 16.

/Table 15

Table 15

LATIN AMERICA: WASTE FLOWS IN THE MAJOR METROPOLITAN AREAS

	Population (thousands) a/		Percentage increase	Domestic sewerage coverage b/ (percentage) c/	Estimated outflow of sewage in 1975 (m3/sec)	Recipient water body
	1975	2000				
Mexico	11 880	31 025	161	80	54	River Tula and Lerma/Panuco
São Paulo	10 740	25 796	140	20-35	22	River Tiete and Lake Billings
Rio de Janeiro	8 885	18 961	113	60	34	Guanabara Bay and Atlantic Ocean
Buenos Aires	9 315	12 104	30	41	96	River Plate and tributaries
Bogotá	4 017	11 663	190	70	10	River Bogotá
Lima-Callao	3 790	8 930	136	-	16	Pacific Ocean
Belo Horizonte	1 543	6 471	319	18-62	4	River Das Velhas and others
Guadalajara	2 127	6 170	190	78	8	River Santiago
Santiago	3 448	5 760	67	86	14	River Mapocho
Curitiba	1 456	5 212	258	26	5	River Belem
Caracas	2 598	5 209	100	72	11	River Guaire and Tuy
Medellín	1 929	4 703	144	79	6	River Medellín
Recife	2 088	4 666	123	14	5	Atlantic Ocean
Monterrey	1 664	4 575	175	60	7	River Santa Catarina
Salvador (Bahía)	1 392	3 258	134	0	3	Atlantic Ocean
Havana	1 929	3 213	66	50	16	Gulf of Mexico
Cali	1 260	3 165	151	81	4	River Cauca
Guayaquil	892	2 370	166	-	4	River Guayas and Salado estuary
Barranquilla	982	2 336	138	55	1	River Magdalena
La Paz	743	1 963	164	38	1	River de La Paz
Quito	658	1 845	180	-	2	River Grande de Tarcoles River Guaillabamba
Montevideo	1 374	1 687	23	57	6	Atlantic Ocean
Maracaibo	704	1 515	115	-	3	Lake Maracaibo
Córdoba	927	1 426	54	25	4	River Primero
San José	536	1 265	136	-	3	River Virilla
Asunción	447	1 112	149	-	1	River Paraguay

a/ United Nations Population Division, Patterns of urban and rural population growth: Population Studies No. 68, New York, 1980.

b/ ECLA estimates based on official statistics of the countries, for various recent years.

c/ In cases of inconsistent data, ranges are given.

/Table 16

Table 16

SANTIAGO, CHILE: MAJOR INDUSTRIAL WASTE FLOWS

Industry	No. plants	Waste flow m^3/day	No. plants with treatment	Percentage of total waste flow treated	Potential pollution
Food and beverages	25	18 529	7	47	BOD_5- SS
Textiles	13	23 780	5	52	BOD_5- DS
Paper and paper products	1	27 700	-	-	BOD_5- SS
Chemicals	14	67 685	4	3	DS
Plastic and rubber	4	16 820	-	-	Low
Leather and leather products	6	3 940	3	77	SS - DS
Cement, gravel and glass	2	4 290	1	94	SS
Metal products	6	5 045	1	3	DS
Copper mining	3	17 430	2	98	SS - DS
Total	74	183 469	23	26	

Source: Corporación de Fomento de la Producción (CORFO) (Development Corporation).

BOD_5 : Biological Oxygen Demand.
SS : Suspended Solids.
DS : Dissolved Solids.

/Noteworthy in

Noteworthy in this case is the relatively high degree of waste treatment although in many of the industries in this example the treatment provided is only partial. In general, as the example indicates, the major industrial waste loads come from the metal-working industries (particularly iron and steel production and non-ferrous metal refining) thermal electricity generation plants, food processing, particularly in tropical Latin America, coffee-processing plants, the pulp and paper industry, textiles and chemicals.

Some advances have been made in the last decade towards remedying the pollution problem resulting from the use of the water resource for waste disposal and transport For example, major programmes to increase sewerage facilities in nearly all the major cities of Brazil have been accompanied by programmes to achieve rational management of the water bodies and to waste disposal by a combination of waste treatment facilities with the means and sites for the deposit of sewer wastes. Similar studies of the behaviour of water bodies have also been undertaken in Havana Bay and, in respect of the Atlantic Ocean, off Montevideo. At the same time, in some countries efforts are being made to introduce simple waste treatment techniques, mainly stabilization ponds, in smaller towns and villages. One example is the Proyecto de Desarrollo Tecnológico de Instituciones de Agua Potable y Alcantarillado in Peru, undertaken with the assistance of PAHO through its sanitary engineering centre, CEPIS.

Chapter 4

POLICY, PLANNING AND MANAGEMENT

In the Mar del Plata Action Plan it was recommended that "each country should formulate and keep under review a general statement of policy in relation to the use, management and conservation of water, as a framework for planning and implementing specific programmes and measures for efficient operation of schemes. National development plans and policies should specify the main objectives of water-use policy, which should in turn be translated into guidelines and strategies, subdivided, as far as possible, into programmes for the integrated management of the resource".10/ Only five of the countries of the region, however, have formulated explicit national water policy statements. In the majority of countries national water policy is, by default, the sum of the policies established for the different water-using sectors.

A. The nature of water policies

In general, the countries of the region do not have national development plans or even normative policy statements for national development except in the most general terms. Not surprisingly, therefore, few countries have adopted normative sets of national objectives for the use, management and conservation of water. In contrast, most countries of the region possess normative plans and, therefore, policy statements for the major water uses, particularly energy, agriculture and water supply. Additionally, a number of countries have some type of policy statement on the preservation, conservation and improvement of the quality of the human environment. In general, since the United Nations Conference the policy adopted towards water resource development has experienced little change in most countries of the region; only five of the nineteen countries which replied to the questionnaire on changes since the Water Conference reported any change in policy. In most countries of Latin America, policy objectives are, as has been the case for many years, to increase national income, to support equitative development of the different regions of each country and to collaborate in the protection and improvement of environmental quality. The highest priorities amongst the uses of water are given to water supply and sanitation, agriculture and the production of hydroelectricity although not always in the same order.

i) National water policies. Not surprisingly, it is the countries with national water resource plans that have normative policy statements for water resource development. The countries of the region that have embarked upon the development of national water resource plans are Colombia, Ecuador, El Salvador, Honduras, Mexico, Peru and Venezuela. All these countries have amongst the objectives of the plan, although not necessarily expressed in these terms, the achievement of more rational use of water through the maintenance of an equilibrium between the demand for and supply of water, with the aim of supporting the more general economic and social objectives of the development process.

/For example,

For example, the overall objective of the National Water Plan of Peru is expressed in the following general statement of national water policy: "To establish a rational, equitable and effective use of water, in relation to that country's requirements for the various uses -social, economic and natural- and in accordance with priorities, overcoming resource constraints and ensuring the maintenance of ecological balance; to which end it is essential to possess knowledge in depth of availabilities in terms of space and time".11/

Similarly, the national water plan in Venezuela includes this general expression of the objectives for a national water policy:

"The national plan for the utilization of water resources is a frame of reference constituted by a set of strategies and guidelines which, as part of overall development policy and of an appropriate legal and institutional system, will make it possible to ensure rational management of water resources and therefore to establish a logical and reasonable distribution of water supply among the probable demands ... The plan is conceived as a process directed towards defining with exactitude any decisions that affect the water resource, with a view to quantitative and qualitative stabilization of the demand-supply balance, by which means water can be prevented from becoming a constraint on the country's economic and social development..." The objective of this same plan is summed up as that of "... maintaining a dynamic equilibrium between supply and the various demands arising in the course of the country's development".12/

Such normative objectives for national water policy found within national water plans are not so different from general policy statements made in the countries of the region without formal national water plans. For example, in the case of Chile the task of the Water Department is to apply a rational policy for the use of water and to carry out the necessary planning, research and administrative action to achieve rational multiple use of the water resource for the country as a whole.13/

ii) Strategies in major water use sectors. Equal in importance to the development of a national water policy statement, as was specifically recognized in the Mar del Plata Action Plan in the national water policy resolution, are the policies adopted for the different sectors of water resource management and water use.14/ Nearly all countries of the region have declared policies at least for the most important water uses.

1. Water supply and sewerage

Traditionally in Latin America, as elsewhere, water supply has been a municipal function. In most of the region, however, the municipalities constitute a weak level of government with very limited autonomy and little financial independence. The countries of the region -even those with a federal system- have been characterized by extremely centralized governments. The typical municipal water company was insufficiently capitalized, it provided an unreliable service with a poorly maintained system, and its income did not keep pace with inflation. This led to the adoption of a series of reforms following the 1960 Punta del Este meeting, directed in addition to the setting of specific supply targets and improvement of

/the organization

the organization and administration of the services. Although the particular form assumed by the policies adopted to this end has varied from one country to another, the reforms have possessed a number of common characteristics. These include the creation of standard national services to replace or supplement existing municipal or State companies, as has long been the case with Obras Sanitarias de la Nación in Argentina, and the Instituto Nacional de Obras Sanitarias in Venezuela; in Brazil the creation of State water supply and sanitation corporations is of more recent date. Normally, the provision of piped water and sewerage services has been fused under the responsibility of a single institution and stricter criteria have been adopted for technical and financial management.

It is clear, however, that despite their initial success these policies have not generally speaking led to the maintenance of a continuous increase in the number of household connections to water or sewerage systems in urban communities nor to a significant expansion of rural water supply and sanitation services. The designation of the 1980s as the International Drinking Water Supply and Sanitation Decade has provided a suitable occasion for governments to reconsider strategies favouring the expansion of water supply and sanitation services, especially the financial aspects, as well as the question of the broader relationship of the sector to the process of economic and social development.

The IDWSSD has led most countries of the region to adopt specific goals for increasing coverage of the population with water supply and sanitation services and, in many cases, to formulate wider improvement and development objectives in respect of water supply and sanitation (see table 17). It must be noted, however, that in a number of countries serious limitations are seen to exist in the ability of the institutions responsible for the sector to meet the goals and plans that have been established; a debility reflected in the large number of countries which by the end of 1982 had not completed the preparation of plans for the decade. The IDWSSD has undeniably stimulated innovation in policies respecting water supply and sanitation in the region, but much remains to be done.

2. Agriculture

In most countries of the region, agriculture is the economic activity which uses the largest volume of water. Accordingly the efficient management of water for agriculture is of considerable importance for the overall efficiency of water use. The demand for water in agriculture stems from two major uses, firstly water supply for animals and the on-farm processing of products, and secondly irrigation. The latter use is by far the greater determinant of the overall level of demand.

In the development strategies of nearly all the countries of the region, irrigation for agriculture has a highly important role to play in increasing food production. In contrast with policies enunciated for irrigation in the past, however, current policies place emphasis on obtaining much higher levels of efficiency from land already provided with infrastructure. For example, in Mexico the first priority in agricultural water use policy is to "increase efficiency in irrigation. This policy comprises: the application of operational rules, for the utilization of both surface and groundwater, whether separately or in conjunction; the maintenance and conservation of the existing hydroagricultural

/Table 17

Table 17

LATIN AMERICA: DECADE ACTION, BY COUNTRIES, DECEMBER, 1982

Country	Goals established	Plan formulated	Limitations of ability to meet planned objectives
Argentina	Yes	Yes	Moderate
Bolivia	Yes	Yes	Very serious
Brazil	Partially	No	Moderate
Colombia	Yes	In preparation	Moderate
Costa Rica	Yes	In preparation	Moderate
Chile	Partially	In preparation	Moderate
Ecuador	Yes	In preparation	Serious
El Salvador	Partially	In preparation	Serious
Cuatemala	Yes	No	Moderately serious
Guyana	Yes	In preparation	Serious
Honduras	Partially	In preparation	Moderately serious
Mexico	Partially	In preparation	Moderately serious
Nicaragua	Partially	No	Serious
Panama	Yes	In preparation	Moderate
Paraguay	Partially	In preparation	Moderate
Peru	Partially	No	Moderately serious
Dominican Republic	Partially	In preparation	Moderate
Trinidad and Tobago	Partially	No	Moderately serious
Uruguay	Partially	No	Moderate
Venezuela	Yes	In preparation	Moderate

Source: PAHO, on the basis of official information.

/infrastructure; the

infrastructure; the improvement and modernization of transportation and distribution systems so as to permit of their more flexible operation; an increase in the efficiency of smallholdings through a drive for the technifying of irrigation, levelling of land and other measures; the restructuration and periodic updating of tariffs so that they may cover at least the costs of conserving, maintaining and operating projects; controlled allocation of water in irrigation systems where this is feasible; and the substitution and diversification of crops, taking into account water and soil availabilities, as well as the specific qualities and productive potential of the land, and national food requirements".15/

On a secondary plane is the increase in the cultivated area provided with irrigation infrastructure, although it is planned to duplicate the irrigated area to 10 million hectares by the end of the century.

In Argentina and Chile, current irrigation policies place even less emphasis on the expansion of the physical area under irrigation. In the case of Chile, the construction of new major irrigation works is not contemplated in current policy. Instead policy is directed towards the maximum utilization of the existing infrastructure by the consolidation of projects already built through the full incorporation of the area served by the projects, by improvements in the efficiency of the application of water both within the system and on the farm, and through improved knowledge of the hydrologic behaviour of the water system used or usable for irrigation.16/

3. Energy

Policy towards utilization of the water resource for the generation of hydroelectricity has been more discussed than that for any other water use sector. Only five countries of the region have made complete inventories of the hydroelectricity generation potential, but all countries have long-term plans for the development of electricity production in general, and hydroelectricity in particular.

In most countries of the region, especially since the big increases in the price of oil in the 1970s, heavy emphasis has been placed on expansion of production of hydroelectricity. For example, in Argentina it is planned to expand the proportion of the country's hydroelectricity potential in use from less than 4% at present to more than one-third by the end of the century. ECLA estimated in 1982 that the proportion of Latin America's installed electricity generating capacity in hydroelectric plants will rise from the 60% existing in 1979 to 66% by 1990 and to about 75% by the end of the century.

As can be expected, the bulk of the new capacity which it is planned to install will be in medium- or large-sized generating stations. Recently, however, there has been as well a renewed interest in the installation of micro-generating stations in many countries. Particular interest has been shown in systematically developing policies and programmes for the installation of micro-stations in Brazil, Colombia, Cuba, Ecuador, Panama and Peru.

/A further

A further area of positive policy development in the region has been and continues to be the construction of bilateral projects which involve large-scale physical integration works. The biggest of such projects are all located on the Paraná-River Plate system and their implementation has given considerable impetus to the overall process of integration among the countries sharing the basin.

4. Other uses

In other sectors of water use, even in the countries which have embarked on a national plan for water resource development less definition is given to policies. A number of countries, particularly the more industrialized, have begun to formulate policies to control water quality. In both Argentina and Mexico a movement has begun towards controlling polluting industries and requiring that effluents be treated. Few countries have as yet, however, sufficient water quality monitoring networks to measure the degree of pollution being caused or to relate specific problems to their source. No country reports a policy for water-based recreation, although it is one of the fastest-growing water uses both for sport fishing and for water contact activities. In this particular case, it cannot be claimed that this is a minor use restricted to only the more affluent classes. There is an interrelationship and conflict between water quality and recreation. The deterioration of water quality due to uncontrolled disposal of wastes and the demand for recreational use of water bodies are both concentrated around major metropolitan centres. The perception or awareness of the nature of the challenge presented by the expansion of the metropolitan centres is in itself a major unresolved issue for water management in Latin America.

Minor uses of the water resource such as navigation are significant to only a few countries of the region, or, although widespread, of restricted impact, like commercial fishing. In the one, however, public policies are little more than supportive while in the other, rigorous policies have been adopted in a number of countries.

B. Water resources planning in Latin America

There is a clear tendency observable in all the countries of the region to extend planning activity in a more integrated manner between the different water-using sectors and to undertake planning for the longer term. Originally, planning of water resource-related activities was introduced into Latin America on a sectoral basis, particularly for the more important water uses, irrigation, the generation of electricity and drinking water supply. The objective of the introduction and application of planning was to establish priorities amongst the various investment possibilities in each sector. In general, in the establishment of these priorities and in the plans developed, aspects other than the expected financial or economic returns were not considered. It is only recently that planning activities have taken into account the wider social and environmental impacts of the investments being analysed or the multiple use of the water resource.

/1. National

1. National water resource development planning in Latin America

All the countries of the region have some experience in the formulation and application of water resource development plans, at least for particular water use sectors. In general, even where a multisectoral or national water resource development planning process does not exist, there does exist ample information on developments relating to the major water uses.

Undeniably, Mexico is the country of the region with the most experience in national water resource planning. A number of other countries, including Venezuela and Peru, have national water resource planning exercises of some maturity. In the last five years a number of other countries have embarked on the national water resource development planning process; these include Colombia, El Salvador, Ecuador and Honduras.

In other countries, as in Argentina and Brazil despite the level of knowledge of the water resource reached and the application of sophisticated techniques in project evaluation and in the preparation of sectoral or regional plans for water resource development, there has been little movement towards the preparation of national water resource development plans. In the case of Chile, the preparation of a national water resource development plan is not contemplated although all the necessary basic information is available. Similarly, Uruguay is not considering the preparation of a national water resource development plan because it has already identified its long-term water demands, particularly for electricity generation, and the preparation of a plan is not, therefore necessary.

Elsewhere, there have been expressions of intent regarding the preparation of national water resource development plans or the consolidation of existing sectoral plans into a national plan, but this intent has not yet been manifested in the creation of the required institutional structure.

2. Institutional structure for water resource planning

In those countries which have embarked on a national water resource development planning process, there are different institutional structures for preparing the plan. Commonly, however, a special commission is created representing all the government institutions active in water resource administration, with a technical secretariat. The variations found in the institutional organization include the following:

i) commissions within the national planning organization, e.g., in Colombia, Honduras and Peru;

ii) commissions within the Ministry of Natural Resources as in Venezuela;

iii) commissions within other ministries, agriculture, public works, etc., for example in El Salvador;

iv) formation of special water resource institutions, as in Cuba and Mexico, although in the latter case the Secretaría de Recursos Hídricos has now been amalgamated with the Ministry of Agriculture.

/In those

In those countries, which have not undertaken a national water resource development planning process, planning activities remain in the hands of the strongest sectoral institutions, normally hydroelectricity or irrigation or with major industrial development projects, particularly in the smaller countries.

