work in progress for
public discussion

Water Resources Management in South Eastern Europe

Volume II

Country Water Notes and Water Fact Sheets

Environmentally and Socially Sustainable Development Department
Europe and Central Asia Region

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This publication is in two volumes: (a) Volume 1—Water Resources Management in South Eastern Europe: Issues and Directions; and (b) the present Volume 2—Country Water Notes and Water Fact Sheets. The Environmentally and Socially Sustainable Development (ECSSD) Department is distributing this report to disseminate findings of work-in-progress and to encourage debate, feedback and exchange of ideas on important issues in the South Eastern Europe region. The report carries the names of the authors and should be used and cited accordingly. The findings, interpretations and conclusions are the authors' own and should not be attributed to the World Bank, its Board of Directors, its management, or any member countries.

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Weights and Measures

Metric System

BCM	Billion cubic meters
GW	Gigawatts
GWh	Gigawatt hour
GWh/year	Gigawatt hour per year
ha	Hectare
KW	Kilowatts
km	Kilometer
km^2	Square kilometer
l/sec	Liters per second
lcd	Liters per capita per day
m	Meter
m^3	Cubic meter
m^3/sec	Cubic meter per second
MCM	Million cubic meters
mg/l	Milligrams per liter

List of Acronyms and Abbreviations

BOD	Biochemical Oxygen Demand
CARDS	Community Assistance for Reconstruction, Development and Stabilization
CAS	Country Assistance Strategy
COD	Chemical Oxygen Demand
EBRD	European Bank for Reconstruction and Development
ECA	Europe and Central Asia
EIB	European Investment Bank
ESR	Environmental Sector Report
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FBiH	Federation of Bosnia and Herzegovina (Federation)
FY	Fiscal Year
FYR	Former Yugoslav Republic
GDP	Gross Domestic Product
GEF	Global Environment Facility
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Assistance Agency)
HMI	Hydro-meteorological Institute
HRMEPP	Hazards Risk Mitigation and Emergency Preparedness Project
ICPDR	International Commission for the Protection of the Danube River
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IDP	Internally Displaced Person
IFI	International Financial Institution
INWEB	International Network of Water-Environment Centers for the Balkans
KfW	Kreditanstalt für Wiederaufbau (German Project Funding Agency)
LOCP	Lake Ohrid Conservation Project
MDG	Millennium Development Goal
MESP	Ministry of Environment and Spatial Planning
MoAWF	Ministry of Agriculture, Water Management and Forestry
MoWEP	Ministry of Water and Environmental Protection
METAP	Mediterranean Environmental Technical Assistance Program
NEAP	National Environmental Action Plan
NGO	Non Governmental Organization
NWC	National Water Council
O&M	Operation and Maintenance
PHARE	Poland, Hungary Aid for Reconstruction of the Economy (European Commission)
REC	Regional Environment Centre
REReP	Regional Environment Reconstruction Programme
RS	*Republika Srpska* (Bosnian Serb Republic)
SAPARD	Special Accession Program for Agriculture and Rural Development
SEE	South Eastern Europe
SWD	State Water Directorate
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme

UNICEF	United Nations International Children's Emergency Fund
USD	United States Dollar
USAID	United States Agency for International Development
WHO	World Health Organization
WRM	Water Resources Management
WSS	Water Supply and Sanitation
WWF	Worldwide Fund for Nature
WWTP	Wastewater Treatment Plant

Geographic Glossary*

Balkan Peninsula	Balkans Peninsula
Balkans Mountains	Balkans Mountains, Stara Planina
Bujana River	Buna River
Butrint Lagoon	Butrinto Lagoon
Cres Island	Cres, Otak
Doiran Lake	Dojran Lake
Drava River	Dráva, Drau River
Drin River	Crni Drim, Drini, Drim River
Krast	Kras, Carso
Iskur River	Iskar River
Lake Ohrid	Ohridsko Lake
Maritsa River	Maritza, Meriç, Marica, Évros, Hebros, Hebrus River
Mura River	Mur River
Nestos River	Mesta, Néstos River
Prespa Lake	Prispansko, Prespansko Lake
Resvaya River	Rezovska, Rezva, Mutlu River
Skadar Lake	Shkodra, Schkodër, Scutari, Skadarsko Lake
Struma River	Strimón River
Timok River	Timoc River
Tisza River	Tisa, Theiss River
Vardar River	Axius, Axiós, Axious River
Vijosë River	Viosa, Voyutsa, Vijose, Vjosë, Vijosa River

* This list provides the default names of the key transboundary geographic features that will be used throughout the report. Other given names of the transboundary geographic feature are also presented in the list.

OVERVIEW

Volume II of the Water Resources Management in South Eastern Europe: Issues and Directions" is divided into two parts. Part I provides a compendium of Country Water Note prepared for the focus countries, namely, Albania, Bosnia and Herzegovina, Bulgaria, Croatia, FYR Macedonia, Romania, and Serbia and Montenegro. These Notes provide a brief description of the socio-economic and geographical context and development objectives pursue in each country and their implications for water resources management. In addition, they describe the water resources base, trends in water use and management, floods and droughts, institutional issues, transboundary water issues, and key challenges and priorities. A 2-page Water Fact Sheet with some socio-economic and water-related indicators, such as freshwater availability (total and per-capita), water use by sector (agriculture including irrigation, industrial, domestic), hydropower dependency, irrigation trends, storage capacity, water pricing and cost recovery, among others is included at the end of each Water Country Note. Part II includes Water Fact Sheets for the non-focus countries, namely, Greece, Hungary, Moldova, Turkey and Slovenia.

Several sources were consulted to assemble the material presented in Volume II of the strategy. The most widely used references are the following: Environmental Performance Reviews produced by the United Nations Economic Commission for Europe (UNECE); National Environmental Action Plans (NEAPs); the Food and Agriculture Organization (FAO) water and population databases, such as AQUASTAT; the 2000 World Development Indicators (online version); the 2002 World Atlas and Industry Guide; among others. Other country-specific references are listed at the end of each Country Water Note.

Part 1

Country Water Notes

ALBANIA

Socio-Economic and Geographic Context

Albania is situated in the western edge of the Balkan Peninsula. With a total area of 2.9 million hectares (ha), it is the smallest country in Europe. Albania is mainly a hilly and mountainous country, and consists of two distinct geographical regions: highlands above 300 meters (m), which represents about three fourths of the territory; and the coastal flat plains or low hills, which include the Adriatic and Ionian Seas' coastline (476 km). Its climate varies with the topography: hot and dry summers and frequent thunderstorms and wet and mild winters in the coastal plains; and more summer precipitation and colder and quite severe winters with heavy snow in the mountains. The average precipitation is 1,485 millimeters (mm), on the coast annual rainfall averages 1,000 mm, but in the mountains it may be as high as 3,000 mm. Most of the precipitation drains into the rivers and flows into the Adriatic Sea. In addition, a large amount of water from neighboring countries drains through Albania.

Albania's population was 3.13 million in 2000. More than half of the population (58%) lives in rural areas. Water resources play a key role in the economy of Albania: about 97% of the total electricity production is generated from hydro-power plants mostly on the Drini, Mati and Bistrice rivers; and about 50% of the cropland is irrigated producing about 80% of agriculture output.

Water Resource Base

For the purpose of water management, Albania is divided into six main hydrographical basins. One-third of them are located outside Albania. About 50% of its territory is in international basins shared with Greece, FRY Macedonia and Serbia and Montenegro.

Surface and groundwater resources. Albania can be considered a water-abundant country. Its overall renewable resources amount to 41.7 billion cubic meters (BCM) or 13,300 cubic meter (m^3) per capita, out of which about 65% are generated within Albania and the remaining from upstream countries (namely, Serbia and Montenegro and FYR Macedonia). Resources are unevenly distributed throughout the country. The major water resource is surface water, and is found in rivers, lakes, and lagoons. The most important rivers are the Drin, the Mati, the Ishmi, the Erzeni, the Shkumbini, the Semani, the Vijosë, and the Bistrica. The Drin River is the longest river with a stable and constant stream. About one-third of its drainage area is within Albania, and the rest is within the Adriatic portion of the Kosovo watershed, and the catchments areas of the Skadar, Prespa and Ohrid Lakes.

Because of the mountainous topography, rivers are torrential with steep slopes. Their year-to-year variability is very high: the annual runoff in dry years is one-tenth of the annual runoff in wet years. Most of the rivers have highly irregular seasonal flow patterns. River flows are the highest in winter or early spring. Nearly all carry less than 10% (and sometime zero) of their winter averages during the summer season. Rivers are difficult to control and unnavigable, with the exception of the Brune. Albania is prone to soil erosion. Although, this is a natural phenomenon in mountainous countries with heavy rainfall, in the case of Albania it has been exacerbated by human activities (e.g. deforestation) and has resulted in large amounts of sediments ending up in reservoirs, rivers and seas.

Lakes cover about 4% of the country's territory. The largest lakes are Ohrid, Prespa and Skadar. These are transboundary lakes. In addition, there are also 247 smaller lakes. At present, lakes are in oligotrophic stage, except in certain areas where discharges into tributary rivers have increased the concentration of nitrogen and phosphorus. Several reservoirs totaling 5.60 BCM of storage capacity have been built mostly along the Drin, Mati and Devolli rivers for flood protection, irrigation and production of hydropower.

Groundwater resources are also abundant and represent about 23% of the total renewable resources[1]. They are well distributed throughout the country and are exploited from wells (in valleys and plains) and springs (in mountainous regions). Springs however are vulnerable to becoming dry during the summer seasons (Mati basin aquifer). Groundwater resources are the main source of drinking water. About 70% of the main cities in Albania are supplied by groundwater wells. They are also the major source for irrigation and agriculture in the Shkodër and Vlorë areas.

Wetlands. Most of the rivers of Albania have formed at their mouth a series of lagoons, swamps and wetlands. During the previous regime, large wetlands along the coast were drained and reclaimed to provide land for agriculture. As a result, valuable wetlands disappeared. Large lagoons along the coastline include Karavasta, Narta and Butrint, which are wetlands of global biodiversity significance. Some of them are Ramsar sites. These natural aquatic ecosystems critical for their high biodiversity value are being threatened by land-based pollution loads and in many cases they are being used for discharging untreated wastewater.

Water Quality. Since 1990 the monitoring of water is much less frequent. As a result the quality of the water resources is not well known. According to available information, the surface waters are highly contaminated as a result of direct discharge of urban and industrial wastewater into surface water bodies. The quality of some rivers is above the maximum European Union standards for river water quality. Many important rivers show signs of high pollution by organic matters—they experience a deficit in dissolved oxygen, with high chemical oxygen demand (COD) and biological oxygen demand (BOD) values.

In general, groundwater is of good quality at the source. Its quality, however, is not continuously monitored throughout the country. There are some localities where little is known about it. This strategic water reserve, however, is currently facing some serious water quality problems: intrusion of saline water into the aquifers (in the coastal regions of Shkodër, Lezhë, Durrës, Lushnjë and Fier), the degradation of water quality as a result of neglecting sanitary protection zones around water wells (Ishmi aquifer which feeds Tirana), and the vulnerability to upstream pollution, particularly in the karstic zones, where untreated discharges filtrate quickly into the ground and reaches the underlying aquifer (Shkodër aquifer).

Water Use and Management by Sector

The lack of an adequate monitoring system, the rapid changes in economic activities, and the continuous movements in population make it difficult to assess the use of

1 At present, not much is known about the availability of groundwater or the potential extraction capacity. Groundwater monitoring and assessment has been neglected during the past decade.

water resources. Available data suggest that irrigation and mining rely mostly on surface water, while households and industry on groundwater from aquifers. According to the draft Water Strategy, in 1995 total water use was 0.93 BCM in 1996, with water for industry and domestic purposes accounting for 28%, and water for irrigation 72%. Although water seems to be plentiful to meet current and future demands, there are certain regions in Albania—particular in areas along the coast -- where water conflicts are very likely to occur in the near future, e.g., in Durres-Vlore, conflicts over the use of water will emerge between municipal supply, irrigation and tourism.

Drinking Water and Sanitation. Although the piped water supply system covers the whole country and the level of coverage reaches 85%, water supply is intermittent because of the dire condition of Albania's water infrastructure. In the case of urban areas, water supply is provided on average for 2-4 hours a day, with many households getting no water at all. In addition, the quality of drinking water is often compromised. Often, water is distributed without any preliminary treatment as a result of the lack of adequate treatment and disinfection facilities and unreliable supply of chemicals. Domestic water demand is increasing not only because of population growth but also because of the increase in the level of water losses, estimated to be greater than 50% in all cities.

The water situation is rural areas is even worse. In localities with piped water supply networks, drinking water is supposed to be supplied by public taps to group of houses, but this is not happening because systems are poorly maintained. At the end of 1989, about 75% of the rural population had access to piped water. Today, access has been reduced to 50%. In order to cope with the lack of piped water supply, rural households dig their own wells without any monitoring of the water quality. In some cases, wells are dug on the banks of heavily polluted rivers, whose waters are unsuitable for human consumption. Lack of sanitary protection zones is causing contamination of groundwater sources. A recent investigation has reported that 73% of drinking wells were bacteriologically contaminated.

During the past decades, insufficient investments have been made in sewerage or wastewater treatment to keep pace with population growth. As a result, most households in urban areas discharge their wastewater directly into the central sewage systems, which cover about 40% of the population. Poorer neighborhoods without access to sewerage systems at all discharge their wastewater to septic tanks. There is no wastewater treatment in Albania. The untreated wastewater is discharged in an uncontrolled manner. In rural areas, households use septic tanks in their yards. Leaks in septic tanks are also becoming problematic.

Irrigation and Drainage. Since less than 21% of the annual precipitation occurs between April and September, irrigation is necessary for agriculture in the drier plain areas. At present, agriculture is the main economic activity in Albania (it represents 55% of GDP) and is the largest water user. About 50% of the arable land is under irrigation and more than half is located in the coastal plains.

Irrigation relies mostly on surface waters—river diversions supplemented by over 600 irrigation dams. Although the water is of satisfactory quality for irrigation, mining and industrial effluents are polluting surface waters making them inappropriate for irrigation. Off-season drainage is necessary in order to prevent floods and water-logging.

Massive investments between 1950-1975, expanded the irrigated land from 29,000 ha to 417,000 ha. The development of irrigation was accompanied by flood protection works, drainage and reclamation of marshland below sea level and saline areas (about 280,000 ha). Albania's drainage schemes are concentrated primarily in the coastal area. Most of the wetlands in the coastal plain (about 100,000 ha) were drained to develop agriculture areas. Today, only 27,000 ha of wetlands remain.

Irrigation systems deteriorated during the 1990s. Inadequate budget allocation for irrigation has led to deferred or poor maintenance, system deterioration and unreliable water delivery. By 1994, 269,000 ha were either inoperative or severely damaged, and only 80,000 ha were operating normally. Plans are under way to rehabilitate irrigation schemes. According to the Ministry of Agriculture and Food, about 315,000 ha can be potentially rehabilitated. The source also reports that the remaining 100,000 ha should not be rehabilitated because of their low agricultural potential.