C. Legislation and institutions

In Latin America, even allowing for the considerable difference between the Latin countries following the principles of Roman Law and the English-speaking countries of the Caribbean following the tradition of English customary law, there is more commonality in the legal systems governing the water resource than in any other region. In general, apart from the continuance of riparian rights in some Caribbean countries, the allocation of water rights is a public discretionary power. This legal situation is paralleled by traditional public intervention in the administration or management of the resource. There are, however, in most countries of the region areas of decision-making related to the utilization of the resource where private water managers play a significant role.

1. The nature of the legislative régimes

Apart from the English-speaking countries of the Caribbean, the legislative systems of the countries of Latin America have been much influenced by Spanish Law from the colonial period and in the nineteenth century by French Law, more particularly the Napoleonic Code. The influence of the Napoleonic Code to a great extent reached most national legislations indirectly, through the widespread adaptation of the Civil Code of Chile of 1855, by other countries of the region.17/

In consequence, the legal régimes of the Latin American countries show certain common characteristics, which include the following:

i) in the first instance, the water resource, both surface water and groundwater, is in the public domain;

ii) the State, on the basis of the public character of the water resource, has discretionary power to allocate concessions or licences to exploit a given water body to individuals or companies, both public and private. In some countries, such a concession on water rights, once assigned, becomes a private property right which can be freely traded, for example in Chile. In others, the transfer of water rights can only be made by the public authority;

iii) A priority system exists for water use, once rigid, but now in most countries recent legislative reforms permit flexible incorporation of the priority order of uses;

iv) all the different statutes relating to water use are incorporated in one law or Water Code.

In the English-speaking countries of the Caribbean, all waters except those which arise, fall or flow on private land before entering a public watercourse are the property of the Crown. A public watercourse may be a surface stream or an aquifer. In countries with legal systems based on English customary law,

/the right

the right to use or appropriate water is of far greater significance than the right to ownership. Those possessing the right to use water, whether gained from ownership, riparian rights or administrative act, have considerable liberty of action in the use of water and acquire priority of use irrespective of the particular use made. Unlike the water codes current in the Latin countries which establish hierarchies of uses, the English customary law followed in the countries of the Caribbean gives priority to those possessing and exercising water rights for the longest periods of time.

The specific nature of the legal system governing the use of the water resource varies considerably from country to country within the two general situations described above. In many Latin American countries riparian land users retain their rights to the use of water independent of administrative assignment, for example in Colombia, Brazil and in recent modifications of the Chilean Water Code.

In the federal countries of Latin America a further complication is added to the question of jurisdiction. In the case of Mexico, according to the Constitution, water is national property and, therefore, is subject to the federal power. In Argentina, in contrast, although the enactment of the Civil Code is within the federal power, its implementation is left to the provinces. In consequence, as little mention of water is made in the Constitution, jurisdiction of the water resource falls largely to the provinces, with the exception of waterfalls (for hydroelectric power generation), which is exclusively reserved to federal jurisdiction.

2. Water resource administration

The importance of water-related development projects over the last half-century in Latin America has led all countries of the region to develop relatively sophisticated systems of water resource administration. Naturally, the complexity of the administrative systems varies with the size of the country, and administration in El Salvador can be far simpler than the system in Brazil. Nevertheless, despite the disparities in country size and in the nature and size of the economic structures there are common elements observable in the administration of water resources in the region.

In general, three groups of institutions may be distinguished in the water administration system. These are:

i) institutions responsible for jurisdiction over the resource itself and responsible for the concession of rights over the use of the resource;

ii) institutions responsible for the measurement of the resource, both superficial flows and groundwater and, increasingly, also responsible for undertaking of the administration of water resource-related research; and

iii) the users of water resources, both public and private.

/The actual

The actual forms taken by these different groups of institutions appear in quite distinct combinations in individual countries. Again, however, certain common characteristics can be observed and a further three sets of administrative arrangements can be distinguished. In this case, there are:

i) countries where many agencies are active in water management, at all levels of government, and responsibilities for the three groups of activities, jurisdiction, measurement and research, are widely diffused;

ii) countries with concentration of water management activities in one institution but with some management functions carried out elsewhere; and, finally,

iii) countries in which the management of administration of the water resource is concentrated in one centralized institution and only the users of water have significant autonomy.

A further differentiation of the water resource administrative systems can be made on the basis of the degree of decentralization of authority. A number of countries are nominally constitutionally federal states, but in only two of these, Argentina and Brazil, do significant powers devolve on the State or provincial governments. In addition, in Colombia there is significant decentralization of water management authority to river basin authorities and the municipalities of the major cities.

In nominal terms, in most countries of the region the administration of the water resource is concentrated in one organization. In reality, the situation most commonly found is that the practical administration of the resource is divided amongst various institutions, many of which are the major users of water services within the public sector. Argentina, Bolivia, Chile, Colombia, Guatemala, Paraguay, Nicaragua, Uruguay, Venezuela and the English-speaking countries of the Caribbean all fall into this category. In administrative systems of this type co-ordination of activities amongst the various institutions or across sectors of use is important and is achieved by a great variety of means. These include inter-Ministerial councils, and even specific co-ordination agencies, or they may be merely ad hoc arrangements for particular issues.

A typical example of both the diffuse system of water administration and the common hiatus between legal formality and management practice is provided by Chile. The Chilean Water Code, one of the most complete in the region and, as mentioned, widely used as a model by other countries, provides for the establishment of the Dirección General de Aguas (Water Department) within the Ministry of Public Works as the sole administrative authority in water matters. Legally the Chilean system is, therefore, undeniably highly centralized. The functions of the Dirección General de Aguas include the study and implementation of plans for the water resources of Chile, the granting of all rights for the use of water, the establishment of priorities for water rights, the maintenance of information systems both for the supply of water and other hydrologic characteristics and the registering of all water right concessions, the formulation of criteria for the conservation of water, for control of its use and for water quality, authority to change the water source of any user, and authority to undertake the study and control of all water-related projects.

/This centralized

This centralized authority of the Dirección General de Aguas is, in practice, considerably diluted by its lack of financial resources and the existence of powerful public-sector water users. These include amongst the most important:

a) the Irrigation Department, responsible for the construction and management of irrigation works built with public funds, and the National Irrigation Commission, responsible for integrated development of irrigation on a river-basin or regional basis;

b) the National Sanitation Works Service (SENDOS), responsible for drinking water supply and sanitation;

c) the National Electricity Company (ENDESA) responsible for the study, design, construction and operation of hydroelectric power stations.

A system such as that described as existing in Chile, which might with justification be regarded as fragmented in terms of function, is found with variations in many countries of the region. In the Chilean case, nearly all sectors have single centralized institutions, the major exceptions being water supply and sanitation and electricity, where there are regional institutions as well as some private companies.

In the federal countries Argentina and Brazil, territorial decentralization is common, and much more complete than in the case of Chile or the other countries with unitary governments. In Brazil, for example, the authority to legislate over water is given concurrently to the federal and State governments, with hierarchy accorded to the federal government. In general, however, the states intervene more actively in the administration of the water resource. In Argentina, the Constitution gives the authority to legislate over water to the National Congress through the legislation in the Civil Code. The bulk of the water resources are, however, part of the public domain of the provinces. This situation considerably limits federal jurisdiction over the water resource. Administratively, however, it was reversed in all but a few of the richer provinces by the growth of strong federal bureaucracies in certain water use sectors, for example Agua y Energía in hydroelectricity, and the national drinking water supply and sanitation agency, Obras Sanitarias de la Nación. Since 1980 the administration of the works and services formerly managed by these federal bureaucracies has been transferred to the provinces. Despite the existence of these federal agencies the administrative system is diffuse, however, with a large variety of institutions within both the federal and the provincial governments.

The second general type of water management system, where one institution predominates over others, is found in Costa Rica, El Salvador, Panama and Peru. The last-named country is perhaps the best example in this group, where there is centralization of authority within the water management system without there existing a single water resource institution. Under the General Water Law (Ley General de Aguas) in Peru the major share of the public powers over the water resource has been delegated to the Ministry of Agriculture, in addition to its particular sectoral responsibility for irrigation and other agricultural uses of water. As distinct from what happens in Chile, the concentration of

/authority on

authority on the control of water rights is made into effective administrative centralization through the Higher Water Council (Consejo Superior de Aguas) responsible for the overall policy of water resource administration. The council has as its members the Departments of Water, Industry, Electricity, Mining, Health and Sanitation Works. The relative weakness of the General-Directorate for Water Department compared to the better capitalized water user Departments is balanced by its presidency of the council. A somewhat similar organization of administration is to be found in Panama, but in Costa Rica it is the National Electricity Service (Servicio Nacional de Electricidad) that is responsible for the granting and registration of water rights, not the Ministry of Agriculture, and thus the electricity service is the primary water resource management institution.

There are four countries in Latin America -Cuba, Ecuador, Honduras and Mexico- where the administration of the water resource is both formally and practically centralized in one institution. As in the other groups into which administrative types have been divided, there are differences amongst these countries, but the important common feature is the centralization of the administration of the water resource. In Mexico, the only significant water use outside the direct control of the Water Resource Division (Secretaría de Recursos Hidráulicos (SARH)) of the Secretariat (i.e., Ministry) of Agriculture and Water Resources is hydroelectric power generation. Other uses, with some exceptions, are controlled by the different divisions of the Secretariat. Interestingly, perhaps, within the monolithic structure of the Secretariat there is considerable decentralization of operating authority to river basin commissions. The authority of the Secretariat is enhanced by the fact that in Mexico, as distinct from the other Federal countries of the region, the Federal Government possesses authority and jurisdiction over almost all waters.

3. River basin authorities

Latin America has had relatively wide and varied experience with river basin authorities. It is in Mexico, as has been mentioned, that within the centralized system, the river basin agency approach to water administration has been most highly developed, and such agencies have extensive authority in six of the most important basins in the country. Recently, however, the creation of regional water agencies (Organizaciones Regionales del Agua) has been proposed. These are not defined on the basis of individual river basins, and their creation would imply a substantial decentralization of the authority of SARH. They would comprise councils on which local as well as federal interests would be represented. The only other country in which river basin agencies have been used on any appreciable scale as administrative devices is Colombia, which has five agencies for the most intensively used rivers; the oldest of these are the Autonomous Corporation for the Cauca Valley (Corporación Autónoma del Valle del Cauca) centred on Cali, and the Regional Corporation for the Sabana of Bogotá and the Ubaté and Chiquinquirá Valleys (Corporación Autónoma Regional de la Sabana de Bogotá y de los Valles de Ubaté y Chiquinquirá (CAR)), centred on Bogotá.

/These are

These are the most highly developed river basin institutions in the region. CAR, for example, is a decentralized agency whose jurisdiction includes the authority to plan and develop the water resource and to operate and maintain the required works to achieve such development. It is likewise the executing agency for the Colombian environmental code within its areas of jurisdiction. Similar powers are possessed by the corporations of the Cauca, Sinú, and Medellín Valleys.

Brazil, Argentina and Uruguay have made only limited use of the river basin authorities. One interesting case is that of the Corporation for the Development of the São Francisco Valley (CODEVASF) in Brazil. The São Francisco river is the major river of north-eastern Brazil, with a basin covering more than 640 000 square kilometres distributed among five states, Minas Gerais, Bahía, Pernambuco, Sergipe and Alagoa. The São Francisco valley project was created as an integrated plan for the economic development of the valley, based on the model of the Tennessee Valley in the United States. One of the focal points of the plan was "water control", which meant the regulation of the São Francisco river for navigation, irrigation and the generation of electricity. Despite the initial integrated approach to the development of the resource, the results have been remarkably single-purpose, restricted largely to the construction of the Sobradinho dam and related hydro-electricity facilities. The influence of CODEVASF over other uses has continuously run into the problem of State and federal institutional constraints which have still not been satisfactorily resolved.

4. Changes in administrative systems since the United Nations Water Conference

The sections on water legislation and administration summarize the prevailing situation, including changes made in the years since the United Nations Water Conference. A clearer impression of the changes that have occurred can be gained from the replies to a recent United Nations questionnaire.18/

In general, few countries have changed their administrative structures since 1977 (see table 18). Where change has occurred there has been a movement towards greater co-ordination among the central and regional or State governments and even a slight tendency towards the strengthening of river basin commissions in a minority of countries. It is interesting to notice the variety of co-ordinating mechanisms that have been created. It is also noteworthy that change is more prevalent in the larger countries of South America than in the smaller countries of Central America and the Caribbean.

5. Multipurpose water use management

Increasing urban demand for use of the water resource, for water supply on the one hand and waste transport on the other, for expansion of irrigated agriculture, and for the spread of water-based recreation as improved transport for access reaches larger numbers of the population, have all played their part in heightening the complexity of water management in Latin America. The extension of management practice to take account of the environmental dimensions of water resource development decisions is only one amongst many new challenges facing water management.

/Table 18

Table 18

SELECTED REPLIES TO UNITED NATIONS QUESTIONNAIRE

(Number of countries indicating change a/)

Question 1

Please indicate whether changes have been planned or implemented since the United Nations Water Conference in your country's institutional structure for co-ordinating water resources activities?

	South America and Mexico	Central America and Caribbean	English speaking Caribbean	Total
Changes in central co-ordination				
national government	5	1	0	6
regional or State governments	6	1	0	6
river basin	3	0	0	3

Question 2

If the answer to 1 is affirmative, does the change or plan provide for an institutional structure at the national level for co-ordination among some or all of the bodies that have responsibilities for water resources matters?

Co-ordination among all institutions	4	1	0	5
Co-ordination among some institutions	1	0	0	1

Question 3

If there is no central co-ordinating machinery (at the national level) at the present time, are the water-related interests dealt with in the context of the national development planning process?

Through the planning institutions	3	1	0	4
Through an inter-Ministerial Committee	3	1	1	5
By Ministries acting individually	3	2	1	6

a/ Not all countries replying to the questionnaire replied to all questions.

/It is

It is undeniably the case that water management techniques and institutions have been modernized in many countries of the region. Great strides have been made in improving data collection concerning all aspects of the water environment. In particular the modelling of flow régimes using computer techniques is becoming routine; and increasing concern is being shown as to the ecological consequences of water management decisions. More tentatively, water demand is being seen as subject to management. Despite these and other management technology innovations, however, water management remains generally single use-oriented and integration is an exception.

For example, less than 20% of the reservoir capacity behind large dams constructed or under construction in the last decade can be classified as multi-purpose. Similarly, basin-wide water management programmes, even when undertaken, have a tendency to break down into a series of individual projects which may be efficiently managed in themselves. Comprehensive regional development related to water resource projects, although agreed upon as a laudable objective, has still to be effected on more than an experimental scale. Significantly, perhaps, at a recent seminar organized by ECLA, the majority of the projects represented were in practice multipurpose and involved in regional development although many were originally conceived as single-purpose projects managed by sectoral agencies, such as electricity companies or irrigation departments, or specific agencies set up for the project, for example the Technical Mixed Commission formed to manage the Argentinean-Uruguayan project at Salto Grande.

Reasons for the persistence of use-oriented or single-purpose management are manifold and vary from country to country. There do exist, however, some underlying general conditions: i) the high degree of centralization of decision-making authority in the Latin American and Caribbean government traditions; ii) the physical configuration of the region giving rise to short watercourses; iii) the relatively simple water-demand patterns prevalent until recently; and iv) the general absence of regional integration which might lead to the development of international basin management agencies.

It is undoubtedly the high degree of centralization of decision-making authority which has done most to obstruct the emergence of integrated river basin management. Centralization militates against the successful establishment of decentralized or regional institutions of any kind. The absence of a decentralized government has aided the maintenance of strong single-purpose management institutions responsible for irrigation, hydroelectricity, and water supply.

The domination of these single-purpose institutions has contributed to a very disparate water management situation in the region. In general, there is a lack of homogeneity in water management practice. It is not surprising, therefore, to find that incorporation of particular considerations in the water management decision-making process is similarly heterogeneous. For example, a typical situation is to find the water management agencies somewhat side-stepped in the environmental management process. Consequently, environmental considerations tend to be imposed on the water resource management process from outside by the international banks, by Ministries of Health, or in the form of general codes of environmental conduct.

/In terms

In terms of management action, the prevalent situation can be described as characterized by the use of single-purpose and single-means strategies with isolated occurrences of both multi-purpose and multi-means approaches. In most countries, one or more individual government agencies -sometimes Ministries, as in Mexico, but more commonly autonomous institutions such as Agua y Energía in Argentina, ENDESA in Chile and the regional corporations in Venezuela- dominate the water resource management system. Thus there is an emphasis on the construction of individual water use-development projects. Machinery to resolve conflicts at the river basin level is rare. In water resources, as in most activities, integration and resolutions of conflict tend to occur at only the highest, most centralized, decision-making level.

As has been discussed, this is despite the fact that, in Latin America, there has been a relatively wide and varied experience in attempts to establish river basin authorities directed towards multiple-use management at the river basin level.

The Colombian river valley corporations could serve as a model for the region. However, such a degree of devolution of authority is unusual. Multi-purpose management is undeniably creeping into water management at the level of national plans but a large gap still exists between the national plan and practical management. The real power over the resource remains with the user institutions, particularly as regards energy and to a lesser extent irrigation.

Chapter 5

NATURAL HAZARDS

A natural hazard can be viewed as an extreme event which has repercussions on man and the environment, causing physical, ecological, social and economic damage. Natural hazards may be of geophysical or metereological origin but it is the latter which are of significance to water resource management. Many areas of Latin America and the Caribbean are prone to natural hazards arising from extreme events related to the water resource. Unfortunately, however, the regional impact of natural disasters is not known; but three of the four main natural hazards, drought, floods and tropical cyclones, are both water-related and of frequent occurrence in Latin America. The other main hazard, earthquakes, is also frequent in the region, but outside the focus of this report.19/

The three main water resource-related hazards, together with six minor water-related hazards, accounted for 30% of all deaths from natural hazard disasters in Latin America for the only period in which statistics are available, 1947-1973 (see table 19). There are, however, considerable differences in the relative seriousness of water-related natural hazards, and in the type of hazards prevalent, between the two major components of the Latin American region: Central America and the Caribbean, and South America. In the former, half the total disaster deaths, equal to half the deaths due to water resource-related hazards in the region as a whole, are caused by typhoons, hurricanes and cyclones, while in South America the largest number of such deaths is due to avalanches, a relatively minor hazard on the global scale.

A. The distribution of natural hazards

Many areas of Latin America and the Caribbean are prone to natural hazards arising from excess or shortage of water. There are large areas of the region which suffer from acute shortage of water and others which regularly suffer from excess in the form either of floods or of tropical storms.

1. Drought

Drought is the failure of rain to fall for extended periods, creating water deficiency, and it is possibly the most insidious of natural hazards. It tends to develop slowly and in terms of its impact on human society it is difficult to define. The hazard of drought cannot be expressed in meteorological or hydrological terms. It depends upon the particular coincidence of human and natural conditions.

The main causes of drought, all of which are operative in Latin America, are:20/

i) widespread and persistent atmospheric subsidence, which results from the general circulation of the atmosphere. Such subsidence is created in sub-tropical latitudes, the major areas affected in Latin America being the north-east of Brazil, northern Chile and southern Peru, and northern Mexico;

/Table 19

Table 19

LOSS OF LIFE BY DISASTER TYPE, 1947-1973 a/

	Floods		Typhoons, cyclones and hurricanes		Thunderstorms and gales		Snowstorms		Landslides		Rainstorms		Avalanches		Tidal waves		All disasters b/	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage water related
Central America and the Caribbean	2 355	10.9	10 792	50.0	310	1.4	200	0.9	260	1.2	-	0	-	0	-	0	21 625	64.4
South America	3 471	7.3	-	0	60	0.1	-	0	912	1.9	130	0.3	3 840	8.1	-	0	47 338	17.7
Latin America	5 826	8.4	10 792	15.6	370	0.5	200	0.3	1 172	1.7	130	0.2	3 840	5.6	-	0	68 963	32.3

Source: Judith Dworkin, Global Trends in Natural Disasters, 1947-1973, Natural Hazard Research, Working Paper No. 126.

a/ Excluding droughts.
b/ Earthquakes, tornados, heat waves, cold waves, volcanoes, fog and sand and dust storms.

/(ii) localized

ii) localized subsidence induced by mountain barriers or other physiographic features. The area affected in Latin America is very restricted as the phenomenon tends to occur only in the middle latitudes. It is the cause of the aridity of much of southern Argentina;

iii) absence of rain-making disturbances, causing dry weather even in the areas of most air. This is a major contributory cause of the aridity of the Mediterranean summer, although persistent atmospheric subsidence plays a part. It gives rise to the long dry summer of Central Chile;

iv) absence of humid airstreams. Some minor areas of Latin America, north-eastern Argentina and neighbouring parts of Bolivia and Paraguay, for example, are quite remote from sources of humidity.

The resulting drought conditions may be divided into various water shortage situations. These have been defined as:

i) permanent drought, leading to desert surface conditions, in which there is no season of appreciable rainfall, as in the Atacama desert;

ii) Seasonal drought, in semi-arid areas or sub-humid climates with a short wet season;

iii) secular drought, in sub-humid regions in which drought occurs primarily in one sequence of years alternating with sets of years of adequate rainfall;

iv) contingent droughts, which may occur in most temperate and tropical regions in which water shortage occurs infrequently.21/

The following are the major regions of Latin America suffering from permanent drought: lower California, the north and north-east of Mexico, the Guajira region of Colombia, and a broad coastal strip on the Pacific Ocean extending from latitude 4° south in northern Peru to approximately latitude 28° south in Chile, which includes the Atacama desert, and vast areas of southern South America, including part of the Bolivian plateau, an extensive tract of the Chaco (Bolivia, Paraguay and Argentina), and the north-east, central-west and extreme south areas of Argentina (Patagonia) (see Map 6).

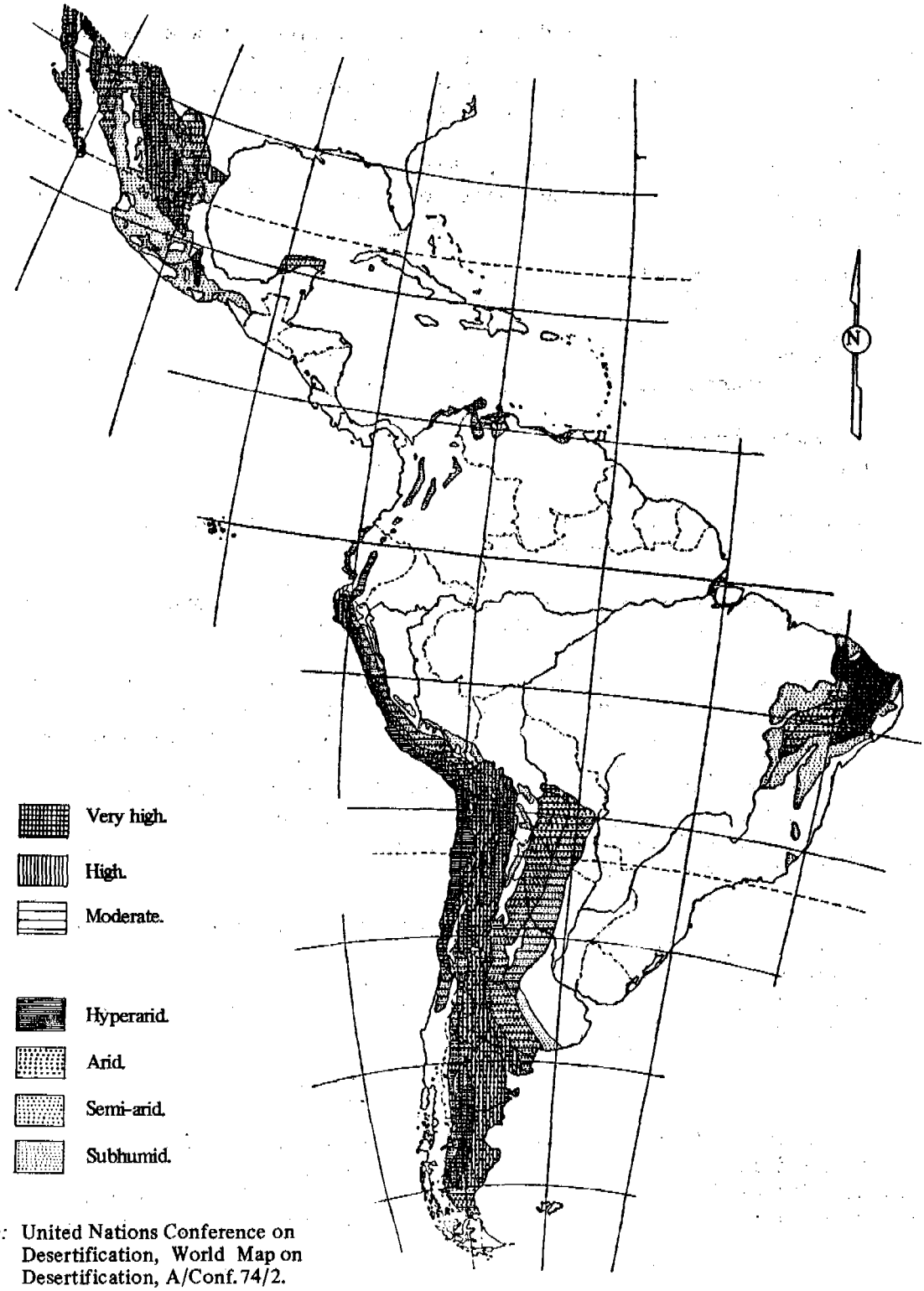
The damage caused by the drought hazard is more serious, however, in those regions where, because of wide variations in rainfall, there are recurrent secular droughts. The north-east of Brazil is the severest case in point. More than 25 million people are affected by droughts in a 5 to 7 year sequence; in this century there have been 15 years of drought.

2. Tropical cyclones

Tropical cyclones or hurricanes, as they are called in the Caribbean, are conventionally defined as circular storms with wind speeds in excess of 32 metres per second. The average duration or life span is from 6 to 9 days but may vary from a few hours to as much as 3 to 4 weeks. On average, eight tropical cyclones

/Map 6

Map 6
DESERTIFICATION IN LATIN AMERICA



Source: United Nations Conference on Desertification, World Map on Desertification, A/Conf.74/2.

/sweep yearly

sweep yearly over the Caribbean and adjacent areas of the Atlantic Ocean, as well as over the Pacific off Central America and Mexico. All the countries of the Caribbean, Central America and Mexico experience cyclones on a regular annual basis, particularly during the summer and autumn.

Cyclone storms are characterized by the centripetal spiralling of cloud bands and associated heavy or indeed torrential rainfall. Between the cloud bands, rainfall is comparatively light and at the outer circumference of the cyclone frequently ceases. The volume of rainfall associated with individual storms varies, but amounts of up to and over 500 millimetres are not uncommon; for example, in Honduras in 1982 600 millimetres fell in three days, and in Nicaragua the rainfall from the same storm reached as much as 860 millimetres.

The losses caused by tropical cyclones are due to three factors, wind, storm, surge and torrential rain. Although all three are potentially very damaging, by far the most destructive is the rainstorm-surge combination in coastal areas which gives rise to catastrophic flooding. The storm-surge is a rapid rise in the sea level produced by the hurricane winds and falling barometric pressure. The surge accompanying hurricane "Alberto" left more than 137 000 hectares of cultivated land flooded and affected by salinity, and the flood water rose to 1.5 metres in places.

3. Floods

Apart from tropical cyclons-related flooding, there are two main types of area subject to flooding in Latin America:

i) the lower valleys of the major rivers, where periodic flooding occurs, as in the flood plains of the middle course of the rivers Paraná and Paraguay in Argentina, Bolivia, Brazil and Paraguay, the lower reaches of the Magdalena in Colombia, the upper Orinoco plains of Venezuela, the valley of the River Guayas in Ecuador and the valley of the Beni in Bolivia;

ii) the lower reaches of other rivers, where flooding is associated with periods of high and intense rainfall. Such metereological events occur less regularly and frequently and give rise to a random pattern of flooding.

Floods in the large rivers are slow in developing; for example, the extent of the flood plains of the river Paraná and its major tributary, the river Paraguay, is so vast that there the flooding periods are very long. In the last twenty-five years, in no major flood in the river has the period between flood crest and flood peak been less than 15 days at Santa Fe, Argentina, and in most floods it has been closer to 30 days.

In contrast, the short rivers of the Pacific watershed exhibit typical "flash flood" régimes with very short crest-to-peak intervals, as in the flood of July 1982 in Santiago, Chile. Floods of this type, because they are sudden and fast, can be particularly dangerous and cause spectacular damage.

/The amount

The amount of damage attributable to floods bears a close relationship to the nature of the economic development of the flood plain. In certain situations, particularly some agricultural or pastoral uses, flooding of land may not only cause no damage but may be envisaged as a beneficial process. One example is afforded by the Apure flood plains around San Fernando, Venezuela, where major efforts have been made to retain floods so as to permit a longer growing season for natural pastures which support livestock production.

In areas of high density of human activity, particularly urban areas, but also in areas of intensive agriculture where crops cannot withstand prolonged submergence, damage from floods can range up to the catastrophic. Flood catastrophe is mainly associated with flash riverine flooding, extreme sea floods or flooding in normally arid zones, such as the northern coast of Peru.

The forms of damage involved in flooding include abrasion and load damage caused by the impact of flood waves and currents. The effects include washing away of structures and vegetation and soil erosion, drowning, the barrier to communication caused by the presence of the flood, pollution and deterioration and the spoiling of cultivated land through excessive sediment deposition.

B. Measures for the mitigation of natural disasters

The Winter of 1983 in the souther hemisphere of Latin America has been characterized by a series of severe floods which have affected Argentina, Bolivia, Brazil, Ecuador and Peru; only Chile and Uruguay, although suffering floods, have been spared serious flood-induced damage. Despite the extent and intensity of the damage, in most cases the impact has been considerably mitigated by the pre- and post-disaster measures taken in the different countries. Obviously, however, there is a significant difference between the types of measures required to reduce damage from floods, whether related to tropical cyclones or not, and those necessary to ameliorate the effects of the drought hazard.

In comparison with action in the case of floods, all the measures required to reduce drought hazard damage are at least relatively long term. Drought is a creeping hazard which if slow to arrive is also slow to disappear.

Undeniably, the area of Latin America where the impact of drought has been and continues to be most severe is northeastern Brazil. Without detracting from the significance of the disruption caused by drought elsewhere in the region or of measures taken in other countries to reduce the damage done, Brazil's experience provides the most outstanding example of efforts to palliate drought in Latin America.

The response in Brazil to the drought hazard in the north-east has been multi-faceted and long term. It has been based on specific intervention by the Federal Government through specialized institutions. The first institution, forerunner of the present Superintendencia do Desenvolvimento do Nordeste (SUDENE), was created during the drought of 1903 although special commissions had been established to advise on possible public action as from 1856.

/The range

The range of measures includes the setting-up of permanent emergency systems for food supply and employment, the large-scale development of irrigation, the establishment of an elaborate system of agricultural research, resettlement of population and a long-term development policy to reduce the region's dependence on drought-sensitive agriculture. Unfortunately, despite all the action that has been taken, the damage from the drought hazard continues to affect an area of more than one million square kilometres with a population of some 20 000 000.22/

In other countries of the region subject to periodic drought hazard efforts have been concentrated on attempts to improve the availability of water through storage or the tapping of groundwater. In addition, in many countries, the public authorities reserve the right within irrigation districts to control the use of water rationing and establish systems for times of scarcity. Specialized institutions like Brazil's have not been created, however, and responsibility for responding to the hazard in the short run lies with the Water Departments, for example in Chile or Peru, and in the long term with the institutions responsible for irrigation.

In attempting to mitigate flood damage, the countries of Latin America have adopted three types of response:

i) emergency measures, including the development of warning systems, evacuation of population, movable goods and livestock and construction of emergency flood barriers by sandbagging or temporary earth movement;

ii) control of flood flows by the construction of dams, or the inclusion of flood flow storage capacity in multipurpose dams, dykes and other engineering works;

iii) the regulation of land use in flood-prone areas, and other non-structural measures.

Emergency measures are usually undertaken by civil defence organizations in charge of response to all natural disasters. For example, in all the countries affected by flood disasters in recent years it was possible to channel assistance rapidly to the affected areas and to evacuate people and property. Such measures can significantly reduce damage in the case of slowly built-up floods such as those in Paraguay and Argentina in 1983, but rapid response in Santiago, Chile in 1982 to an unexpectedly severe flash flood prevented loss of life, and good organization in Cuba to some extent controlled the damage wrought by hurricane "Alberto".

Physical flood flow control measures are an effective response to floods of specific orders of magnitude and have been adopted in many river basins in Latin America to a limited extent. Nowhere in the region have flood protection works on the scale of those found in the Mississippi system been built, although large works are contemplated for the Paraná in Argentina. Such works consist in dykes or containing walls to control the river course and prevent overbank flooding; for example, many of the Pacific coast rivers of Peru have been dyked, the lower course of the Guayas in Ecuador was dyked in 1976 and the containing walls of the

/river Mapocho

river Mapocho in Santiago, Chile, are currently being extended into the upper suburbs of the city. The construction of flood control dams and reservoirs is not common.

Land use regulation as a flood damage mitigation recourse is applied in isolated cases within urban areas, but no national policies exist, although the adoption of controls has been proposed in Argentina. In Jamaica a project to produce a spatial analysis of natural hazards has been carried out, and in other Caribbean islands disaster-controllable areas have been identified so as to improve protection systems, most notably perhaps in Cuba, which has a national disaster plan prepared by the Office of Civil Defence.

In the Caribbean and Central America, regional activities to mitigate damage from water-related natural hazards include those of the Hurricane Committee, which, under the auspices of the World Meteorological Organization, co-ordinates national and international activities related to early hurricane warning and flood forecasting. In addition much concern and interest have been shown by governments in connection with defining comprehensive disaster-preparedness programmes both within individual countries and for the Caribbean region as a whole. Their endeavours have been assisted by the United States Government, which has established a Caribbean Disaster Information Exchange. In contrast, regional action in South America is limited to bilateral emergency assistance, although some co-ordination in flood forecasting is maintained by the countries of the Plate basin.

Chapter 6

EDUCATION AND TRAINING

The rapid economic growth of Latin America in the last decade was accompanied by a notable transfer of technology in many areas of economic activity. Activities related to water resource management have benefited considerably from this transfer; but these benefits have not spread equally to all water uses. Technological advances have been largely concentrated in areas of capital-intensive exploitation, such as electric power generation, large-scale irrigation and urban water supply and sanitation. In these areas, there has been much successful technological transfer which, together with the development of indigenous ability, has considerably augmented the capacity to resolve water-related development issues in three sectors in the region. To supply the demand generated for well-qualified professionals in the areas of technological progress a training system has been developed. As a result, there now exist in Latin America and the Caribbean as a whole groups of professionals and technicians qualified in many fields related to the development and management of water resources. However, there are still not enough of them and distribution between countries, areas of specialization and levels of training remain uneven.

A. The supply of skilled personnel

Four classes of skilled personnel or manpower required for water resources can be distinguished: engineers and scientists, higher technicians, technicians and skilled workers. In general, in Latin America facilities and methodologies for the education of engineers and scientists at the university level are widely available. Such personnel represented only 5 to 9% of the staff employed in the electricity, gas and water sector, i.e., the occupational grouping which most closely represents the manpower structure for water-related activities (see table 20). For the remaining 90% of manpower the situation is not so good, and even where training facilities exist, they do not always generate a flow of trained personnel to the water management institutions.

Undeniably, in the region as a whole, the best developed technical speciality for water management is civil engineering, particularly, those aspects of the discipline concerned with the design and preparation of projects for structural works in both hydrology and sanitary engineering. To take one example, in Chile, all the universities offer, on a regular basis, civil engineering courses in hydrology, hydraulics and water management. Unfortunately, the relative abundance of professional engineers in the region is not supported by other qualified staff.