The rehabilitation of irrigation schemes must be accompanied by watershed management measures to prevent or reduce soil erosion and flash run-off in the upland areas. At present, these are serious problems for irrigation schemes. Neither farmers nor the government can afford the cost to remove eroded materials from canals, reservoirs and drain channels. A more sustainable watershed management approach should be followed when investing in the irrigation sector.

Private groundwater development—medium-sized shallow tubewells—has been started by farmers. About 1,000 ha are irrigated by groundwater, but there seems to be a tendency among farmers to increase the area. The motivations for this tendency are several: the high price of vegetables, easy exploitation of groundwater, and the lack of rehabilitation of gravity channels. This is a well-suited option for small-private farmers located in existing irrigation schemes, non-irrigated lands or land needing drainage provided the tubewells do not threaten the quality of the aquifer with salinization.

Unless environmental concerns are taking into account when restoring the agriculture sector in Albania, wetlands along the coastline may be threatened by investments in the sector, as a result of an increase in pollution loads of drainage water. Apart from threatening coastal lagoons of eutrophication, drainage water could also negatively impact drinking water sources.

Hydropower: The gross theoretical hydropower potential has been estimated at 40,000 gigawatts hours per year (GWh/year) and the technically feasible potential at 15,000 GWh/year. The economic feasible potential in turn has been estimated at 6,380 GWh/year out of which about 35% has been developed so far on the Drin River. In 2000, hydropower generation represented about 83% of total annual electric generation in the country. Plans are under consideration to develop the hydropower potential of Vijosë and Devoll rivers. The Energy Strategy calls for the development of new hydro capacity.

Floods. Flooding is a frequent problem in Albania, especially from November to March when intense or prolonged rainfall is most probable. The area most likely to be flooded is the western plain where the rivers from Albania's mountain regions flow into the Adriatic Sea. The western plain is also Albania's population center: more than 50% of Albanians live there, and the tendency is for the proportion to increase. The plains of the Drin in the north and the Vijosë in the south are especially flood prone. The increased peak discharge and flooding is the result of heavy deforestation.

The annual cost of flooding is not established; regular flood monitoring was not carried out before 1949, and the record keeping that began then did not publish full data. It is known that catastrophic nationwide flooding occurred in 1962-63. That flood was calculated to be a 50-year event.

Smaller floods also recur. A flood in November 1992 caused flash floods in six districts. It killed eleven people, damaged roads, bridges and irrigation networks, inundated 17,000 ha of agricultural land, damaged 1330 houses and destroyed 216, damaged the Fierza hydroelectric facility, and carried off food stored for the coming winter. Altogether, it affected 35,000 people. Flooding in September 1995 killed four and affected 1500.

The plain of Zadrima is inundated several times per year due to damage done to the drainage system during the transition period. The main drainage channel of the area is not maintained, and as a result, inundation occurs, creating problems in the agriculture sector in particular. Lezha was flooded in December 1995, September 1996, and again in December 1997. In the latter case, the damage was estimated at USD120,000.

Flood control activities are neglected due to shortage of funds. As of June 2000, the institute that formerly designed flood protection systems was closed. The Water Use Directorate that is responsible for maintenance of the flood protection system lacked funds. Water Users' Associations designated to take over the Directorate's functions were charged with maintenance of the irrigation system, but not with flood control, which appeared to have been orphaned by the new system. A newly created Department of Civil Protection in the Ministry of Local Administration did not yet have any technical experts.

Apart from flood protection works, enforcement of regulations on extracting activities can contribute greatly to reduce the damage caused by floods. At present, houses are being built with gravel and sand extracted illegally from nearby riverbeds and beaches. This illegal practice has caused modifications of the river course. As a result, water flows accelerate, causing floodplains to lose their retention function.

Water Legislation and Policies

The main legislation on water resources management is the 1996 Law on Water Resources, which established the National Water Council and its Technical Secretariat. This Law is based on modern principles of water management. In brief, the Law provides for the protection, development and sustainable use of water resources; organizes water resources management by river basin; introduces permits, concessions and authorizations for using water and for discharging wastewater; and calls for the development of a water strategy.

Recently, a draft Law on Water Protection has been prepared and is under review. It deals exclusively with reinforcing existing legislation to protect the quality of water bodies in order to protect human health. On the institutional side, the draft Law clarifies the role of the National Water Council and assigns more responsibility to the Ministry of Environment for the protection of water resources.

A "National Water Strategy for Albania" was prepared in 1997 with the assistance of the European Union. The draft strategy promotes "water resources conservation and the sustainable use of water resources in harmony with the environment and other natural resources." It clearly identifies the national objectives for water use and management, and suggests changes in the institutional framework for implementing the strategy. It sets radical institutional priorities with the objective of establishing clear lines of policy-decision within the institutional setup including the National Water Council and the relevant line ministries, in particular those in charge of environmental protection, irrigation and drinking water supply. At its final state, the strategy met with opposition and as a result it was never adopted.

A new Law was adopted in 2002 on the Organization and Functioning of Local Government. This Law assigns full responsibility for the administration, service, investment and regulation of water supply, sewerage and drainage systems as well as flood protection channels to local governments. In order to implement this Law, there is a need to improve the capacity of municipalities on water management and urban planning.

Given the large number of dams throughout the country and the concerns for their safety, at present, the Government has taken the first steps towards establishing an institutional and legal framework for dam safety.

The following instruments are available for the management of water resources management in Albania: administrative fees for issuing of water abstraction license, abstraction charges for surface and groundwater, user charges for water supply and irrigation, sewerage charges, and non-compliance fines. Application of abstraction charges is not practiced yet since the actual rates have not been set.

Water Management Institutions

In accordance with the 1996 Law on Water Resource, a new institutional setup for water resource management was established. At the central level, the National Water Committee, a policy decision body comprising all Ministers involved in the water sector, headed by the Prime Minister and co-chaired by the Minister of Territorial Adjustment and Tourism and the Minister of Transport and Telecommunications; and its Technical Secretariat, the country water administration body attached to the Prime Minister office. At the local level, the Law calls for the establishment of water basin authorities.

Two important decisions have been made by the NWC. The first decision was for the establishment of a water basin council and an implementing agency for each one of the six basins, but it was never implemented. The second decision defined the responsibilities of the water basin councils and water agencies regarding the issuing of abstraction permits. This decision again was not implemented since the water agencies were not in place. Despite its efforts, the NWC has made limited progress in the implementation of the 1996 Law. Evidence for this is the limited progress in the introduction of a water strategy, the lack of an inventory of water resources, and the failure to issue any authorization or permit for the use and discharge of water. Implementation mechanisms are not in place and more importantly, decisions in the water sector are not backed up by the necessary financial resources.

Transboundary and International Water Issues

Since about 35% of Albania's renewable resources come from neighboring countries, and about 50% of its territory is within international river basins, transboundary water issues are of particular concern to Albania. In 1994, Albania ratified the UNECE

Convention on the Protection and Use of Transboundary Watercourses and International Lakes, and in 2002, the Protocol on Water and Health. Albania is currently implementing several environmental projects in international lakes: Ohrid Lake jointly with the FYR Macedonia, Prespa Lake jointly with Greece and the FYR Macedonia and Skadar Lake jointly with Serbia and Montenegro. So far, no bilateral legal agreement has been concluded with these neighboring jurisdictions to address transboundary waters issues. With the support of the Regional Environmental Center, a new project is being prepared for the Drin River entitled "Drini River Watershed and Erosion Master Plan," to be implemented by Albania, Serbia and Montenegro and FYR Macedonia.