There is a pronounced shortage of personnel at the level of intermediate technicians and skilled workmen. In the operation of irrigation works, in particular, the level of technical knowledge of operators is often far below that specified in the design of projects. In drinking water supply and sanitation, although much has been done through in-house training of technicians and operators,

/Table 20

Table 20

LATIN AMERICA SELECTED COUNTRIES: NUMBER OF PERSONNEL AND EMPLOYMENT STRUCTURE IN THE ELECTRICITY, GAS AND WATER SECTORS

Country and year	Total number	Percentage		
		Professional and technical	Administrative and clerical	Workers
Bolivia (1976)	2 143	8.6	25.9	65.5
Colombia (1973)	24 968	6.1	20.5	73.0
Chile (1979)	28 400	5.3	38.7	56.0
Dominican Republic (1970)	1 711	5.5	41.3	53.2
El Salvador (1979)	6 780	6.2	20.1	73.6
Guatemala (1979)	5 731	7.6	14.5	77.9
Panama (1979)	6 367	9.3	33.0	57.7
Uruguay (1975)	16 120	4.8	33.8	61.4
Venezuela (1979)	49 569	5.8	29.6	64.6

Source: International Labour Office, Yearbook of Labour Statistics, 1982.

/the lack

the lack of intermediate or sub-professional trained personnel is seen as one of the most severe constraints on the achievement of accelerated development of water supply and sanitation during the International Drinking Water Supply and Sanitation Decade.

Despite the recent increases in education and training for water supply and sanitation, the subsector best provided with qualified personnel is undoubtedly hydroelectricity generation, where because of the scale of the investment and the nature of the technology employed much emphasis has been placed on the preparation of qualified staff. Moreover, at least partly due to the commercial nature of the subsector's development through autonomous public corporations or private companies, salaries are higher and qualified staff tend to be both attracted and retained.

One positive development in the 1970s was the overall improvement in enrolment at all levels of education in nearly all the countries of Latin America (see table 21). This improvement has been particularly marked in post-secondary education (level three), but has also been remarkable at the secondary level. This has increased the base of educated people to whom specialized training can be given, and, with one or two exceptions the lack of people with secondary education, for example, should no longer be a constraint on the supply of technicians in the region.

B. The demand for qualified personnel

It has not proved possible to provide a complete evaluation of the education and training needs or even of the facilities existing in the region with respect to water resources. Education and training, and research and development, are carried out in a great variety of ways, ranging from specialized short courses to multi-year university education in innumerable institutions, some belonging to the general educational and research systems, such as universities or industrial training institutes, while other institutions are an integral part of the water management sector itself. For example, in almost all countries, the large institutions responsible for electrical generation, water supply and sanitation and irrigation all maintain in-house training schemes for all levels of personnel. In addition, in many countries there are specialized institutions dedicated to training water management personnel within Ministries or in the universities.

An idea of the scale of the system required for education and training can be gained from recent discussions of education and training requirements for accelerated development of the drinking water supply and sanitation subsector. In the discussion of the requirements for trained personnel it was estimated that to meet the current deficit and the new demands signified by the goals adopted under the IDWSSD for expansion of service, some 300 000 trained personnel would be needed. The majority of these -some 75%- would be at the lowest level of skills, but this is exactly where the existing training systems are weakest.23/

/Table 21

Table 21

LATIN AMERICA: GROSS ENROLMENT RATIOS AT DIFFERENT LEVELS OF EDUCATION

Country	First level		Second level		Third level	
	1970	1980	1970	1980	1970	1980
Argentina	106	112	45	56	14.2	22.7
Barbados	108	107	71	81	4.0	-
Bolivia	76	84	24	36	9.3	
Brazil (1979)	84(1971)	93	26	32(1978)	5.1	11.5(1978)
Colombia	108	128	25	46	4.8	10.8
Costa Rica	110	107	28	48	10.6	25.8
Cuba (1979)	121	112	22	71	3.6	19.5
Chile	107	117	39	55	9.4	11.9(1979)
Dominican Republic (1978)	95	102	20 0	32	6.3	10.3
Ecuador (1979)	97	107	22	40	7.9	34.6(1978) (1979)
El Salvador	85	74	22	23	3.3	8.4
Guatemala	57	69	8	16	3.4	9.2
Guyana (1979)	99	115	56	59	2.0	2.7
Haiti (1971, 1979)	53	64	-	12	-	0.9(1978)
Honduras (1978)	87	89	14	21	-	8.0
Jamaica (1979)	119	99	46	57	5.5	-
Mexico	104	120	22	37	5.9	14.6
Nicaragua	83	100	18	43	5.7	11.2(1979)
Panama	106	113	39	65	7.2	23.2
Paraguay (1979)	109	102	17	26	4.3	7.2(1978)
Peru (1979)	105	112	30	56	11.0	16.2(1977)
Suriname (1978)	131	103	43	49	1.3	3.1(1977)
Trinidad and Tobago	107	94(1977)	42	-	2.8	-
Uruguay	113 3	105	59	60	-	15.9
Venezuela (1979)	94	104	33	39	10.9	20.6

Source: UNESCO, Statistical Yearbook, 1982.

/Few countries

Few countries of the region have attempted assessments of total demand for the education and training of personnel to plan, contract for and operate water-related projects.

It has been estimated in Cuba, however, that during the 1980s it will be necessary to increase fourfold the number of persons currently working in the water sector; of these 17 000 would be university-trained staff and middle-level technicians. In the 1981 National Water Resources Plan of Mexico, it was estimated that some 1 000 professionals a year were required in the water resources field. Of these, half the demand would be for civil engineers and a quarter for agricultural engineers. Such an increase in numbers implies a percentage growth rate of 13% a year in the total number of professionals working in the sector, excluding those working in the area of hydroelectricity.

The planning of human resources for water management and use is growing in the region and specialized sector surveys have been undertaken, particularly in water supply and sanitation, but manpower projections have unfortunately generally proved unreliable. With the exception of isolated attempts, like those cited for Cuba and Mexico, no data exist in the region regarding manpower needs for water resource management as a whole.

Chapter 7

REGIONAL AND INTERNATIONAL CO-OPERATION

In the years since the Mar del Plata Conference, Latin America's long tradition of regional and international co-operation in the field of water resources has been continued and strengthened. For the first time, a permanent intergovernmental arrangement for co-operation has been established in the region: the Sessional Committee on Water of the Economic Commission for Latin America. A number of initiatives have been launched in horizontal co-operation both for the region as a whole and for different subregions. Similarly, co-operation in shared basins and international co-operation in investment have witnessed innovations.

A. The water resources of shared basins

Some 71% of the total surface flow of the Latin American region is derived from shared basins, which cover 55% of the total area of the region. In South America international basins provide 75% of the total flow and in Mexico and Central America, 24%. There is only one major international basin in the Caribbean islands, the Artibonite, shared by the Dominican Republic and Haiti, and accounting for 17% of the total drainage of the island of Hispaniola (see table 22).

1. International agreements on shared water resources

International agreements on study and development of basin resources cover fifteen of the region's international river basins. In addition there are numerous bilateral agreements dealing with frontier waters or reaches and tributaries of continental river basins. These agreements vary, and include formal treaties, exchange of notes, joint declarations, memoranda of agreement and finally informal "actas" or summary records, which are the official minutes of meetings of the interested parties (see table 23).

For example, the Uruguay River, which forms for part of its length the boundary between Argentina and Brazil and for part of its length the boundary between Argentina and Uruguay, is covered by quite distinct types of agreements. First, there exists a general convention signed in 1960 among the three countries on the exploitation of the river for hydroelectricity generation. Secondly, a specific treaty was signed in May 1980 for the design, construction and operation of hydroelectric works, which Argentina and Brazil plan to build on the segment of river which forms the boundary between them; the treaty provides for the separate but simultaneous operation of the generation stations, but not for the creation of any agency. Finally, and in contrast, for the construction and operation of the Salto Grande hydroelectric project on the Argentina-Uruguay stretch of the river an international entity was created, in the shape of a joint technical commission (Comisión Técnica Mixta-CTM), under the treaty signed by the two countries in 1946, to build and operate the dam and related generating facilities.

The majority of agreements, like those on the Uruguay River, are bilateral, not only because multilateral agreements are more difficult to negotiate, but also because in the region there are only 6 river basins shared by three or more

/Table 22

Table 22

LATIN AMERICA AND THE CARIBBEAN: HYDROLOGICAL CHARACTERISTICS OF THE MAIN SHARED BASINS

Basin	Watershed	Countries involved	Area km2 a/	Average flow at outlet (m3/sec) a/
Grande or Bravo	Atlantic	Mexico and United States	238 600b/	150b/
Tijuana	Pacific	Mexico and United States	3 200	1
Concepción	Pacific	Mexico and United States	26 635	10
Yaqui	Pacific	Mexico and United States	50 000b/	110b/
Colorado	Pacific	Mexico and United States	5 300b/	60b/
Hondo-Azul	Atlantic	Mexico and Guatemala	33 500	280
Candelaria	Atlantic	Mexico and Guatemala		
Usumacinta-Grijalva	Atlantic	Mexico and Guatemala	137 310	3 300
Suchiate	Pacific	Mexico and Guatemala	1 410	80
Coatán-Achute	Pacific	Mexico and Guatemala	1 437	45
Lempa	Pacific	Guatemala, Honduras and El Salvador	17 423	380
Paz	Pacific	Guatemala and El Salvador	2 362	50
Motagua	Atlantic	Guatemala and Honduras	16 601	250
Goascorán	Pacific	El Salvador and Honduras	2 428	36
Coco or Segovia	Atlantic	Honduras and Nicaragua	26 549	950
Choluteca	Pacific	Honduras and Nicaragua	8 214	75
Negro	Pacific	Honduras and Nicaragua	3 039	50
San Juan	Atlantic	Nicaragua and Costa Rica	38 904	1 614
Sixaola	Atlantic	Costa Rica and Panama	2 930	180
Changuinola	Atlantic	Costa Rica and Panama	3 135	190
Juradó	Pacific	Panama and Colombia	250c/	10
Total Mexico and Central America			619 227	7 821
Artibonite	Atlantic	Haiti and Dominican Republic	9 320	240
Total Caribbean			9 320	240
Juradó	Pacific	Colombia and Panama	850d/	30
Catatumbo	Atlantic	Colombia and Venezuela	30 956	350
Orinoco	Atlantic	Colombia and Venezuela	982 000	33 000
Essequibo	Atlantic	Venezuela and Guyana	155 000	5 000
Amacuro	Atlantic	Venezuela and Guyana	12 400	300
Barima	Atlantic	Venezuela and Guyana		
Courantyne	Atlantic	Guyana and Suriname	78 590	2 300
Maroni	Atlantic	Suriname and French Guiana	68 990	2 500
Oiapoque	Atlantic	French Guiana and Brazil	31 100	1 000
Amazon	Atlantic	Brazil, Colombia, Ecuador, Peru, Venezuela, Bolivia, Guyana and Suriname	6 059 100	180 000

/Table 22 (cont.)

Table 22 (concl.)

Basin	Watershed	Countries involved	Area km2 a/	Average flow at outlet (m3/sec) a/
Patía	Pacific	Colombia and Ecuador	22 500	
Mira	Pacific	Colombia and Ecuador	11 000	500
Zarumilla	Pacific	Ecuador and Peru	1 000	35
Tumbes-Puyango	Pacific	Ecuador and Peru	5 645	150
Chira-Catamayo	Pacific	Ecuador and Peru	17 150	110
Lagos Titicaca and Poopó	Interior	Peru, Bolivia and Chile	138 400	212
Laguna Blanca	Interior	Perú and Chile		
Zapaleri	Interior	Chile, Bolivia and Argentina		
Cancosa	Interior	Bolivia and Chile		
Todos los Santos	Interior			
Cauca	Interior			
Cosapilla	Interior			
River Plate	Atlantic	Bolivia, Brazil, Argentina, Paraguay and Uruguay	3 092 000	22 000
Laguna Merín	Atlantic	Brazil and Uruguay	60 650	450
Calle Calle-Hua Hum	Pacific	Chile and Argentina		
Puelo-Manso	Pacific			
Yelcho-Futaleufú	Pacific			
Palena-Carrenleufú	Pacific			
Pico				
Aysen-Simpson	Pacific			
Baker-Lakes Buenos Aires-Pueyrredón	Pacific		106 320	3 700
Pascua-Lakes San Martín-Mayer	Pacific			
Serrano-Vizcachas-Don Guillermo	Pacific			
Penitente	Río Gallegos			
Zurdo			3 818	12
Ciake-Chico	(Atlantic)			
Cullen	Atlantic			
San Martín	Atlantic		15 800	80
Chico	Atlantic			
Grande	Atlantic			
Lago Fagnano	Pacific		4 062	20
Total South America			10 874 831	251 714
Total Latin America			11 503 378	259 775
Percentage of total			56.0	71.0

Note: The geographical names used above do not imply any opinion on the demarcation of frontiers or borders on the part of the United Nations Secretariat.

a/ Both the areas and the average flow are estimated.
b/ Refers only to the area in Mexico.
c/ The area in Panama.
d/ The area in Colombia.

/Table 23

Table 23

LATIN AMERICA AND THE CARIBBEAN: TREATIES AND AGREEMENTS ON THE USE OF SHARED WATER RESOURCES

Basin	River	Signatory countries	Year signed
Colorado	Colorado	Mexico-United States	1966-1970
Río Grande	Grande	Mexico-United States	1906-1933
	Chamizal	Mexico-United States s	1963
Lake Güija	Lake Güija	El Salvador-Guatemala	1957
San Juan	San Juan	Costa Rica-Nicaragua	1888
Artibonite	Artibonite	Haiti-Dominican Republic	1929 a/
Catatumbo	Catatumbo and Zulia	Colombia-Venezuela	1903
Amazonas	Tacutú	Brazil-United Kingdom (Guyana)	1940
Amazon basin as a whole		Bolivia-Brazil-Colombia-Ecuador-Guyana-Peru-Suriname-Venezuela	1978 d/b/
Maroni	Maroni	France-Netherlands (Suriname)	1915
Zarumilla	Zarumilla	Ecuador-Peru	1944
Tumbes	Puyango	Ecuador-Peru	1971 b/c/
Chira	Catamayo	Ecuador-Peru	1971 b/c/
River Plate	River Plate	Argentina-Uruguay	1910
	Uruguay	Argentina-Uruguay	1938
	Pilcomayo	Argentina-Paraguay	1939
		Argentina-Bolivia-Paraguay	1941
		Argentina-Paraguay	1945
	Uruguay	Argentina-Uruguay	1946
	Acaray	Brazil-Paraguay	1956
	Paraná	Argentina-Paraguay	1958
	Uruguay	Argentina-Uruguay	1961
	Uruguay	Argentina-Uruguay	1968 c/d/
	Paraguay	Argentina-Paraguay	1969 c/d/
	River Plate	Argentina-Bolivia-Brazil-Paraguay and Uruguay	1969-1971 c/d/
	Paraná	Argentina-Paraguay	1971
La Plata	Pilcomayo	Argentina-Bolivia-Paraguay	1972
	La Plata	Argentina-Uruguay	1973
	Paraná	Argentina-Paraguay	1974
	Uruguay	Argentina-Uruguay	1975
	Paraná	Brazil-Paraguay	1975
Mchusuma	Mchusuma, Mauri and Azucarero canals	Chile-Peru	1929

/Table 23 (concl.)

Table 23 (concl.)

Basin	River	Signatory countries	Year signed
Lake Titicaca	Lake Titicaca	Bolivia-Peru	1935
	Lake Titicaca	Bolivia-Peru	1955
	Lake Titicaca	Bolivia-Peru	1957

Source: United Nations, "Legal problems relating to the utilization and use of international rivers", Document A/5409, April 1963.

Note: Reference is also made to international rivers in the Declaration of Montevideo, in resolution LXXII of the Seventh American International Conference in 1933 which was signed by all the countries composing what was then called the Pan-American Union with the exception of the United States, Mexico and Venezuela.

a/ National report of the Dominican Republic prepared for the United Nations Water Conference.

b/ IDB, Derecho de la Integración, Vol. XI, November 1978, pp. 28-29.

c/ National report of Peru prepared for the United Nations Water Conference.

d/ United Nations, United Nations Treaty Series, No. 671, 1969 and No. 709, 1970.

/countries. In

countries. In addition, of these only the Amazon (shared by 7 countries) and the River Plate (shared by 5 countries) are of significant importance. Most bilateral agreements are concerned with the delimitation of the courses and form of rivers and lakes which mark political boundaries between nations, or with questions of free navigation. Agreements dealing with irrigation, hydropower and integrated or multipurpose river basin research and development are perhaps more of a novelty, and, with the exception of those between Mexico and the United States, date from the second half of this century.

The levels of co-operation and the degree of institutionalization vary widely. Agreements are in general limited to exchange of information and preliminary research and joint studies. Usually, a joint (or mixed) commission is created, with equal representation of technical personnel from each nation. Examples of this type of agreement are many. Among the most important are those between Brazil and Uruguay on the Quarai and Mirim Lagoon, the one already mentioned between Argentina and Uruguay on the Uruguay River, and another between Peru and Ecuador for the use of the resources of the Puyango-Tumbes and Catamayo-Chira basins.

The agreement for the use of the Puyango-Tumbes and Catamayo-Chira basins was signed in September 1971. It provides for the joint exploitation of the two basins for multipurpose use but concentrating on irrigation. The necessary studies for the design of projects to develop the basins were to be jointly financed and undertaken. In addition, the joint Ecuador-Peru Commission, through the respective national sub-commissions, has power to co-ordinate water-related activities carried out by the different national institutions in the basins. The Commission also has jurisdiction over related resources, land, flora, fauna and the environment. As a result of the studies completed, Ecuador and Peru submitted a joint application for assistance to the Inter-American Development Bank.

There are several other examples of agreements which contemplate, in addition to joint studies, the formulation of joint projects. An example is the agreement between Bolivia and Peru on Lake Titicaca. Several recent agreements also include joint construction and operation of projects. This is the case, for instance, with the agreements between Brazil and Paraguay on the Itaipú hydropower development, and between Argentina and Paraguay for the Yacyretá and Corpus hydropower development, all on the Paraná river. A higher level of co-operation demands also a higher level of institutionalization. In these cases of joint construction and operation projects, binational enterprises were created which have decision-making powers greater than those of mixed commissions.

An analysis of existing agreements reveals that there is a general reluctance on the part of national governments to delegate power to an international body over which they do not have full control. In general mixed commissions and other institutional entities are given authority to decide only on strictly technical matters. Differences of opinion which cannot be solved by consensus within such entities are settled through traditional diplomatic procedures.

/2. Multilateral

2. Multilateral agreements

The only working multilateral agreements are those on the River Plate basin. In the 14 years of operation since the 1969 treaty was signed, the most important achievements of these agreements have been: i) comprehensive knowledge of the water and other natural resources of the basin which represents a considerable improvement over pre-existing knowledge; ii) various agreements on questions of principle, for example, it was resolved that bilateral agreements must precede development of all reaches of those rivers of the basin that form international boundaries, while in th case of successive international rivers, each country may use the water within its territory as long as no significant injury is inflicted on the other riparians through changes in the quantity or quality of the flow; iii) as a basis for integration and co-ordination of policies and programmes within the basin, comparative legal and administrative studies have been undertaken; iv) the concept of the basin as a geographic and economic unit has been stressed and studies have been carried out on measures to improve navigation, interconnection or road, rail and electricity networks, co-ordinated radio broadcasting regulations, and communications in general. Many initiatives have not, however, gone beyond the stage of preliminary research. Practically all implementation projects have been the result of bilateral agreements. The progress made can be attributed to a great extent to the atmosphere of inter-country co-operation which has been reaffirmed by the meetings of the Foreign Ministers of the countries sharing the River Plate basin.

One of the major achievements has been the establishment of the Plate Basin Financial Fund in 1977, with resources of US$ 100 000 000 drawn from the five signatory countries. The fund has been active since its initiation in financing studies and design of various integration projects.

In the River Plate basin other multilateral agreements have been reached which to a great extent are also the result of this spirit of co-operation: for example, the agreement between Bolivia, Paraguay and Argentina on research and development in respect of the Pilcomayo river.

The more recent "Amazon pact" was signed by the Foreign Ministers of Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela on 4 July 1978. The "Amazon pact" has wider and more numerous objectives than the agreements on the River Plate. In particular, the pact refers to co-ordination of action among the signatory governments in many areas of development, not just in relation to the water resource. Institutionally, however, the Amazon treaty is less defined so far, lacking a permanent secretariat or working groups on particular topics, such as exist under the River Plate agreements.

On many occasions the notion of a continental convention on international rivers has been discussed. The idea of establishing principles for the development and use of international rivers in Latin America can be traced to some of the early meetings of the Inter-American system. The Seventh Inter-American Conference, held in Montevideo in 1933, adopted a 10-point declaration on the industrial and agricultural use of water resources.24/ The principles established in this declaration were not binding; nevertheless, they have not only inspired other attempts at regional conventions but have been taken as a basis for many bilateral

/and multilateral

and multilateral agreements among Latin American countries. With a view to perfecting the 1933 declaration the Second Special Conference of American States, held in Rio de Janeiro in 1965, decided to convene a specialized conference to formulate recommendations and standards for the exploitation of international rivers and lakes. However, the conference was not held.

Existing conventions or draft conventions will certainly continue to serve as valuable guidelines for the conduct of States. To a great extent, the same could be said of global conventions such as the principles adopted by the Stockholm Conference on the Human Environment, the Mar del Plata Conference on Water and other international instruments or recommendations for the exploitation of shared water resources.

B. Multilateral loans for investment in water-related projects

Whatever strategy is adopted for the development and management of water resources, putting it into effect entails investment. The international banks, despite the changes in the international lending situation in the last decade, remain a major source of funds for water resource development.

In the period between 1971 and 1982 the International Bank for Reconstruction and Development (IBRD) and the Inter-American Development Bank (IDB) made loans for projects related to water resource development of some US$ 8.7 billion, expressed in constant 1975 dollars.25/ From year to year there have been considerable fluctuations in the amounts of loans issued and changes in the proportion of the loans allocated to the different water-using sectors (see figure 5). After 1977 there was a discontinuous but sustained increase in loans related to water resources, but this fell off considerably in 1982. Much of the increase could be attributed to increased loans for water supply and sanitation, particularly in 1980.

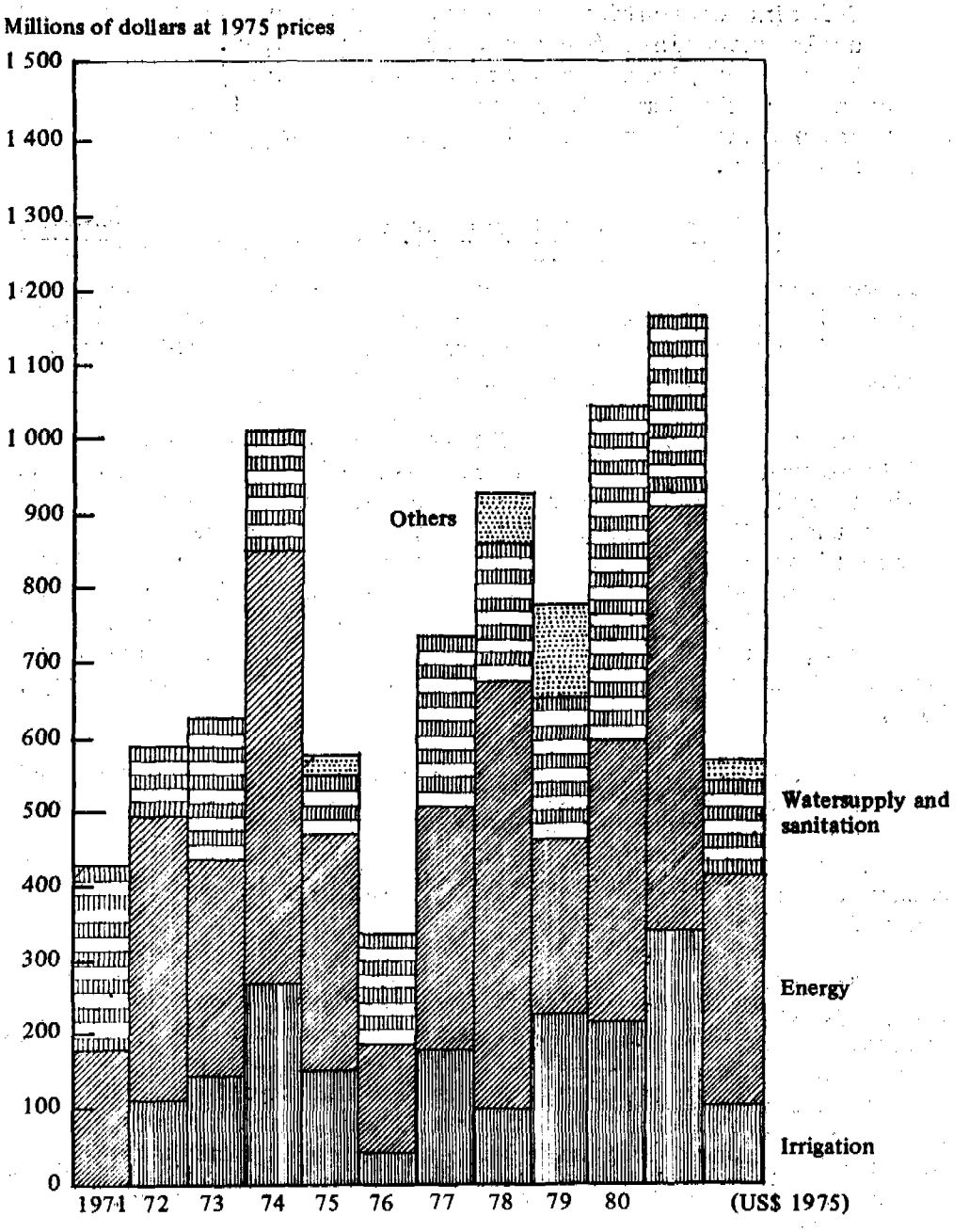
As can be expected, the pattern of loans is concentrated geographically both by country and, perhaps more interestingly from the viewpoint of water management, by river basin. In the period reviewed almost three-quarters of the loans were made to just three countries: Brazil, Mexico and Colombia. Of the remaining countries of the region only two received as much as 5% of the total loans: Argentina and Honduras.

The distribution of loans by river basin, on the basis of the location of the projects financed, is less unequal, although there is still a heavy concentration in a few basins. The river basins with most projects financed by loans from the international banks are the Caribbean, the Plate, the Tropical Pacific Basins of South and Central America and the Gulf of Mexico (see figure 6). There are a number of basins with no projects financed by loans from the international banks. These tend, however, to be either unpopulated or in Venezuela, which has not received loans in recent years.

/Figure 5

Figure 5

LATIN AMERICA: LOANS FROM IBRD AND IBD FOR WATER-RELATED PROJECTS, DISTRIBUTION BY SECTOR, 1971-1982

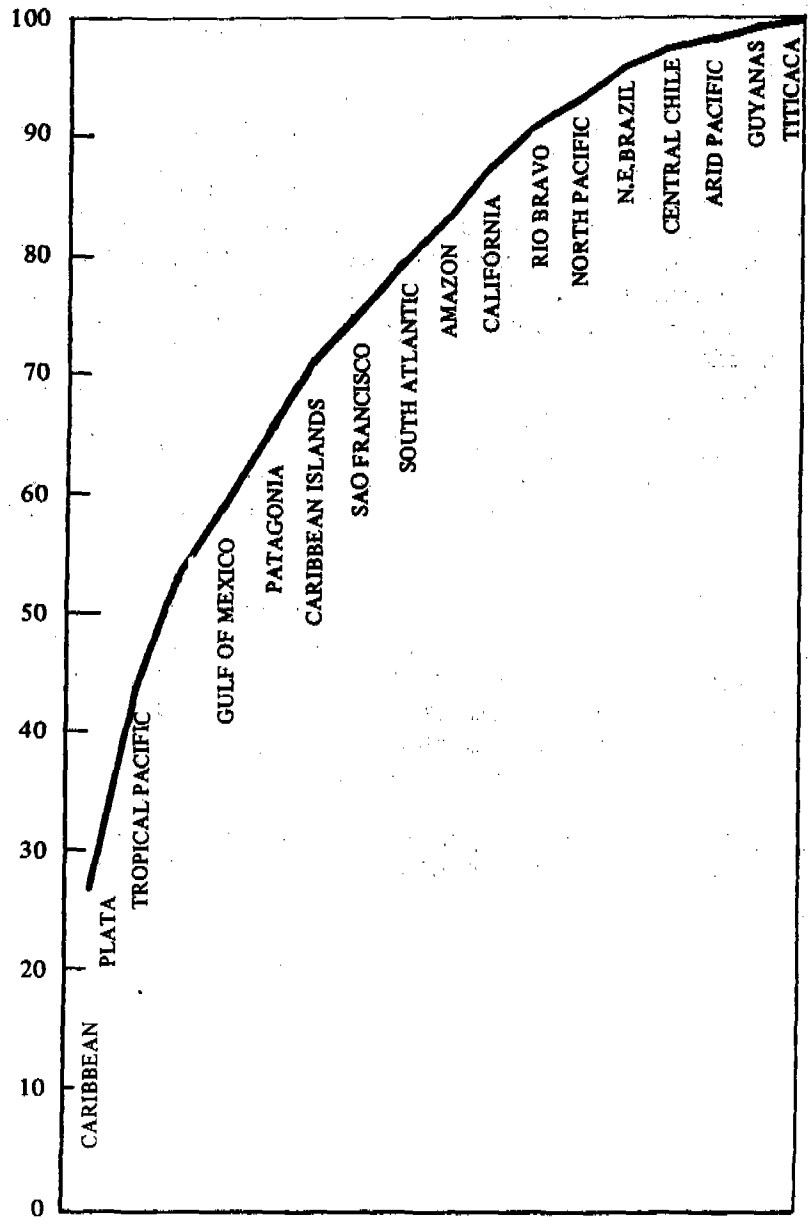


Source: IBRD and IBD Annual Reports.

/Table 6

Figure 6

CUMULATIVE PERCENTAGE DISTRIBUTION OF INTERNATIONAL BANKLOANS, FOR WATER-RELATED PROJECTS, BY RIVER BASIN, 1971-1982



/C. Activities

C. Activities of international agencies

Fifteen different organizations of the United Nations and three organizations belonging to the Inter-American system, as well as the international banks, have water-related activities in Latin America. The involvement of these organizations in the water resource-related development of the region is complex and in many countries of the region continues to grow. The emphasis of these activities is on technical co-operation for pre-investment studies which account for approximately 90% of total expenditure.

Types of action vary considerably from organization to organization, both in the areas of interest and in the kind of activities undertaken. Some organizations are eminently specialized: for example, the International Atomic Energy Agency, whose water-related activities are limited to isotype hydrology, and the United Nations Children's Fund, which concentrates its activities in water supply and sanitation for the rural poor. In contrast, other organizations, such as the Economic Commission for Latin America and the United Nations Department of Technical Co-operation for Development, cover the whole range of water-related activities, although the latter mainly specializes in groundwater studies. Similarly, there are considerable variations in size, from very large organizations with many field staff, like the Food and Agriculture Organization and the Pan American Health Organization, to small one-man units such as the UNESCO Regional Office, although its work is supplemented by programmes directed from UNESCO headquarters.

The actual involvement of the organizations of the United Nations system in different areas of water resource development is presented in table 24. The first column shows the different management and use areas, the second the organizations with the main concern or responsibility for the area and the last column those organizations with some interest in the area, for instance, in the specific context of their main area of interest or in co-operating with other organizations.

A more detailed list of the programmes and projects of a selected group of international organizations both within and outside the United Nations system is presented in annex 1.

/Table 24

Table 24

LATIN AMERICA AND THE CARIBBEAN: INVOLVEMENT OF ORGANIZATIONS OF THE UNITED NATIONS SYSTEM IN WATER RESOURCES DEVELOPMENT

Use and management areas	Organization(s) with main concern	Organization(s) with interest in some aspects of area
A. MANAGEMENT FUNCTIONS		
1. Water planning, policy legislation and administration (including river basin development planning)	UN/TCD, FAO, UNDP, WB, ECLA	UNESCO, WMO, WHO, UNEP, UNICEF, UNIDO, ILO, IAEA
2. Water resources assessment (collection, processing, storage and dissemination of surface and ground water data), including the Application of Remote Sensing and Isotope Techniques	WMO, UNESCO, IAEA	UN/TCD, FAO, WHO, UNDP, WB, ECLA
3. Education and training	UNESCO, FAO, ILO	UNDP, WHO, WB, UNEP, UN/TCD, WMO, UNICEF, ECLA, UNIDO, IAEA, UNCHS
4. Water and human environment. Water quality management and pollution control	UNEP	All others
5. Flood control (flood loss management)	UNDRO, WMO	UNDP, WB, FAO, UNESCO, UN/TCD
6. Drought management (desertification control)	UNEP, FAO	UN/TCD, ECLA, UNESCO, WMO, UNDP, WB, WFP, IFAD
7. Technical co-operation among developing countries (TCDC)	UNDP	All others
B. DEVELOPMENT AND USE FOR SECTORAL PURPOSES		
1. Agriculture and fisheries (irrigation and drainage; rainfed agriculture; fresh water fisheries; aquaculture	FAO, WB, WFP, IFAD	UNDP, UNESCO, WMO, ILO, UNDP, UNEP, UN/TCD, IAEA

/Table 24 (concl.)

Table 24 (concl.)

Use and management areas	Organization(s) with main concern	Organization(s) with interest in some aspects of area
2. Community water supply and sanitation	WHO, WB, UNICEF, UNDP, UNCHS	FAO, UN/TCD, ECLA, UNESCO, WMO
3. Groundwater resources exploration and development (including well-drilling)	UN/TCD, UNICEF, FAO, WHO, WB	ECLA, UNESCO, WMO, IAEA, UNCHS
4. Industrial water use	UNIDO	WB, UN/TCD, FAO, UNDP
5. Inland navigation	ECLA	WB, UNDP
6. Hydropower	WB, UNDP	FAO, WMO, UN/TCD

Source: United Nations, Intersecretariat Group for Water, The United Nations Organization and Water, 1983.

/Notes

Notes

1/ Recent examples include Colombia, Departamento Nacional de Planeación, Estudio del Sector de Energía Eléctrica, Vol. III. Inventario de los Recursos Hidroeléctricos, Bogotá, 1979; Ecuador, Instituto Ecuatoriano de Recursos Hidráulicos, Recursos Hidrológicos Superficiales de Ecuador (first assessment), Quito, 1979; Peru, Oficina Nacional de Evaluación de Recursos Naturales, Inventario y Evaluación Nacional de Aguas Superficiales, Lima, 1980.

2/ FAO, Production Yearbook, Vol. 35, 1981, Notes on the Tables, p. 3.

3/ OLADE, El potencial hidroeléctrico: Alternativa energética y desafío industrial y financiero para América Latina, February 1981.

4/ United Nations Economic Commission for Latin America, Water Management and Environment in Latin America, Pergamon Press, Oxford, 1979, p. 65.

5/ Intervention by man in natural processes cannot be restricted to the construction of physical works; this must be accompanied by other actions if the full benefit of such exercises in environmental management is to be reaped.

6/ ECLA, Report of the Regional Seminar on Environmental Management and Large Water Resource Projects, Concordia, Argentina, 30 September-2 October 1981 (E/CEPAL/L.262), Santiago, Chile.

7/ A PAHO study made ten years ago on patterns of childhood mortality demonstrated "that lack of water services has a direct relationship to excessive postneonatal mortality and is an important measure of unfavourable environmental conditions". See PAHO, "Patterns of mortality in childhood", Scientific Publication No. 262, Washington D.C., 1973, p. 134.

8/ World Bank, "Measuring levels of living in Latin America: An overview of main problems", in Living standards measurement study, Working Paper No. 3, October 1980.

9/ PAHO/WHO, Health Conditions in the Americas, 1961-1972, Washington D.C., 1974, p. 40.

10/ United Nations, Report of the United Nations Water Conference, Mar del Plata, 14-25 March 1977, New York, 1977, p. 30.

11/ Peru, Plan Nacional de Ordenamiento de los Recursos Hidráulicos, Lima, 1977, pp. V to VIII.

12/ Venezuela, Comisión de Planificación Nacional de Recursos Hidráulicos, Plan Nacional de Aprovechamiento de los Recursos Hidráulicos, Vol. I, El Plan, Caracas, 1972, p. 61.

13/ Chile, Ministry of Public Works, Riego y Drenaje en Chile, Santiago, 1980, p. 59.

14/ See the points included in paragraph 44 of the Report of the United Nations Water Conference, United Nations, 1977, pp. 30-31.

15/ Mexico, Comisión del Plan Nacional Hidráulico, Plan Nacional Hidráulico 1981, p. 94.