Key Issues and Challenges

Albania is endowed with relatively abundant fresh water resources. Following extensive development of its water resources during the previous regime, Albania is well equipped for hydropower and irrigation development. A drastic reduction of water withdrawal from irrigation and industrial purpose occurred during the past 10 years as a result of the collapse of the industrial sector. The decline in economic activity has also caused a reduction in pollution and improvement in the quality of its water resources. While a serious water crisis is not imminent at present, the fast development of the private sector, the urbanization process, the rehabilitation of irrigation schemes and the plans to expand hydropower capacity may increase the number of localized water crises. In order to avert a water crisis, it is necessary that Albania strengthens its current institutional framework for management of water resources. The following should be considered:

- Carry out a comprehensive water resource assessment, including *inter alia* an evaluation of the current institutional setup, water resource and demand inventory, regional water balances and assessment of water quality issues.

- Review and update of the legal instruments (amendments of Law on Water Resource and Environmental Protection, passing of additional regulations, etc.).

- Institutional/capacity building support for the most urgently needed water administration units, in particular for licensing and enforcement, and preparation of river basin hydrological plans.

- Improve management and enhance protection of groundwater sources.

- Short-term and medium term investments should focus on: dam safety, flood protection, wetlands conservation and restoration and watershed management.

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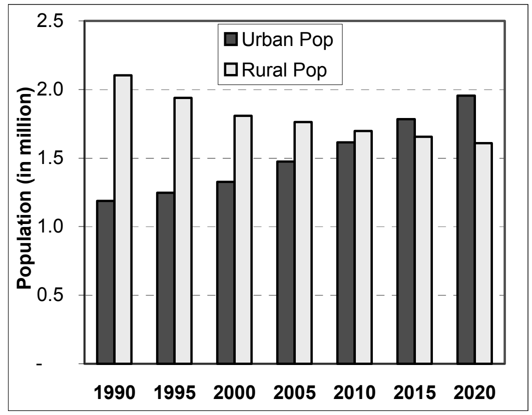
ALBANIA: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (in million)	3.29	3.13	3.44	3.57
Urban population	36%	42%	52%	55%
Rural population	64%	58%	48%	45%

Source: Aquastat database, FAO (2002).



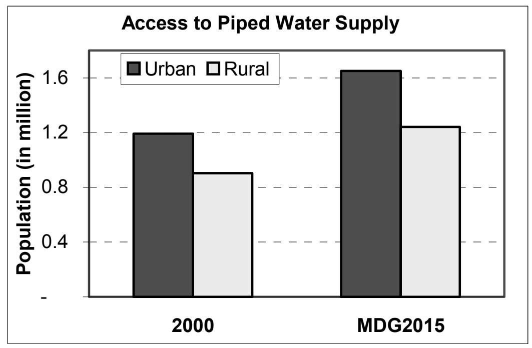
	1998	2000	Goal for 2015
Access to piped water supply	65%	67%	84%
Urban	85%	90%	93%
Rural	50%	50%	75%

Note: Goal refers to MDGs.

	1998	2000	Goal for 2020
Access to sewerage	61%	59%	80%
Urban	95%	90%	97%
Rural	37%	37%	68%

Note: Goal refers to MDGs.

	1996
Share of poor in rural areas	89%

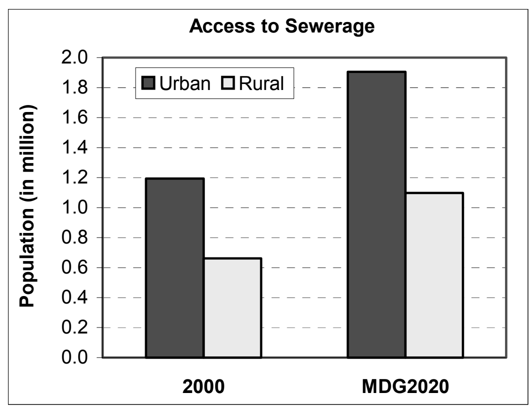


	1990	1995	1999	2000
GDP per capita (constant 1995 US$)	841	769	863	914
GDP total (billions of 1995 US$)	2.8	2.5	2.9	3.1
Share from agriculture	36%	55%	53%	55%
Share from industry	45%	22%	25%	26%

	1990	1991	1995	1999
Labor force (millions of people)	0.42	0.40	0.34	0.34
Share in agriculture	55%	24%		78%
Share in industry	23%	45%		

Average annual growth	1990-97	1998-00
Of GDP	-1.4%	7.4%
Of population	-0.4%	-0.1%

	1999
Infant mortality rate (per 1,000 live births)	24.3

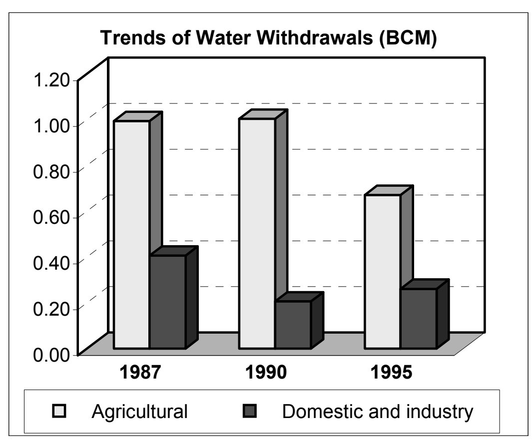


LAND AND WATER RESOURCES

Land area (millions of ha)	2.88
Land area in international basins (millions of ha)	1.43
Percentage of country in international basins	49.6%
Average precipitation (mm)	1,485
Average total volume of rainfall (BCM)	1,485
Total internal water resources (BCM)	26.9
Of which surface water (BCM)	23.1
Of which groundwater	6.2
Overlap between surface and groundwater	2.4
Total external water resources (BCM)	14.8
Of which surface water (BCM)	14.8
Of which groundwater (BCM)	
Total water resources (BCM)	41.7
Of which total surface water (BCM)	37.9
Of which total groundwater (BCM)	6.2
Overlap between surface and groundwater	2.4
Dependency ratio	35%

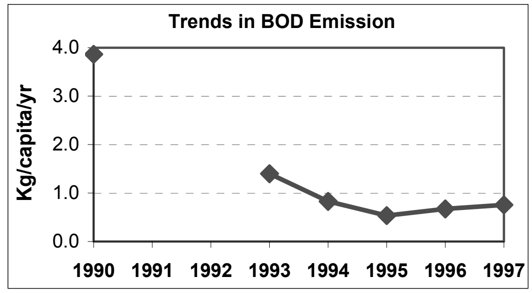
	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	12,679	13,306	12,126	11,697

	1987	1990	1995
Total annual withdrawals (in BCM)	1.40	1.21	0.93
Agricultural	0.99	1.00	0.67
Domestic and industry	0.41	0.21	0.26



WATER QUALITY AND POLLUTION

Wastewater produced	*			
Wastewater treated	*			
	1990	**1993**	**1996**	**1997**
Annual emissions of BOD per day (Tons)	34.8	12.5	5.8	6.5
Annual emissions of BOD per capita (kg)	3.86	1.40	0.67	0.76