16/ Chile, Ministry of Public Works, Riego y Drenaje en Chile, Santiago, 1980, pp. 53-57.

17/ For detailed discussion of the nature of water régimes in the ECLA region, see United Nations, Abstraction and Use of Water. A comparison of legal régimes, ST/ECA/154, New York, 1972.

18/ United Nations, Questionnaire on Present Status of Water Resources Development: Progress and Prospects since the United Nations Water Conference, March 1980.

19/ These four natural hazards cause 90% of all loss of life and damage both to human society and to the environment. See UNEP, Review of the Priority Subject Area: Natural Disasters, Report of the Executive Director, 1977.

20/ Taken from UNEP, op.cit., p. 3.

21/ Based on the discussion in Kenneth Hewitt and Ian Burton, "The Hazardousness of a Place", University of Toronto, Department of Geography, Research Publication No. 6, 1971, pp. 98-99.

22/ An excellent review of the drought hazard and the response of Brazil is to be found in Brazil, Ministry of the Interior, Superintendencia do Desenvolvimento do Nordeste, Departamento do Recursos Naturais, As Secas do Nordeste, Recife, 1981.

23/ Pan American Health Organization, Regional Symposium on Human Resources for the International Drinking Water Supply and Sanitation Decade, Panama, July 1982.

24/ Resolution LXXII of the Seventh Inter-American Conference held in Montevideo in 1933.

25/ The amounts of loans stated in the annual reports of the respective banks have been inflated/deflated by the United States Capital Equipment Price Index.

Annex 1

ACTIVITIES OF INTERNATIONAL ORGANIZATIONS IN THE FIELD
OF WATER RESOURCES IN LATIN AMERICA

Table 1

ADMINISTRATIVE SPHERE AND HYDROGRAPHIC SPHERE OF ACTIVITY

ACRONYM of INTERNATIONAL ORGANIZATION Reporting	TITLE of ACTIVITY and / or PROJECT	ADMINISTRATIVE SPHERE		HYDROGRAPHIC SPHERE	
		NAME OF ADMINISTRATIVE DIVISION Major	NAME OF ADMINISTRATIVE DIVISION Minor	BASIN(S)	WATER BODY (River, lake, etc.)
ECLA	Horizontal co-operation in the field of water resources (Programme item 460.1.1)	Latin America and the Caribbean			
ECLA	Environmental aspects of water resource management. (Programme item 460.1.2)	Latin America and the Caribbean			
ECLA	Measures supplementary to the implementation of the Mar del Plata Action Plan. (Programme item 460.1.3)	Latin America and the Caribbean			
ECLA	Support for co-ordination of water resource activities at the regional level. (Programme item 460.1.4)	Latin America and the Caribbean			
ECLA/Mexico	Support to Central American Governments in the Formulation of Water Resource Management Strategies. (Project 460.1.5)	Isthmus of Central America		Trop.Pac.,Yucatan,Caribbean(C.A.)	
DTCD / UN	Development of Water Resources in Northwest Argentina (ARG - 78 - 005)	North-West Argentina	North-West Argentina	Endorreico Argentina	River Plate, All surface & groundwater bodies
DTCD / UN	ARGENTINA : Water Resources Information System (ARG - 81 - 018)	Argentina	Argentina	Plate, S.Atlantic, Paana, Endorr.Arg.	All surface & groundwater bodies
DTCD / UN	BAHAMAS : Water Resources Development and Management (BHA - 78 - 003)	Island of New Providence	Island of New Providence	Caribbean Islands	Island of New Providence
DTCD / UN	BAHAMAS : Water Abstraction, Transportation and Supply (BHA - 82 - 001)	Commonwealth of the Bahamas	Commonwealth of the Bahamas	Caribbean Islands	
DTCD / UN	CARIBBEAN : Technical Co-operation for Water Resources Development in Small Islands (CAR - 79 - R01)	Caribbean Islands	Caribbean (selected islands)	Caribbean Islands	Caribbean (small islands)
DTCD / UN	CAYMAN ISLAND : Establishment of a Public Water Supply (CAY - 82 - 001)	Cayman Islands (entire group)	Cayman Islands (entire group)	Caribbean Islands	Cayman Islands (entire group)

Table 1 cont.

ACRONYM of INTERNATIONAL ORGANIZATION Reporting	T I T L E of A C T I V I T Y and / or P R O J E C T	ADMINISTRATIVE SPHERE: NAME OF ADMINISTRATIVE DIVISION Major	ADMINISTRATIVE SPHERE: NAME OF ADMINISTRATIVE DIVISION Minor	HYDROGRAPHIC SPHERE: B A S I N (S)	HYDROGRAPHIC SPHERE: W A T E R B O D Y (River, lake, etc.)
DTCD / UN	EL SALVADOR : Master Plan for Development and Multiple Use of Water Resources (ELS - 78 - 005)	El Salvador (entire country)	El Salvador (entire country)	Tropical Pacific	All water bodies
DTCD / UN	HAITI : Assistance to the Groundwater Exploration and Research Services. (HAI - 79 - 001)	Haiti	Urban and rural communities	Caribbean Islands	Haiti
DTCD / UN	HONDURAS : National / Regional Planning Systems (HON - 82 - X01)	N.E. Honduras	N.E. Honduras	Caribbean (Central America)	Aguan River Valley
DTCD / UN	PARAGUAY : Professional Training for River Navigation (PAR - 82 - 005)	Paraguay	Paraguay	River Plate	River Paraguay
UNICEF	BOLIVIA : Programme of Integrated Rural Development.	Bolivia	Tarija,Potosi,Oruro,Chuquisaca	Titicaca	
UNICEF	CUBA : Rural Water Supply and Environmental Sanitation	Cuba (7 Provinces)	Rural areas	Caribbean Islands	
UNICEF	EL SALVADOR : Water Introduccion to Medium Size and Small Communities (200 - 1000 inhabitants)	El Salvador (North-East)	3 Departaments	Tropical Pacific	
UNICEF	GUATEMALA : Drinking Water and Sanitation in Rural Areas	Guatemala (18 Departaments)	Small and poor rural communities	Yucatan,GulfMex,TropPacif,Caribb	
UNICEF	HONDURAS : Drinking Water for Rural Communities	Border area with El Salvador	Rural communities	Caribbean(Central America)	
UNICEF	PANAMA : Water Introduction to Small Communities	Cocle, Veraguas and Chiriqui	Small villages	Tropical Pacific,Caribbean(C.A.)	
UNICEF	HAITI : Urban Slums and Rural Water Supply	Haiti (entire country)	Urban slums & coastal rural area	Caribbean Islands	

Table 1 cont.

ACRONYM of INTERNATIONAL ORGANIZATION Reporting	TITLE of ACTIVITY and / or PROJECT	ADMINISTRATIVE SPHERE: NAME OF ADMINISTRATIVE DIVISION Major	ADMINISTRATIVE SPHERE: NAME OF ADMINISTRATIVE DIVISION Minor	HYDROGRAPHIC SPHERE: BASIN(S)	HYDROGRAPHIC SPHERE: WATER BODY (River, lake, etc.)
UNICEF	DOMINICA : Rural Water Supply Project Saint LUCIA : Services Benefiting Children Saint VINCENT : Rehabilitation Project	Caribbean countries	Dominica,St.Lucia,St.Vincent	Caribbean Islands	Dominica,St.Lucia,St.Vincent
UNICEF	JAMAICA : Basic Services for Children, Rural Water Supply and Rehabilitation of Minor Water Supplies.	Parishes of St.Thomas & St.James	St.Thomas & Claredon (rural)	Caribbean Islands	
IAEA / UN	Coordinated Research Programme on Isotopic Techniques in Hydrology and Geothermics in the Latin American Region	Latin America and the Caribbean	To be defined	To be defined	To be defined
UNESCO	International Hydrological Programme (IHP)	Worldwide			
ROSTLAC	Major Regional Project (MRP) for the Utilization and Conservation of Water Resources in the Rural Areas of Latin America and the Caribbean.	Latin America and the Caribbean	Rural areas		
PAHO	EASTERN CARIBBEAN : Basin water management.	Caribbean countries	10 Caribbean countries	Caribbean Islands	
PAHO	COLOMBIA : Monitoring and control of pollution of Cartagena Bay and areas de influence.	Departament of Bolivar,Colombia	Cartagena	Magdalena	Bay, Canal del Dique
PAHO	COLOMBIA : Protection de Water Resources on the Savannah of Bogota.	Special District,D.Cundinamarca	Bogota	Magdalena	River Bogota
CEPIS/PAHO	Advisory assistance on water pollution and application of mathematical models of water quality.	Bogota/ Managua/ Chimbote(Lima)		Central Pacif and Amazon	R.Bogota/LagoonAsososca/Chimbote
CEPIS/PAHO	Regional Project on Simplified Methodologies for Studies on Eutrophication in Tropical Lakes.	Latin America and the Caribbean		Amazon,Yucatan,Trop.Pacif,Carib	Tropical lakes
CEPIS/PAHO	Manual of Design for Marine Outfalls.	Latin America and the Caribbean			Coastal areas

Table 1 cont.

ACRONYM of INTERNATIONAL ORGANIZATION Reporting	TITLE of ACTIVITY and/or PROJECT	ADMINISTRATIVE SPHERE		HYDROGRAPHIC SPHERE	
		NAME OF ADMINISTRATIVE DIVISION Major	NAME OF ADMINISTRATIVE DIVISION Minor	BASIN(S)	WATER BODY (River, lake, etc.)
CEPIS/PAHO	Regional Programme for Technical and Institutional Development of Agencies Responsible for Basic Sanitation (and Water Supply) in Clustered and Dispersed Rural Population.	Latin America and the Caribbean	Rural areas		
CEPIS/PAHO	Regional Programme for the strengthening of Commercial Aspects of Drinking Water and Sewerage Institutions.	Latin America and the Caribbean	Urban, periurban and rural areas		
CEPIS/PAHO	Regional Programme for Extension of Water Services to Urban Marginal Groups through Reduction of Water Non Accounted for.	Latin America and the Caribbean	Urban marginal areas		
CEPIS/PAHO	Project on Technological Development of Drinking Water and Sewerage Institutions. (Project DTIAPA)	Andean Pact signatories & other	Urban and rural areas		
CEPIS/PAHO	Transfer of water from River Mantaro: Contaminacion	Peru	Lima	Central Pacific	River Mantaro
CEPIS/PAHO	Regional Programme for Improvement of Quality of Water for Human Consumption	Latin America and the Caribbean	Urban, periurban and rural areas		
CEPIS/PAHO	Regional Programme on Appropriate Technology for the Collection, Treatment and Final Disposal of Waste Water and Excreta in Medium-sized, Small and Scattered Rural Communities.	District de Lima	Sn.Juan de Miraflores(rural)	Central Pacific	Stabilization Lagoon
WMO / UN	Working Groups on Hydrology and Hydrological Advisers for Regions III and IV	Latin America and the Caribbean			
WMO / UN	BRAZIL : Hydrology and Climatology of the Brazilian Amazon River Basin.	Brazil	Amazon	Amazon River Basin	
WMO / UN	COLOMBIA : Hydrometeorological Studies for land improvement.	Colombia		Orinoco, Amazon, Magdalena, TropPac	
WMO / UN	DOMINICAN REPUBLIC : Agrometeorology, Hydrometeorology and Flood Forecasting.	Dominican Republic		Caribbean Islands	

Table 1 cont.

ACRONYM of INTERNATIONAL ORGANIZATION Reporting	TITLE of ACTIVITY and / or PROJECT	ADMINISTRATIVE SPHERE: NAME OF ADMINISTRATIVE DIVISION Major	ADMINISTRATIVE SPHERE: NAME OF ADMINISTRATIVE DIVISION Minor	HYDROGRAPHIC SPHERE: BASIN(S)	HYDROGRAPHIC SPHERE: WATER BODY (River, lake, etc.)
WMO / UN	HONDURAS : Meteorology and Hydrology for development.	Honduras		Trop.Pacific;Caribbean(C.A.)	
WMO / UN	PANAMA : Hydrometeorological Data Bank.	Panama		Trop.Pacific;Caribbean(C.A.)	
WMO / UN	PERU : Meteorology, Hydrometeorology and Agrometeorology.	Peru		Titicaca;Amazon;Central Pacific	
WMO / UN	VENEZUELA : Hydrology, Hydrometeorology and Flood Forecasting.	Venezuela		Magdalena;Orinoco;Caribbean(Vene	
WMO / UN	CENTRAL AMERICAN ISTHMUS : Strengthening of the Regional Water Resources Committee.	Isthmus of Central America		Trop.Pacific;Caribbean(C.A.)	
WMO / UN	ENGLISH SPEAKING CARIBBEAN COUNTRIES : Hydrological Operations and Training.	English Speaking Caribbean		Caribbean Islands	
WMO / UN	CENTRAL AMERICA and ANDEAN COUNTRIES : Applications of HOMS and Flood Forecasting.	Latin America			
OAS	Updating and enlargement of inventory and analysis of basic information on natural resources and relevant topics in the River Plate Basin.	Countries sharing R.Plate basin		River Plate basin	
OAS	Expansion of the agricultural frontier, food production and production of energy in the River Plate Basin: Gran Chaco			River Plate basin	Gran Chaco
OAS	Integrated regional development of Parasuayan Chaco	Paraguay	Region Occidental IV	River Plate basin	Parasuayan Chaco
OAS	Regional Development of Parasuayan area of Pilcomayo	Paraguay	Pilcomayo	River Plate basin	Pilcomayo - Paraguay

Table 1 cont.

ACRONYM of INTERNATIONAL ORGANIZATION Reporting	TITLE of ACTIVITY and / or PROJECT	ADMINISTRATIVE SPHERE: NAME OF ADMINISTRATIVE DIVISION Major	ADMINISTRATIVE SPHERE: NAME OF ADMINISTRATIVE DIVISION Minor	HYDROGRAPHIC SPHERE: BASIN(S)	HYDROGRAPHIC SPHERE: WATER BODY (River, lake, etc.)
OAS	Intesrated development of the rivers Araguaya - Tocantins basin	Brasil		Tocantins	Rivers Araguaia-Tocantins
OAS	Agricultural development under irrigation in the Upper Basin of the River Pilcomayo	Bolivia		River Plate basin	Upper River Pilcomayo basin
OAS	Case Study of environmental management: Selva Central del Peru	Peru		Amazonas	Basins in the Selva Central, Peru
OAS	Inter-American Centre for Intesrated Development of Land and Water (Centro Interamericano de Desarrollo Integral de Aguas y Tierras - CIDIAT) (Headquarters: Merida, Venezuela)	Latin America and the Caribbean			
OAS	COLOMBIA : Project on Consumption or Substitution and Conservation of Energy in the Transport Sector.	Colombia			
OAS	Production of non-conventional energy in Central America (Multinational Project: Panama / Costa Rica / Nicaragua)	Isthmus of Central America		Tropical Pacific, Caribbean (C.A.)	
OAS	ECUADOR : Planning of hydrographic systems.	Ecuador		Tropical Pacific	River Jubones
OAS	HAITI : Development of frontier zone.	Haiti		Caribbean Islands	River Fer a Cheval
OAS	NICARAGUA : Hydrographic Basin Management Plan	Nicaragua		Tropical Pacific	Lake Xolotlan (Managua), R. Volcano
OAS	DOMINICAN REPUBLIC: Study on Development of the Cibao Region	Cibao Region	Cibao (13 Provinces)	Caribbean Islands	
OAS	Human Settlement and Energy Project in the Caribbean	Caribbean countries		Caribbean Islands, North Atlantic	

Table 1 conclusion

ACRONYM of INTERNATIONAL ORGANIZATION Reporting	TITLE of ACTIVITY and / or PROJECT	ADMINISTRATIVE SPHERE		HYDROGRAPHIC SPHERE	
		NAME OF ADMINISTRATIVE DIVISION Major	NAME OF ADMINISTRATIVE DIVISION Minor	BASIN(S)	WATER BODY (River, lake, etc.)
OAS	SURINAME : Integration of Development	Suriname	Coronie and Paramaribo	North Atlantic (Guianas)	Coronie and Paramaribo
IDB	HAITI : Rehabilitation of irrigation areas Phase II	Haiti		Caribbean Islands	River Artibonite
CDB	Development Expansion and Improvement of Water Supply Systems in the Bank's Borrowing Member countries	Caribbean countries	To be defined	Caribbean Islands	
IFAD	PERU : Upper Mayo Rural Areas Development Project	Peru		Central Pacific	Upper Mayo
IFAD	HAITI : Irrigation and Rural Development of Cul de Sac	Haiti	Cul de Sac	Caribbean Islands	
IFAD	CUBA : Project on Rural Development of Canalete	Cuba	Canalete	Caribbean Islands	

Table 2

OPERATIONAL PATTERNS OF ACTIVITY

TITLE OF ACTIVITY and / or PROJECT	OPERATIONAL PATTERNS											
	STUDIES AT OFFICE LEVEL	FIELD STUDIES	PROMOTION OF EXPERT MEETINGS ON WATER RESOURCES	SELECTION AND ASSIGNMENT OF CONSULTANTS	PREPARATION OF MANUALS. DIFFUSION OF METHODOLOGIES	PREPARATION AND CONDUCT OF TRAINING COURSES	EVALUATION AND FINANCING OF INVESTMENT PROJECTS	COMPILATION AND SYSTEMATIC DISSEMINATION OF DATA	FIELD RESEARCH	PROMOTION OF HORIZONTAL CO-OPERATION	FOLLOW-UP AND PERMANENT CONTROL	OTHER
Horizontal co-operation in the field of water resources (Programme item 460.1.1)	ECLA							ECLA		ECLA	ECLA	
Environmental aspects of water resource management. (Programme item 460.1.2)	ECLA		ECLA									
Measures supplementary to the implementation of the Mar del Plata Action Plan. (Programme item 460.1.3)	ECLA		ECLA					ECLA		ECLA	ECLA	
Support for co-ordination of water resource activities at the regional level. (Programme item 460.1.4)			ECLA								ECLA	
Support to Central American Governments in the Formulation of Water Resource Management Strategies. (Project 460.1.5)			ECLA/Mexico					ECLA/Mexico		ECLA/Mexico	ECLA/Mexico	
Development of Water Resources in Northwest Argentina (ARG - 78 - 005)		DTCD / UN							DTCD / UN			
ARGENTINA : Water Resources Information System (ARG - 81 - 018)	DTCD / UN				DTCD / UN	DTCD / UN		DTCD / UN				
BAHAMAS : Water Resources Development and Management (BHA - 78 - 003)		DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		
BAHAMAS : Water Abstraction, Transportation and Supply (BHA - 82 - 001)		DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		
CARIBBEAN : Technical Co-operation for Water Resources Development in Small Islands (CAR - 79 - R01)		DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		

Table 2 cont.