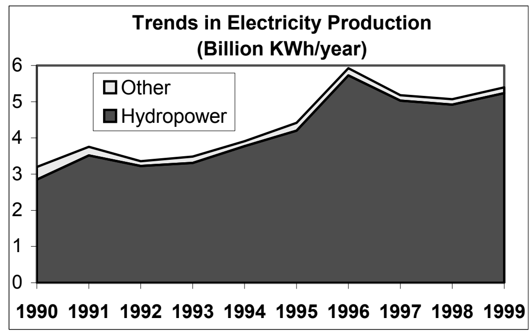


AQUATIC ECOSYSTEMS

Wetlands designated as Ramsar sites (2002)	
In ha	20,000
As % of land area	0.70%

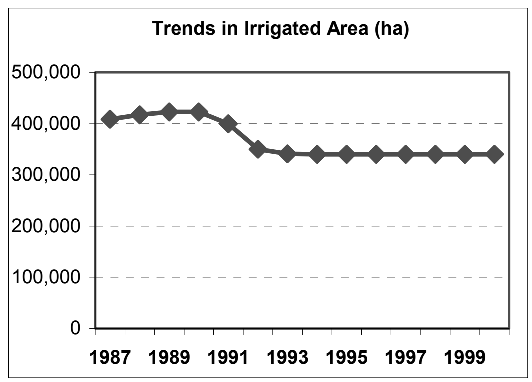
DAMS AND HYDROPOWER

Reservoir capacity (BCM)	4.56	(630 dams, and 306 >15 m)
Irrigation dams	0.56	
Hydropower dams	5.04	
Reservoir capacity in cubic meters per capita	1,455	
Gross theoretical hydropower potential (GWh/y)	40,000	
Technically feasible (GWh/y)	15,000	
Economically feasible (GWh/y)	6,380	
Current production from hydropower (GWh/y)	5,283	(in 2000)

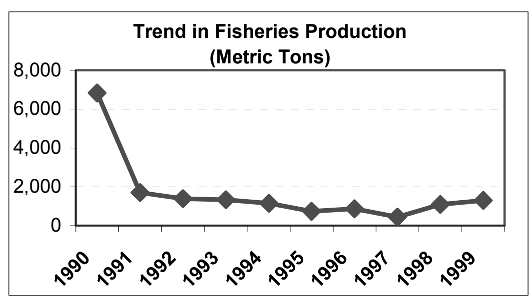


	1990	**1995**	**1998**	**1999**
Total electricity production (M KWh)	3,198	4,414	5,068	5,396
Share from hydroelectric	89%	95%	97%	97%

IRRIGATION	**1990**	**1995**	**1998**	**1999**
Irrigated land ('000 ha)	423	340	340	340
Irrigated land per capita (ha)	0.129	0.107	0.108	0.109
Irrigated land as share of cropland	60%	48%	49%	49%



FRESHWATER FISHERY	**1990**	**1995**	**1998**	**1999**
Fishery production (metric tons)	6,836	734	1,102	1,302
Fishery production per capita (kg)	2.08	0.23	0.35	0.42



FINANCING THE WATER SECTOR

Average cost recovery:	**2002**	
Irrigation water services	40%	O&M costs
Municipal water services	30%-40%	O&M costs
* These are ball park estimates.		
Average actual water price (US cent/m^3)	**2001**	
Households	11-20	
Industry	52-63	
Irrigation		
Wastewater charges (US cent/m3)		
Households	2.2-3.3	
Industry	4.4-7.4	

BOSNIA AND HERZEGOVINA

Socio Economic and Geographic Context

Bosnia and Herzegovina is situated in southeastern Europe, in the central part of the Balkan peninsula. Its total land area is 5.11 million ha, of which 762.5 km are land borders, 751.0 km river borders and 23.5 km sea borders. The current state structure of Bosnia and Herzegovina is regulated by the Dayton Agreement, composed of the Federation of Bosnia Herzegovina (FBiH) (divided into 10 cantons), the Republika Srpska (RS) and the District of Brčko as separate administrative units. The current population of 4.24 million is roughly divided between the two entities. FBiH and RS have separate constitutions, laws, and institutional structures. In the past, Bosnia and Herzegovina was one of the most polluted republics in pre-existing Federal Republic of Yugoslavia due to intensive development of heavy industry and lack of environmental controls. More recently, it emerged from the devastating war of 1992-95 with drastically lower living standards, major disruptions across its society, almost totally destroyed infrastructure, and ruined industry.

Of the total land area, 5% is lowlands, 24% hills, 42% mountains and 29% karst. Out of the total area 76% belongs to the Sava River catchment and 24% belongs to the Adriatic Sea catchment. The rivers are characterized by high gradients and relatively high run-off (22 l/sec per km^2). All the rivers flow through rough mountainous areas in upper parts, while in downstream sections, close to the river mouth or confluence, they flow though plains where they are liable to flooding. The Sava River, which runs along the northern border of Bosnia and Herzegovina, is the border with Croatia. In the east, the Drina River marks the natural border with Serbia and Montenegro. Starting from the source of the Drina River, along the mountainous chain towards the Crna Gora (Serbia and Montenegro), the boundary with Serbia and Montenegro slopes down toward the Adriatic Sea. In the west, the border with Croatia goes along the high Dinaric chain of mountains. In the far south, the territory of Bosnia and Herzegovina goes out to the Adriatic coast via the Neretva River. The coastal part of Bosnia and Herzegovina is 24 km long and includes one town—Neum. Internal river traffic is significant in Bosnia and Herzegovina. On the Sava, traffic is possible from the mouth of the Drina to the mouth of the Una, along length of 322 km. This is particularly important because it allows for traffic with Middle Europe and the North Sea. Traffic is possible for about 4 km on the Una, and 4.5 km on the Neretva.

Water Resource Base

Bosnia and Herzegovina has considerable water resources that represent an important economic potential. The territory of Bosnia and Herzegovina receives annually some 1250 mm of precipitation. Bosnia and Herzegovina is also rich in mineral and thermal waters, which represent a great potential in the fields of eco-tourism and health tourism.

Surface and groundwater resources. Freshwater river basins are the key water resources in Bosnia and Herzegovina. The territory of Bosnia and Herzegovina lies within two major basins - the Black Sea and the Adriatic Sea basins. The major stream of the Black Sea basin is the Sava River, whereas the Neretva, Trebisnjica and Cetina rivers are the major rivers of the Adriatic Sea basin. The part of the territory that belongs to the Adriatic Sea basin is richer in water resources than the one belonging to the Black Sea basin. There are seven river basins in Bosnia and Herzegovina, which are transboundary with cantons, entities, and other countries: Una-Sana, Vrbas, Bosna, Drina, Sava, Neretva, and Cetina.

The Una River, a right bank tributary of the Sava, forms a border between Croatia and Bosnia and Herzegovina and has a watershed of 9640 km^2 and a mean discharge of 290 m^3/sec. The Vrbas River has a watershed of 6386 km^2 and has a mean discharge of 100 m^3/sec. The Bosna River has a watershed of 10, 460 km^2 and mean discharge of 170 m^3/sec. The Drina River forms a border between Bosnia and Herzegovina and Serbia and Montenegro. It has a watershed of 19,570 km^2 and mean discharge of 370 m^3/sec. Al small part of the Drina watershed is in Albania. The Neretva River is the most significant transboundary river basin in the Adriatic Sea watershed. The Neretva originates in Bosnia and Herzegovina. Of its total length of 222 km only about 25 km lies within Croatia but this area includes two thirds of the Neretva Delta, which is known for its globally significant biodiversity. The middle and lower stretches of the Neretva, which flow through Bosnia and Herzegovina contribute heavy loads of pollution, which threaten the delta biodiversity. Operation of the five hydro power plants in the upper and middle courses of the Neretva result in significant drops in water levels in the Neretva in the summer, altering the natural habitat.

There are several natural lakes in Bosnia and Herzegovina. River lakes formed in the extensions of riverbeds or due to the natural dam in rivers beds are found primarily on the Pliva, Una and Trebizat rivers. Mountain lakes of glacier origin are found in the Dinarids and range in volume from 0.01-3.5 MCM. They are important for their biodiversity, tourism appeal, and cattle raising.