TITLE OF ACTIVITY and / or PROJECT	OPERATIONAL PATTERNS												
	STUDIES AT OFFICE LEVEL	FIELD STUDIES	PROMOTION OF EXPERT MEETINGS ON WATER RESOURCES	SELECTION AND ASSIGNMENT OF CONSULTANTS	PREPARATION OF MANUALS, DIFFUSION OF METHODOLOGIES	PREPARATION AND CONDUCT OF TRAINING COURSES	EVALUATION AND FINANCING OF INVESTMENT PROJECTS	COMPILATION AND SYSTEMATIC DISSEMINATION OF DATA	FIELD RESEARCH	PROMOTION OF HORIZONTAL CO-OPERATION	FOLLOW-UP AND PERMANENT CONTROL	OTHER
CAYMAN ISLAND : Establishment of a Public Water Supply (CAY - 82 - 001)		DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		
EL SALVADOR : Master Plan for Development and Multiple Use of Water Resources (ELS - 78 - 005)	DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN		DTCD / UN	DTCD / UN		DTCD / UN	DTCD / UN		
HAITI : Assistance to the Groundwater Exploration and Research Services. (HAI - 79 - 001)	DTCD / UN	DTCD / UN		DTCD / UN	DTCD / UN			DTCD / UN	DTCD / UN			
HONDURAS : National / Regional Planning Systems (HON - 82 - X01)		DTCD / UN						DTCD / UN			DTCD / UN	
PARAGUAY : Professional Training for River Navigation (PAR - 82 - 005)			DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN				DTCD / UN		
BOLIVIA : Programme of Integrated Rural Development.			UNICEF				UNICEF					
CUBA : Rural Water Supply and Environmental Sanitation		UNICEF				UNICEF			UNICEF			
EL SALVADOR : Water Introduccion to Medium Size and Small Communities (200 - 1000 inhabitants)		UNICEF										
GUATEMALA : Drinking Water and Sanitation in Rural Areas		UNICEF	UNICEF		UNICEF	UNICEF			UNICEF	UNICEF	UNICEF	
HONDURAS : Drinking Water for Rural Communities							UNICEF					
PANAMA : Water Introduction to Small Communities		UNICEF										

Table 2 cont.

TITLE OF ACTIVITY and / or PROJECT	OPERATIONAL PATTERNS												
	STUDIES AT OFFICE LEVEL	FIELD STUDIES	PROMOTION OF EXPERT MEETINGS ON WATER RESOURCE	SELECTION AND ASSIGNMENT OF CONSULTANTS	PREPARATION OF MANUALS, DIFFUSION OF METHODOLOGIES	PREPARATION AND CONDUCT OF TRAINING COURSES	EVALUATION AND FINANCING OF INVESTMENT PROJECTS	COMPILATION AND SYSTEMATIC DISSEMINATION OF DATA	FIELD RESEARCH	PROMOTION OF HORIZONTAL CO-OPERATION	FOLLOW-UP AND PERMANENT CONTROL	OTHER
HAITI : Urban Slums and Rural Water Supply												
DOMINICA : Rural Water Supply Project Saint LUCIA : Services Benefiting Children Saint VINCENT : Rehabilitation Project			UNICEF									
JAMAICA : Basic Services for Children: Rural Water Supply and Rehabilitation of Minor Water Supplies.		UNICEF				UNICEF			UNICEF			
Coordinated Research Programme on Isotopic Techn in Hydrology and Geothermics in the Latin American Region		IAEA / UN	IAEA / UN	IAEA / UN		IAEA / UN			IAEA / UN			
International Hydrological Programme (IHP)	UNESCO	UNESCO	UNESCO	UNESCO	UNESCO	UNESCO		UNESCO	UNESCO	UNESCO		
Major Regional Project (MRP) for the Utilization and Conservation of Water Resources in the Rural Areas of Latin America and the Cari			ROSTLAC	ROSTLAC	ROSTLAC			ROSTLAC		ROSTLAC		
EASTERN CARIBBEAN : Basin water management.					PAHO					PAHO		
COLOMBIA : Monitoring and control of pollution of Cartagena Bay and areas de influence.		PAHO		PAHO	PAHO	PAHO			PAHO	PAHO		
COLOMBIA : Protection de Water Resources on the Savannah of Bogota.		PAHO			PAHO	PAHO	PAHO		PAHO	PAHO		
Advisors assistance on water pollution and application of mathematical models of water quality.				CEPIS/PAHO								
Regional Project on Simplified Methodologies for Studies on Eutrophication in Tropical Lakes.		CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO					CEPIS/PAHO	CEPIS/PAHO	

Table 2 cont.

TITLE OF ACTIVITY and / or PROJECT	OPERATIONAL PATTERNS												
	STUDIES AT OFFICE LEVEL	FIELD STUDIES	PROMOTION OF EXPERT MEETINGS ON WATER RESOURCE	SELECTION AND ASSIGNMENT OF CONSULTANTS	PREPARATION OF MANUALS. DIFFUSION OF METHODOLOGIES	PREPARATION AND CONDUCT OF TRAINING COURSES	EVALUATION AND FINANCING OF INVESTMENT PROJECTS	COMPILATION AND SYSTEMATIC DISSEMINATION OF DATA	FIELD RESEARCH	PROMOTION OF HORIZONTAL CO-OPERATION	FOLLOW-UP AND PERMANENT CONTROL	OTHER
Manual of Design for Marine Outfalls.		CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO		CEPIS/PAHO		
Regional Programme for Technical and Institution of Agencies Responsible for Basic Sanitation (an in Clustered and Dispersed Rural Population.	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO			CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Regional Programme for the strengthening of Commercial Aspects of Drinking Water and Sewerage Institutions.	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Regional Programme for Extension of Water Services to Urban Marginal Groups through Reduction of Water Non Accounted for.	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Project on Technological Development of Drinking Water and Sewerage Institutions. (Project BTIAPA)	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Transfer of water from River Mantaro: Contaminacion	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO		CEPIS/PAHO			
Regional Programme for Improvement of Quality of Water for Human Consumption		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Regional Programme on Appropriate Technology for Treatment and Final Disposal of Waste Water and in Medium-sized, Small and Scattered Rural Commu		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Working Groups on Hydrology and Hydrological Advisers for Regions III and IV		WMO / UN	WMO / UN	WMO / UN	WMO / UN	WMO / UN				WMO / UN		
BRAZIL : Hydrology and Climatology of the Brazilian Amazon River Basin.	WMO / UN	WMO / UN										
COLOMBIA : Hydrometeorological Studies for land improvement.	WMO / UN	WMO / UN										

Table 2 cont.

TITLE OF ACTIVITY and / or PROJECT	OPERATIONAL PATTERNS											
	STUDIES AT OFFICE LEVEL	FIELD STUDIES	PROMOTION OF EXPERT MEETINGS ON WATER RESOURCES	SELECTION AND ASSIGNMENT OF CONSULTANTS	PREPARATION OF MANUALS. DIFFUSION OF METHODOLOGIES	PREPARATION AND CONDUCT OF TRAINING COURSES	EVALUATION AND FINANCING OF INVESTMENT PROJECTS	COMPILATION AND SYSTEMATIC DISSEMINATION OF DATA	FIELD RESEARCH	PROMOTION OF HORIZONTAL CO-OPERATION	FOLLOW-UP AND PERMANENT CONTROL	OTHER
DOMINICAN REPUBLIC : Agrometeorology, Hydrometeorology and Flood Forecasting.	WMO / UN	WMO / UN										
HONDURAS : Meteorology and Hydrology for development.	WMO / UN	WMO / UN										
PANAMA : Hydrometeorological Data Bank.	WMO / UN	WMO / UN										
PERU : Meteorology, Hydrometeorology and Agrometeorology.	WMO / UN	WMO / UN										
VENEZUELA : Hydrology, Hydrometeorology and Flood Forecasting.	WMO / UN	WMO / UN										
CENTRAL AMERICAN ISTHMUS : Strengthening of the Regional Water Resources Committee.												
ENGLISH SPEAKING CARIBBEAN COUNTRIES : Hydrological Operations and Trainins.												
CENTRAL AMERICA and ANDEAN COUNTRIES : Applications of HOMS and Flood Forecastins.												
Updating and enlargement of inventory and analysis of basic information on natural resources and relevant topics in the River Plate Basin.	OAS											
Expansion of the agricultural frontiers food production and production of energy in the River Plate Basin: Gran Chaco	OAS	OAS	OAS							OAS		
Intesrated regional development of Paraguayan Chaco		OAS				OAS				OAS		

Table 2 cont.

TITLE OF ACTIVITY and / or PROJECT	OPERATIONAL PATTERNS														
	STUDIES AT OFFICE LEVEL	FIELD STUDIES	PROMOTION OF EXPERT MEETINGS ON WATER RESOURCES	SELECTION AND ASSIGNMENT OF CONSULTANTS	PREPARATION OF MANUALS, DIFFUSION OF METHODOLOGIES	PREPARATION AND CONDUCT OF TRAINING COURSES	EVALUATION AND FINANCING OF INVESTMENT PROJECTS	COMPILATION AND SYSTEMATIC DISSEMINATION OF DATA	FIELD RESEARCH	PROMOTION OF HORIZONTAL CO-OPERATION	FOLLOW-UP AND PERMANENT CONTROL	OTHER
Regional Development of Paraguayan area of Pilcomayo		OAS										
Integrated development of the rivers Araguaya - Tocantins basin		OAS		OAS		OAS						
Agricultural development under irrigation in the Upper Basin of the River Pilcomayo		OAS					OAS					
Case Study of environmental management: Selva Central del Peru	OAS	OAS	OAS		OAS				OAS	OAS		
Inter-American Centre for Integrated Development (Centro Interamericano de Desarrollo Integral del CIDIAT) (Headquarters: Merida, Venezuela)	OAS	OAS	OAS	OAS	OAS	OAS		OAS	OAS	OAS		
COLOMBIA : Project on Consumption or Substitution and Conservation of Energy in the Transport Sector.	OAS	OAS										
Production of non-conventional energy in Central America (Multinational Project: Panama / Costa Rica / Nicaragua)	OAS	OAS										
ECUADOR : Plannins of hydrographic systems.	OAS	OAS	OAS	OAS	OAS				OAS			
HAITI : Development of frontier zone.	OAS	OAS										
NICARAGUA : Hydrographic Basin Management Plan	OAS	OAS	OAS							OAS		
DOMINICAN REPUBLIC: Study on Development of the Cibao Region	OAS	OAS	OAS							OAS		

Table 2 conclusion

TITLE OF ACTIVITY and / or PROJECT	OPERATIONAL PATTERNS												
	STUDIES AT OFFICE LEVEL	FIELD STUDIES	PROMOTION OF EXPERT MEETINGS ON WATER RESOURCE	SELECTION AND ASSIGNMENT OF CONSULTANTS	PREPARATION OF MANUALS, DIFFUSION OF METHODOLOGIES	PREPARATION AND CONDUCT OF TRAINING COURSES	EVALUATION AND FINANCING OF INVESTMENT PROJECTS	COMPILATION AND SYSTEMATIC DISSEMINATION OF DATA	FIELD RESEARCH	PROMOTION OF HORIZONTAL CO-OPERATION	FOLLOW-UP AND PERMANENT CONTROL	OTHER
Human Settlement and Energy Project in the Caribbean	OAS	OAS											
SURINAME : Integration of Development	OAS	OAS								OAS			
HAITI : Rehabilitation of irrigation areas Phase II	IDB	IDB	IDB										
Development Expansion and Improvement of Water Supply Systems in the Bank's Borrowing Member countries													
PERU : Upper Mayo Rural Areas Development Project							IFAD						
HAITI : Irrigation and Rural Development of Cul de Sac							IFAD						
CUBA : Project on Rural Development of Canalote							IFAD						

Table 7

TECHNICAL ORIENTED ACTIVITIES

TITLE of ACTIVITY and / or PROJECT	TECHNICAL - ORIENTED ACTIVITIES					
	INVENTORIES, STUDIES, EVALUATIONS or DIAGNOSES of WATER RESOURCES	FORMULATION and EVALUATION of INVESTMENT PROJECTS	CONSTRUCTION of ABSTRACTION, REGULATION, TRANSPORT, TREATMENT and DISPOSAL STRUCTURES	OPERATION and MAINTENANCE of WATER WORKS	RECOVERY, CONSERVATION, MANAGEMENT, PROTECTION, etc., of WATER RESOURCES	TOTAL TECHNICAL- ORIENTED ACTIVITIES
Horizontal co-operation in the field of water resources (Programme item 460.1.1)						
Environmental aspects of water resource management. (Programme item 460.1.2)						
Measures supplementary to the implementation of the Mar del Plata Action Plan. (Programme item 460.1.3)	ECLA				ECLA	
Support for co-ordination of water resource activities at the regional level. (Programme item 460.1.4)						
Support to Central American Governments in the Formulation of Water Resource Management Strategies. (Project 460.1.5)	ECLA/Mexico					
Development of Water Resources in Northwest Argentina (ARG - 78 - 005)					DTCD / UN	
ARGENTINA : Water Resources Information System (ARG - 81 - 018)	DTCD / UN					
BAHAMAS : Water Resources Development and Management (BHA - 78 - 003)						DTCD / UN
BAHAMAS : Water Abstraction, Transportation and Supply (BHA - 82 - 001)						DTCD / UN
CARIBBEAN : Technical Co-operation for Water Resources Development in Small Islands (CAR - 79 - R01)						DTCD / UN
CAYMAN ISLAND : Establishment of a Public Water Supply (CAY - 82 - 001)						DTCD / UN

Table 3 cont.

TITLE of ACTIVITY and / or PROJECT	TECHNICAL-ORIENTED ACTIVITIES					
	INVENTORIES, STUDIES, EVALUATIONS or DIAGNOSES of WATER RESOURCES	FORMULATION and EVALUATION of INVESTMENT PROJECTS	CONSTRUCTION of ABSTRACTION, REGULATION, TRANSPORT, TREATMENT and DISPOSAL STRUCTURES	OPERATION and MAINTENANCE of WATER WORKS	RECOVERY, CONSERVATION, MANAGEMENT, PROTECTION, etc., of WATER RESOURCES	TOTAL TECHNICAL-ORIENTED ACTIVITIES
DOMINICA : Rural Water Supply Project Saint LUCIA : Services Benefiting Children Saint VINCENT : Rehabilitation Project			UNICEF			
JAMAICA : Basic Services for Children, Rural Water Supply and Rehabilitation of Minor Water Supplies.		UNICEF	UNICEF	UNICEF		
Coordinated Research Programme on Isotopic Techniques in Hydrology and Geothermics in the Latin American Region	IAEA / UN					
International Hydrological Programme (IHP)	UNESCO					
Major Regional Project (MRP) for the Utilization and Conservation of Water Resources in the Rural Areas of Latin America and the Caribbean.	ROSTLAC	ROSTLAC			ROSTLAC	
EASTERN CARIBBEAN : Basin water management.				PAHO		
COLOMBIA : Monitoring and control of pollution of Cartagena Bay and areas de influence.	PAHO				PAHO	
COLOMBIA : Protection de Water Resources on the Savannah of Bogota.		PAHO	PAHO		PAHO	
Advisory assistance on water pollution and application of mathematical models of water quality.	CEPIS/PAHO				CEPIS/PAHO	
Regional Project on Simplified Methodologies for Studies on Eutrophication in Tropical Lakes.	CEPIS/PAHO				CEPIS/PAHO	
Manual of Design for Marine Outfalls.	CEPIS/PAHO				CEPIS/PAHO	

Table 3 cont.

TITLE of ACTIVITY and/or PROJECT	TECHNICAL-ORIENTED ACTIVITIES					
	INVENTORIES, STUDIES, EVALUATIONS or DIAGNOSES of WATER RESOURCES	FORMULATION and EVALUATION of INVESTMENT PROJECTS	CONSTRUCTION of (ABSTRACTION, REGULATION, TRANSPORT, TREATMENT and DISPOSAL STRUCTURES	OPERATION and MAINTENANCE of WATER WORKS	RECOVERY, CONSERVATION, MANAGEMENT, PROTECTION, etc., of WATER RESOURCES	TOTAL TECHNICAL-ORIENTED ACTIVITIES
Regional Programme for Technical and Institutional Development of Agencies Responsible for Basic Sanitation (and Water Supply) in Clustered and Dispersed Rural Population.	CEPIS/PAHO			CEPIS/PAHO	CEPIS/PAHO	
Regional Programme for the strengthening of Commercial Aspects of Drinking Water and Sewerage Institutions.						
Regional Programme for Extension of Water Services to Urban Marginal Groups through Reduction of Water Non Accounted for.	CEPIS/PAHO			CEPIS/PAHO	CEPIS/PAHO	
Project on Technological Development of Drinking Water and Sewerage Institutions. (Project DTIAPA)				CEPIS/PAHO	CEPIS/PAHO	
Transfer of water from River Mantaro! Contaminacion						CEPIS/PAHO
Regional Programme for Improvement of Quality of Water for Human Consumption	CEPIS/PAHO			CEPIS/PAHO	CEPIS/PAHO	
Regional Programme on Appropriate Technology for the Collection, Treatment and Final Disposal of Waste Water and Excreta in Medium-sized, Small and Scattered Rural Communities.	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Working Groups on Hydrology and Hydrological Advisers for Regions III and IV	WMO / UN				WMO / UN	
BRAZIL : Hydrology and Climatology of the Brazilian Amazon River Basin.	WMO / UN					
COLOMBIA : Hydrometeorological Studies for land improvement.	WMO / UN					
DOMINICAN REPUBLIC : Agrometeorology, Hydrometeorology and Flood Forecasting.	WMO / UN					

Table 3 cont.

TITLE of ACTIVITY and/or PROJECT	TECHNICAL-ORIENTED ACTIVITIES					
	INVENTORIES, STUDIES, EVALUATIONS or DIAGNOSES of WATER RESOURCES	FORMULATION and EVALUATION of INVESTMENT PROJECTS	CONSTRUCTION of ABSTRACTION, REGULATION, TRANSPORT, TREATMENT and DISPOSAL STRUCTURES	OPERATION and MAINTENANCE of WATER WORKS	RECOVERY, CONSERVATION, MANAGEMENT, PROTECTION, etc., of WATER RESOURCES	TOTAL TECHNICAL-ORIENTED ACTIVITIES
HONDURAS : Meteorology and Hydrology for development.	WMO / UN					
PANAMA : Hydrometeorological Data Bank.	WMO / UN					
PERU : Meteorology, Hydrometeorology and Agrometeorology.	WMO / UN					
VENEZUELA : Hydrology, Hydrometeorology and Flood Forecasting.	WMO / UN					
CENTRAL AMERICAN ISTHMUS : Strengthening of the Regional Water Resources Committee.						
ENGLISH SPEAKING CARIBBEAN COUNTRIES : Hydrological Operations and Training.						
CENTRAL AMERICA and ANDEAN COUNTRIES : Applications of HOMS and Flood Forecasting.						
Updating and enlargement of inventory and analysis of basic information on natural resources and relevant topics in the River Plate Basin.	OAS					
Expansion of the agricultural frontier, food production and production of energy in the River Plate Basin; Gran Chaco	OAS					
Integrated regional development of Paraguayan Chaco	OAS	OAS			OAS	
Regional Development of Paraguayan area of Pilcomayo	OAS	OAS				

Table 3 cont.

TITLE of ACTIVITY and / or PROJECT	TECHNICAL-ORIENTED ACTIVITIES					
	INVENTORIES, STUDIES, EVALUATIONS or DIAGNOSES of WATER RESOURCES	FORMULATION and EVALUATION of INVESTMENT PROJECTS	CONSTRUCTION of ABSTRACTION, REGULATION, TRANSPORT, TREATMENT and DISPOSAL STRUCTURES	OPERATION and MAINTENANCE of WATER WORKS	RECOVERY, CONSERVATION, MANAGEMENT, PROTECTION, etc., of WATER RESOURCES	TOTAL TECHNICAL-ORIENTED ACTIVITIES
Intesrated development of the rivers Araguaya - Tocantins basin	OAS	OAS				
Agricultural development under irrisation in the Upper Basin of the River Pilcomayo	OAS	OAS				
Case Study of environmental management: Selva Central del Peru	OAS					
Inter-American Centre for Integrated Development of Land and Water (Centro Interamericano de Desarrollo Integral de Aguas y Tierras - CIDIAT) (Headquarters: Merida, Venezuela)	OAS	OAS				
COLOMBIA : Project on Consumption or Substitution and Conservation of Energy in the Transport Sector.	OAS	OAS				
Production of non-conventional energy in Central America (Multinational Project: Panama / Costa Rica / Nicaragua)	OAS	OAS				
ECUADOR : Planning of hydrographic systems.	OAS					
HAITI : Development of frontier zone.		OAS				
NICARAGUA : Hydrographic Basin Management Plan	OAS	OAS				
DOMINICAN REPUBLIC: Study on Development of the Cibao Region	OAS	OAS				
Human Settlement and Energy Project in the Caribbean	OAS	OAS				

Table 3 conclusion

TITLE of ACTIVITY and / or PROJECT	TECHNICAL-ORIENTED ACTIVITIES					
	INVENTORIES, STUDIES, EVALUATIONS or DIAGNOSES of WATER RESOURCES	FORMULATION and EVALUATION of INVESTMENT PROJECTS	CONSTRUCTION of ABSTRACTION, REGULATION, TRANSPORT, TREATMENT and DISPOSAL STRUCTURES	OPERATION and MAINTENANCE of WATER WORKS	RECOVERY, CONSERVATION, MANAGEMENT, PROTECTION, etc., of WATER RESOURCES	TOTAL TECHNICAL-ORIENTED ACTIVITIES
SURINAME : Integration of Development	OAS	OAS				
HAITI : Rehabilitation of irrigation areas Phase II						IDB
Development Expansion and Improvement of Water Supply Systems in the Bank's Borrowing Member countries						
PERU : Upper Mayo Rural Areas Development Project			IFAD			
HAITI : Irrigation and Rural Development of Cul de Sac			IFAD			
CUBA : Project on Rural Development of Casalote			IFAD			

Table 4

MANAGEMENT ORIENTED ACTIVITIES

TITLE of ACTIVITY and / or PROJECT	MANAGEMENT-ORIENTED ACTIVITIES										
	WATER RESOURCES PLANS and POLICIES	LEGISLATION ON WATER RESOURCES	EVALUATION of ECONOMIC & FINANCIAL ASPECTS	ORGANIZATION of INSTITUTIONS and PROJECTS	IMPROVEMENT INTERMEDIATE and ADVANCED TECHNIQUES	DIRECTING EXECUTION of INVESTMENT PROJECTS	TRAINING of TECHNICIANS PROFESSIONALS and USERS	ORGANIZATION of USERS and PROMOTION of PARTICIPATION	ENVIRONMENTAL MANAGEMENT	PROMOTION of HORIZONTAL CO-OPERATION	ALL MANAGEMENT ACTIVITIES
Horizontal co-operation in the field of water resources (Programme item 460.1.1)										ECLA	
Environmental aspects of water resource management. (Programme item 460.1.2)	ECLA								ECLA	ECLA	
Measures supplementary to the implementation of the Mar del Plata Action Plan. (Programme item 460.1.3)	ECLA									ECLA	
Support for co-ordination of water resource activities at the regional level. (Programme item 460.1.4)				ECLA						ECLA	
Support to Central American Governments in the Formulation of Water Resource Management Strategies. (Project 460.1.5)				ECLA/Mexico						ECLA/Mexico	
Development of Water Resources in Northwest Argentina (ARG - 78 - 005)	DTCD / UN			DTCD / UN			DTCD / UN				
ARGENTINA : Water Resources Information System (ARG - 81 - 018)	DTCD / UN			DTCD / UN	DTCD / UN		DTCD / UN				
BAHAMAS : Water Resources Development and Management (BHA - 78 - 003)											DTCD / UN
BAHAMAS : Water Abstraction, Transportation and Supply (BHA - 82 - 001)											DTCD / UN
CARIBBEAN : Technical Co-operation for Water Resources Development in Small Islands (CAR - 79 - R01)											DTCD / UN
CAYMAN ISLAND : Establishment of a Public Water Supply (CAY - 82 - 001)											DTCD / UN

Table 4 cont.

TITLE of ACTIVITY and / or PROJECT	MANAGEMENT - ORIENTED ACTIVITIES										
	WATER RESOURCES PLANS and POLICIES	LEGISLATION ON WATER RESOURCES	EVALUATION of ECONOMIC & FINANCIAL ASPECTS	ORGANIZATION of INSTITUTIONS and PROJECTS	IMPROVEMENT INTERMEDIATE and ADVANCED TECHNIQUES	DIRECTING EXECUTION of INVESTMENT PROJECTS	TRAINING of TECHNICIANS PROFESSIONALS and USERS	ORGANIZATION of USERS and PROMOTION PARTICIPATION	ENVIRONMENTAL MANAGEMENT	PROMOTION of HORIZONTAL CO-OPERATION	ALL MANAGEMENT ACTIVITIES
EL SALVADOR : Master Plan for Development and Multiple Use of Water Resources (ELS - 78 - 005)	DTCD / UN	DTCD / UN	DTCD / UN	DTCD / UN			DTCD / UN		DTCD / UN	DTCD / UN	
HAITI : Assistance to the Groundwater Exploration and Research Services. (HAI - 79 - 001)	DTCD / UN			DTCD / UN	DTCD / UN		DTCD / UN			DTCD / UN	
HONDURAS : National / Regional Planning Systems (HON - 82 - X01)	DTCD / UN		DTCD / UN		DTCD / UN		DTCD / UN		DTCD / UN		
PARAGUAY : Professional Training for River Navigation (PAR - 82 - 005)				DTCD / UN	DTCD / UN		DTCD / UN			DTCD / UN	
BOLIVIA : Programme of Integrated Rural Development.								UNICEF			
CUBA : Rural Water Supply and Environmental Sanitation				UNICEF		UNICEF	UNICEF	UNICEF			
EL SALVADOR : Water Introduccion to Medium Size and Small Communities (200 - 1000 inhabitants)											
GUATEMALA : Drinking Water and Sanitation in Rural Areas						UNICEF	UNICEF			UNICEF	
HONDURAS : Drinking Water for Rural Communities							UNICEF	UNICEF			
PANAMA : Water Introduction to Small Communities											
HAITI : Urban Slums and Rural Water Supply											

Table 4 cont.

TITLE of ACTIVITY and / or PROJECT	MANAGEMENT-ORIENTED ACTIVITIES											
	WATER RESOURCES PLANS and POLICIES	LEGISLATION ON WATER RESOURCES	EVALUATION of ECONOMIC & FINANCIAL ASPECTS	ORGANIZATION of INSTITUTIONS and PROJECTS	IMPROVEMENT INTERMEDIATE and ADVANCED TECHNIQUES	DIRECTING EXECUTION of INVESTMENT PROJECTS	TRAINING of TECHNICIANS PROFESSIONALS and USERS	ORGANIZATION of USERS and PROMOTION PARTICIPATION	ENVIRONMENTAL MANAGEMENT	PROMOTION of HORIZONTAL CO-OPERATION	ALL MANAGEMENT ACTIVITIES
DOMINICA : Rural Water Supply Project Saint LUCIA : Services Benefiting Children Saint VINCENT : Rehabilitation Project				UNICEF							
JAMAICA : Basic Services for Children, Rural Water Supply and Rehabilitation of Minor Water Supplies.						UNICEF	UNICEF	UNICEF			
Coordinated Research Programme on Isotopic Techniques in Hydrology and Geothermics in the Latin American Region							IAEA / UN				
International Hydrological Programme (IHP)	UNESCO				UNESCO					UNESCO	
Major Regional Project (MRP) for the Utilization and Conservation of Water Resources in the Rural Areas of Latin America and the Caribbean.	ROSTLAC							ROSTLAC	ROSTLAC	ROSTLAC	
EASTERN CARIBBEAN : Basin water management.							PAHO			PAHO	
COLOMBIA : Monitoring and control of pollution of Cartagena Bay and areas de influence.	PAHO	PAHO					PAHO				
COLOMBIA : Protection de Water Resources on the Savannah of Bogota.	PAHO	PAHO									PAHO
Advisory assistance on water pollution and application of mathematical models of water quality.					CEPIS/PAHO		CEPIS/PAHO		CEPIS/PAHO		
Regional Project on Simplified Methodologies for Studies on Eutrophication in Tropical Lakes.	CEPIS/PAHO				CEPIS/PAHO				CEPIS/PAHO	CEPIS/PAHO	
Manual of Design for Marine Outfalls.	CEPIS/PAHO				CEPIS/PAHO		CEPIS/PAHO			CEPIS/PAHO	

Table 4 cont.

TITLE of ACTIVITY and / or PROJECT	MANAGEMENT - ORIENTED ACTIVITIES										
	WATER RESOURCES PLANS and POLICIES	LEGISLATION ON WATER RESOURCES	EVALUATION of ECONOMIC & FINANCIAL ASPECTS	ORGANIZATION of INSTITUTIONS and PROJECTS	IMPROVEMENT INTERMEDIATE and ADVANCED TECHNIQUES	DIRECTING EXECUTION of INVESTMENT PROJECTS	TRAINING of TECHNICIANS, PROFESSIONALS and USERS	ORGANIZATION of USERS and PROMOTION of PARTICIPATION	ENVIRONMENTAL MANAGEMENT	PROMOTION of HORIZONTAL CO-OPERATION	ALL MANAGEMENT ACTIVITIES
Regional Programme for Technical and Institutional Development of Agencies Responsible for Basic Sanitation (and Water Supply) in Clustered and Dispersed Rural Population.	CEPIS/PAHO			CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Regional Programme for the strengthening of Commercial Aspects of Drinking Water and Sewerage Institutions.			CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO			CEPIS/PAHO	
Regional Programme for Extension of Water Services to Urban Marginal Groups through Reduction of Water Non Accounted for.	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Project on Technological Development of Drinking Water and Sewerage Institutions. (Project DTIAPA)			CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Transfer of water from River Mantaro: Contamination			CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO		CEPIS/PAHO			
Regional Programme for Improvement of Quality of Water for Human Consumption					CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Regional Programme on Appropriate Technology for the Collection, Treatment and final Disposal of Waste Water and Excreta in Medium-sized, Small and Scattered Rural Communities.					CEPIS/PAHO		CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	CEPIS/PAHO	
Working Groups on Hydrology and Hydrological Advisers for Regions III and IV				WMO / UN	WMO / UN		WMO / UN			WMO / UN	
BRAZIL : Hydrology and Climatology of the Brazilian Amazon River Basin.				WMO / UN	WMO / UN		WMO / UN				
COLOMBIA : Hydrometeorological Studies for land improvement.					WMO / UN		WMO / UN				
DOMINICAN REPUBLIC : Agrometeorology, Hydrometeorology and Flood Forecasting.					WMO / UN		WMO / UN				

Table 4 cont.

TITLE of ACTIVITY and/or PROJECT	MANAGEMENT-ORIENTED ACTIVITIES											
	WATER RESOURCES PLANS and POLICIES	LEGISLATION ON WATER RESOURCES	EVALUATION of ECONOMIC & FINANCIAL ASPECTS	ORGANIZATION of INSTITUTIONS and PROJECTS	IMPROVEMENT INTERMEDIATE and ADVANCED TECHNIQUES	DIRECTING EXECUTION of INVESTMENT PROJECTS	TRAINING of TECHNICIANS PROFESSIONALS and USERS	ORGANIZATION of USERS and PROMOTION of PARTICIPATION	ENVIRONMENTAL MANAGEMENT	PROMOTION of HORIZONTAL CO-OPERATION	ALL MANAGEMENT ACTIVITIES
HONDURAS : Meteorology and Hydrology for development.					WMO / UN		WMO / UN				
PANAMA : Hydrometeorological Data Bank.					WMO / UN		WMO / UN				
PERU : Meteorology, Hydrometeorology and Agrometeorology.					WMO / UN		WMO / UN				
VENEZUELA : Hydrology, Hydrometeorology and Flood Forecasting.					WMO / UN		WMO / UN				
CENTRAL AMERICAN ISTHMUS : Strengthening of the Regional Water Resources Committee.				WMO / UN						WMO / UN	
ENGLISH SPEAKING CARIBBEAN COUNTRIES : Hydrological Operations and Training.					WMO / UN		WMO / UN				
CENTRAL AMERICA and ANDEAN COUNTRIES : Applications of HOMS and Flood Forecasting.					WMO / UN		WMO / UN				
Updating and enlargement of inventory and analysis of basic information on natural resources and relevant topics in the River Plate Basin.	OAS										
Expansion of the agricultural frontier, food production and production of energy in the River Plate Basin: Gran Chaco	OAS		OAS	OAS						OAS	
Integrated regional development of Parapuayan Chaco	OAS		OAS	OAS							
Regional Development of Paraguayan area of Pilcomayo	OAS		OAS								

Table 4 cont.

TITLE of ACTIVITY and/or PROJECT	MANAGEMENT-ORIENTED ACTIVITIES											
	WATER RESOURCES PLANS and POLICIES	LEGISLATION ON WATER RESOURCES	EVALUATION of ECONOMIC & FINANCIAL ASPECTS	ORGANIZATION of INSTITUTIONS and PROJECTS	IMPROVEMENT of INTERMEDIATE and ADVANCED TECHNIQUES	DIRECTING EXECUTION of INVESTMENT PROJECTS	TRAINING of TECHNICIANS PROFESSIONALS and USERS	ORGANIZATION of USERS and PROMOTION of PARTICIPATION	ENVIRONMENTAL MANAGEMENT	PROMOTION of HORIZONTAL CO-OPERATION	ALL MANAGEMENT ACTIVITIES
Integrated development of the rivers Araguaya - Tocantins basin	OAS		OAS				OAS				
Agricultural development under irrigation in the Upper Basin of the River Pilcomayo			OAS								
Case Study of environmental management: Selva Central del Peru	OAS		OAS						OAS		
Inter-American Centre for Integrated Development of Land and Water (Centro Interamericano de Desarrollo Integral de Aguas y Tierras - CIDIAT) (Headquarters: Merida, Venezuela)	OAS	OAS	OAS	OAS	OAS		OAS	OAS	OAS	OAS	
COLOMBIA : Project on Consumption or Substitution and Conservation of Energy in the Transport Sector.	OAS		OAS								
Production of non-conventional energy in Central America (Multinational Project: Panama / Costa Rica / Nicaragua)	OAS		OAS								
ECUADOR : Planning of hydrographic systems.	OAS	OAS		OAS							
HAITI : Development of frontier zone.	OAS		OAS								
NICARAGUA : Hydrographic Basin Management Plan	OAS		OAS				OAS				
DOMINICAN REPUBLIC: Study on Development of the Cibao Region	OAS		OAS				OAS				
Human Settlement and Energy Project in the Caribbean	OAS		OAS	OAS							

Table 4 conclusion

TITLE of ACTIVITY and / or PROJECT	MANAGEMENT - ORIENTED ACTIVITIES										
	WATER RESOURCES PLANS and POLICIES	LEGISLATION ON WATER RESOURCES	EVALUATION of ECONOMIC & FINANCIAL ASPECTS	ORGANIZATION of INSTITUTIONS and PROJECTS	IMPROVEMENT INTERMEDIATE and ADVANCED TECHNIQUES	DIRECTING EXECUTION of INVESTMENT PROJECTS	TRAINING of TECHNICIANS, PROFESSIONALS and USERS	ORGANIZATION of USERS and PROMOTION of PARTICIPATION	ENVIRONMENTAL MANAGEMENT	PROMOTION of HORIZONTAL CO-OPERATION	ALL MANAGEMENT ACTIVITIES
SURINAME : Integration of Development	OAS		OAS				OAS		OAS	OAS	
HAITI : Rehabilitation of irrigation areas Phase II											
Development Expansion and Improvement of Water Supply Systems in the Bank's Borrowing Member countries											
PERU : Upper Nanu Rural Areas Development Project											
HAITI : Irrigation and Rural Development of Cul de Sac											
CUBA : Project on Rural Development of Canalote											