There are about 30 water reservoirs in Bosnia and Herzegovina primarily on the Neretva and Trebisnjica basin, and the Drina. Most are designed for hydropower and all are important for flood control, drinking water supply and irrigation. The total volume of the reservoirs is about 3.9 BCM with about 90% belonging to the Adriatic Sea basin and the rest to the Black Sea.

Ninety percent of drinking water comes from groundwater resources. It is estimated that 16 m^3/sec of groundwater from all zones could be exploited. Water needs in 2020 are estimated to be 35m^3/sec. Groundwater in Bosnia and Herzegovina is found in three geographically separate areas with special characteristics. In the northern part of the country, the ground water reserves are within alluvial connected sediments along the Sava River and its tributaries at a depth of about 50 m. Artesian water is found at 100-200 m. In the central part of the country, groundwater accumulates in caves and cavities of limestone massifs and emerges on the surface as lime wells in the river basins of Una, Sava, Bosna, Drina and Neretva rivers. In the Adriatic Sea catchments area, the southern part of the country, where the geology is primarily karst, groundwater is mostly found in the wells of the Cetina, Neretva, and Trebisnjica rivers basins.

Wetlands in Bosnia and Herzegovina support a rich biodiversity but are constantly in threat by loss of habitat; changes in the hydraulic regime; fishing; water pollution; and erosion and siltation. The wetlands that have received the most attention are those of the Neretva Delta is a transboundary delta shared by Bosnia and Herzegovina and Croatia.

Water Quality. Before the war, Bosnia and Herzegovina was the industrial heartland of the pre-existing Federal Republic of Yugoslavia and most of the rivers were severely polluted by industrial wastewater discharges. Industrial production has plummeted and therefore surface water pollution has decreased. Water quality is, however, suspect and in some cases clearly unsatisfactory. Water quality testing at best is unfocused and unregulated. The water quality monitoring system collapsed during the war and has yet to be re-established. There is almost no wastewater treatment and untreated flow is consequently discharged directly to the surface waters. Post-war data on water quality is almost non-existent. The surface water quality monitoring systems in place before the war have not been operational for over 10 years. There has never been any monitoring of groundwater quality. The system of monitoring stations is slowly being rehabilitated, largely with donor assistance.

Wastewater generated by 90% of the population is discharged directly and without treatment into the closest water flows or bodies or into karstic holes, which are connected to groundwater. Primarily because of this pollution surface water quality, particularly immediately downstream of municipalities is generally very low (Class III and IV). The most polluted rivers are Vrbas, Bosna and the lower part of the Sava. Only the most upstream sections of the Una, Drina, and Neretva maintain high water quality. The karstic nature of the geology contributes to ground water pollution, and the pollution of surface waters a distance from the discharge point. Polluted surface water infiltrates into the ground and uncontrolled dumping of solid waste, which mixes with rainwater, also contributes to ground water pollution. Uncontrolled deforestation and erosion of soil and mountains streams have resulted in eutrophication of surface waters as well creation of alluvia and sludge that increase the risk of flooding and water pollution. There is no information on non-point source pollution.

In 1991 when the population was 4.5 million, the majority of rivers were in class IV and the pollution load was equal to that of a population of 9.4 million. Water resources are also polluted by direct disposal of solid waste into rivers.

The key problems in water resources identified in the recently (2002) endorsed National Environmental Action Plan (NEAP) are:

- Inadequate water supply to the population and industry;
- Inadequate protection of springs;
- Inadequate disposal of municipal and industrial wastewaters; and
- Inadequate flood protection.

These problems are attributed to:

- Lack of integrated water management systems and strategy;
- Insufficient financial resources; and
- Non-harmonized legislation.

Water Use and Management by Sector

Drinking Water and Sanitation Coverage. The public drinking water supply system serves approximately 50% of households and other consumers in Bosnia and

Herzegovina. The rest use some type of alternative water supply facility beyond the purview of the water and public health sectors. The water supply sources are mainly based on exploitation of groundwater (89% of total water supply sources), rivers (10.2%) and water from natural lakes and artificial accumulations (0.8%). The urban population primarily relies on piped water systems to the home (96%) while in the rural areas 29% of the population has water in yards, 21% in houses, and 18% use pumps. Water related epidemics occur, usually on a seasonal basis, in smaller water supply facilities that are not monitored by the public health institutions. Water supply systems cannot meet the needs of the consumers during the dry season when the quantity and quality requirements are not met due to a combination of inadequate potential of the water resource, inadequate capacity of the infrastructure. Service interruptions are frequent.

Sewage collection systems cover about 56% of the urban population, while smaller towns and rural areas are faced with a much lower coverage—about 10%. The existing infrastructure is significantly damaged. Before the war, only seven cities in Bosnia and Herzegovina had wastewater treatment plants, out of which only five are currently in function. Out of the 122 industrial wastewater treatment plants that exist, only a few are operational due to war-time devastation and lack of equipment. There are a number of operational and physical obstacles to improved water supply services including lack of autonomy of the water utilities, poor utility organization, neglected maintenance, and huge losses in the system (50%).

Improvements on water supply and wastewater services were identified as a major donor priority for reconstruction of Bosnia and Herzegovina after the war. During the post war period, the international community contributed about USD210 million directly into restoring water services. In order to achieve the water service level of European Union member countries, the total investments for water and sanitation are estimated to be USD1 billion through the year 2030.

Irrigation. There are no developed irrigation systems in Bosnia and Herzegovina. Only about 0.65% of agricultural land is irrigated.

Hydropower. The total hydropower potential of Bosnia and Herzegovina is 6.1 GW. At present over 60% of electricity is from hydropower. The most important rivers for future hydro power development are the Drina, Neretva and Trebisnjica.

Floods. There is a permanent flood risk in Bosnia and Herzegovina. Floods threaten 4% of the total area of Bosnia and 60% of lowland area. Floods are quite frequent in the plains through which the major rivers flow and where intensive agricultural production takes place. Despite numerous flood protective and flood mitigation structures, many areas suffer from frequent flooding. Flood damages surpass to a large extent the capital values of the structures that would be built for the purpose of flood mitigation. In that respect prompt reservation of space for reservoirs and retentions is extremely important. However, reconstruction of damaged structures and provision of necessary funds is priority over construction of new flood protection and flood mitigation structures. Flood management is a transboundary issue particularly on the Sava River.

Water Legislation and Policies

A challenge in Bosnia and Herzegovina to the water sector, and many other sectors, since the Dayton Agreement has been the two different water laws and two different organizational structures. Since FBiH and RS have their own constitutions and governments, they both have separate bodies of law including for the water sector. Both FBiH and RS have had existing water laws dating from 1998 which had serious gaps and deficiencies including a poorly developed policy on the use and protection of water resources; insufficient provisions on permits, interaction standards and water use. To lay the groundwork for dealing with environmental issues across geopolitical boundaries, the EU PHARE program has financed the preparation of a new set of six frameworks laws on environment, one of which is a Water Law. The new Water Law (still in the approval process) governs the protection of waters, watersides and water lands. The new Water Law (based on the EU Water Framework Directive) calls for a river basin approach in water administration and establishes new bodies responsible for water protection based on river basins. While the new Water Law will address many of the deficiencies of the previous water laws it still has some deficiencies, which will be addressed in by-laws.

The EU sought to harmonize the water laws between both entities with one common law; however, both entities have revised the draft Water Law to fit their needs. There are no significant differences in the laws however. Passage of the water law in each entity varies as well. Currently, the Water Law is pending approval in RS. In FBiH, the draft Water Law is still in the approval process. Note, clauses for the regulation of groundwater are not included in the Water Law of either entity but are planned for inclusion in subsequent by-laws.

Water Management Institutions

In both FBiH and RS the agency with primary responsibility for the water sector is within their respective Ministry of Agriculture, Water Management and Forestry (MoAWF). Within the MoAWF, each entity has a Department of Water Management, which is responsible for the federal water strategy and policy, the issue of agreements and permits, setting of standards and regulations; ensuring compliance with laws and regulations through licensing and inspections; and overall control of Public Companies for Watershed Areas. Under the Law on Water of 1998, in FBiH MoAWF delegates the main responsibility of preparation of strategic decisions and planning to two Public Companies of Watershed areas, one for the River Sava and the other the Adriatic Sea. A Commission for coordination of water management issues between the two entities was established in 1998. Amongst other duties, the Water Commission deals with international water management projects; cooperation with Croatia and Serbia and Montenegro on water related issues as well as with the harmonization of the two entities water quality monitoring and flood protection.

As described above, the new Water Law reorganizes management of the water sector including establishment of inter-entity river basin agencies. The EU technical assistance program will finance the piloting of the new approach with two river basin bodies for Bosna and Vrbas river basins. Lessons learned from this 18-month project beginning in 2003 will be used to further development the concept.

As stated above, the inter-entity cooperation in water management is the responsibility of the Inter-entity Water Committee. The Commission's responsibilities on water resources are:

- International contracts regarding water management;
- International waterways;

- International water management projects;
- Cooperation with Republic of Croatia and Serbia and Montenegro on the water related issues;
- Harmonization of present and future regulations in water management;
- Harmonization and monitoring of water quality standards;
- Harmonization of solid waste disposal program—protection of water resources;
- Harmonization and control of laboratories' work for monitoring of water quality and water stream categorization;
- Construction and reconstruction of water management facilities on the, and in the near proximity of the entity line;
- Facilities divided by the entity line;
- Harmonization of plan documents from the field of water management for the facilities divided by the entity line;
- Gathering and exchange of data (inter-entity and international); and
- Harmonization of plans for flood protection and other extreme situations.

Another significant obstacle to the water sector has been the absence of a state (federal) level body responsible for environment and water. There is no state level organization responsible for overall management and coordination of environment and water. This has led to numerous bottlenecks and obstacles to effective international cooperation on water resources. For instance, although Bosnia and Herzegovina is party to some international conventions related to water (including: International Convention for the Protection of Birds, Convention on Fishing and Conservation of the Living Resources of the High Seas, The Ramsar Convention on Wetlands the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean the Convention of Biological Diversity; Convention on Cooperation for the Protection and Sustainable Use of the Danube River), there are at least 21 major multilateral environmental and water protection treaties to which Bosnia and Herzegovina is not yet a signatory, largely due to the absence of a state level body with this responsibility. Also, participation in important regional initiative such as the Danube Basin Agreement and the Mediterranean Action Plan is limited for Bosnia and Herzegovina to observer status due to the absence of a state level body dealing with international issues. Thus, Bosnia and Herzegovina misses out on the substantial financial support and technical assistance offered under these treaties to help them implement and monitor international procedures and standards. (Bosnia and Herzegovina is an observer to the Helsinki Convention on transboundary water and the Danube River Protection Convention. The Ministry of Foreign Affairs has been requested to ratify these conventions but no decision has been made as yet).

Like the legal framework for water, the organizational structure has been examined particularly through the EU program for institutional strengthening in the water sector and also the METAP financed study "Urgent Strengthening of Institutions". Consensus is that there should be vertical integration between the entities and the State of Bosnia and Herzegovina in environmental matters of an international nature. It is proposed in the new Law on Council of Ministers that a Committee for Sustainable Development be formed and that it be the body responsible for international water resource issues through a sub-committee for water. The new organization structure is in place and awaiting approval by the government.

Transboundary and International Water Issues

Flood management, water pollution control and water quality monitoring are all important water resource management challenges in Bosnia and Herzegovina and all require transboundary approaches. FBiH and RS have been largely ineffective in addressing these problems, particularly due to the lack of effective ties with Croatia, and Serbia and Montenegro, with whom they share key international waterways. The institutions and organizational structure of Bosnia and Herzegovina's water resource sector are different from its neighbors. Effective ties internationally may have been hindered by internal policy disputes regarding water management caused by two different water laws and water protection approaches. The new water laws in each entity, harmonized, and the application of a river basin approach to water resource management is expected to improve the internal problems with water resource management. The proposed State level body (Committee on Sustainable Development) dealing with water hopefully will provide one means for Bosnia and Herzegovina to participate in transnational water initiatives, like the Danube Basin Commission.

There are important transboundary water resource challenges as they relate to balancing competing demands and conflicting interests with environmental protection and conservation. For instance, the Neretva River and its delta are transboundary in nature. The Neretva River has significant hydropower potential and production; is an important source of water for supply and irrigation; and requires flood control. Yet some of these activities can have deleterious effect on the globally significant biodiversity and the coastal ecosystems of the Neretva Delta. The majority of the watershed is in Bosnia and Herzegovina, mostly in FBiH but some in RS, while the lowland area and delta are in Croatia. Coastal areas affected by the river are in both Bosnia and Herzegovina and Croatia. Geopolitical and administrative boundaries in the river basin on both the national (FBiH and RS) and international level make the solution of common problems and the optimal management of the river basin and coastal areas complex and difficult. Furthermore, achievement of an integrated concept of water resources management and the sustainable development of river basin and coastal areas depends on integrated plans for water resource management that, in turn, are based on sound water resource data bases. Both are missing in Bosnia and Herzegovina.

Key Issues and Challenges

Transboundary takes on added significance in Bosnia and Herzegovina where there are two separate governments and bodies of law. Historically, politically charged policy disputes have hindered progress towards sustained development of Bosnia and Herzegovina water resources. Differences in entity water management structures have also hindered effective management of water resources. Hopefully the new Water Law and the inter-entity river basin organizations it establishes, by introducing an inter-entity approach to water resource management, will overcome these obstacles and be replicated on an international basis.

Within Bosnia and Herzegovina itself, due the fact that six of the seven rivers in Bosnia and Herzegovina extend across both entities and are shared at least by two cantons, there is an obvious need to coordinate and cooperate on a inter-canton and inter-entity basis. In the recent past, the entities have differed in their environmental goals and the methods employed to achieve them, including water resource managements. Attempts to harmonize the laws and institutions are in progress but the sector is still in a state of flux. It will be a significant challenge to Bosnia and Herzegovina to implement the new body of environmental legislation. Implementation of the Water Law may be delayed. In the near future, water sector authorities in Bosnia and Herzegovina will be relatively consumed with their internal restructuring which could delay their attention to transboundary initiatives.

On a country level, a key challenge is that water supply systems cannot meet the needs of the consumers during the dry season due to a combination of inadequate availability of water resource and inadequate capacity of the infrastructure. The most important improvement measures in this field to address the key problems are modernizing the water sector including creation of river basin agencies, harmonizing water legislation between the two entities, and encouraging the participation of the private sector in the water supply and sanitation sector.

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BOSNIA AND HERZEGOVINA: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	4.31	3.98	4.28	4.24
Urban population	39%	43%	51%	54%
Rural population	61%	57%	49%	46%

Source: Aquastat database, FAO (2002).

	1990	2000	Goal for 2015
Access to piped Water Supply	n.a	72%	86%
Urban	n.a	87%	94%
Rural	n.a	60%	80%

Note: Goal refers to MDGs.

	1993	2000	Goal for 2020
Access to Sewerage	35%	37%	69%
Urban	71%	71%	86%
Rural	12%	12%	56%

Note: Goal refers to MDGs.

	1999
Share of poor in rural areas	n.a.

	1994	1995	1999	2000
GDP per capita (constant 1995 US$)	439	546	1,479	1,526
GDP total (billions of 1995 US$)	1.5	1.9	5.7	6.1
Share from agriculture	36%	25%	14%	n.a.
Share from industry	27%	26%	25%	26%

	1990	1994	1999	2000
Labor force (millions of people)	2.0	1.6	1.8	1.9
Share in agriculture	11%	n.a	n.a	n.a
Share in industry	48%	n.a	n.a	n.a

Average annual growth	1995-97	1998-00
Of GDP	48.8%	12.4%
Of population	0.1%	4.1%

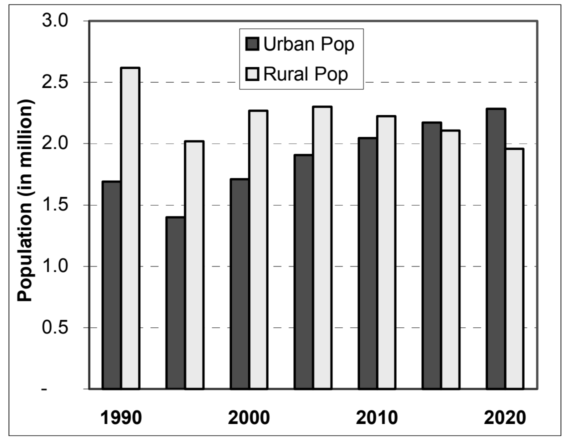
	1999
Infant mortality rate (per 1,000 live births)	13.0

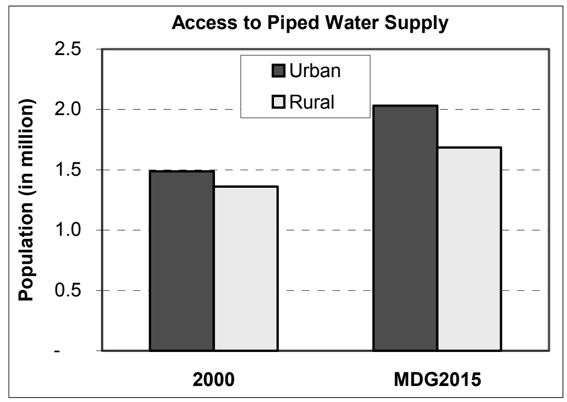
LAND AND WATER RESOURCES

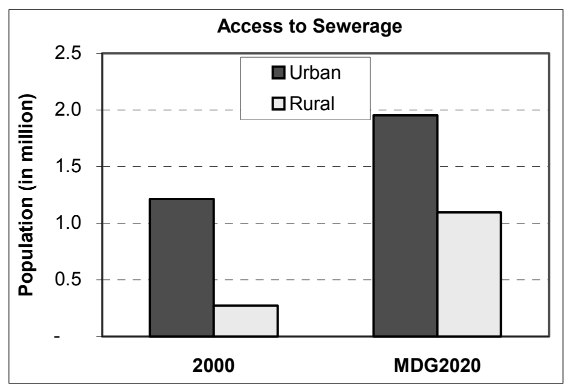
Land area (millions of ha)	5.11
Land area in international basins (millions of ha)	4.78
Percentage of country in international basins	93.5%
Average precipitation (mm)	1,375
Average total volume of rainfall (BCM)	13
Total internal water resources (BCM)	36.0
Of which surface water (BCM)	n.a.
Of which groundwater	n.a.
Overlap between surface and groundwater	n.a.
Total external water resources (BCM)	2.0
Of which surface water (BCM)	n.a.
Of which groundwater (BCM)	n.a.
Total water resources (BCM)	38.0
Of which total surface water (BCM)	n.a.
Of which total groundwater (BCM)	n.a.
Overlap between surface and groundwater	n.a.
Dependency ratio	5.3%

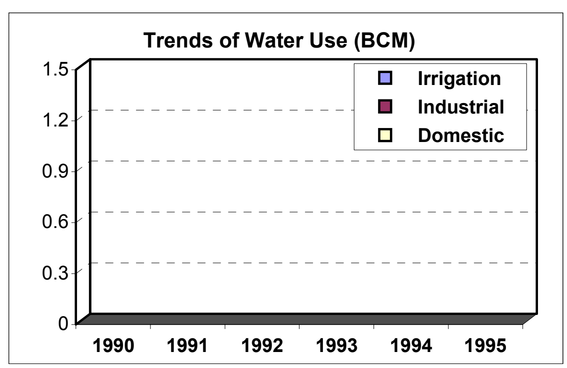
	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	8,821	9,555	8,881	8,954

	1990	1993	1994	1995
Total annual water use (in BCM)	0.8	n.a.	n.a.	n.a.
Irrigation	n.a.	n.a.	n.a.	n.a.
Industrial	n.a.	n.a.	n.a.	n.a.
Domestic	n.a.	n.a.	n.a.	n.a.



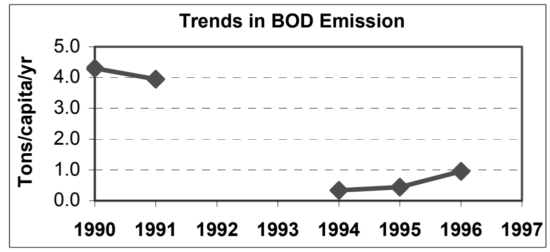






WATER QUALITY AND POLLUTION

Wastewater produced (BCM)	n.a.		
Wastewater treated (BCM)	n.a.		
	1990	**1995**	**1996**
Annual emissions of BOD per day (Tons)	50.7	4.1	8.9
Annual emissions of BOD per capita (kg)	4.3	0.4	0.9



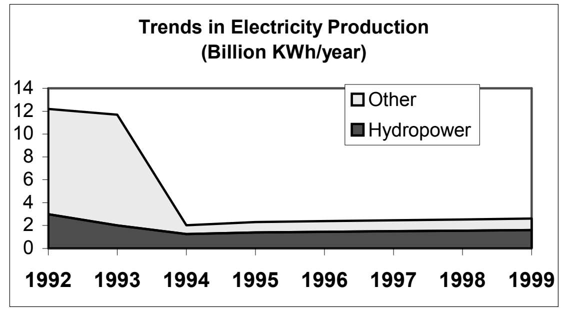
Trends in BOD Emission

AQUATIC ECOSYSTEMS

Wetlands designated as Ramsar sites (2002)	
In ha	7,411
As % of land area	0.1%

DAMS AND HYDROPOWER

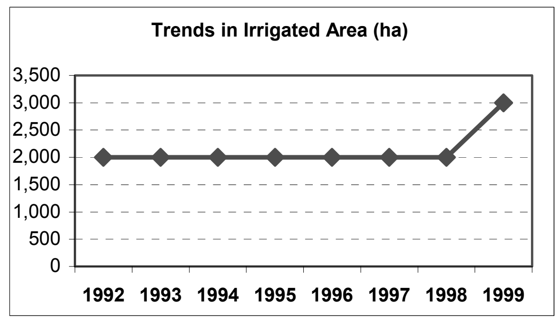
Reservoir capacity (BCM)	3.85	
Irrigation dams		
Hydropower dams		
Reservoir capacity in cubic meters per capita	968	(in 2000)
Gross theoretical hydropower potential (GWh/y)	28,000	
Technically feasible (GWh/y)	24,000	
Economically feasible (GWh/y)	19,000	
Current production from hydropower (GWh/y)	8,900	(in 2000)



Trends in Electricity Production (Billion KWh/year)

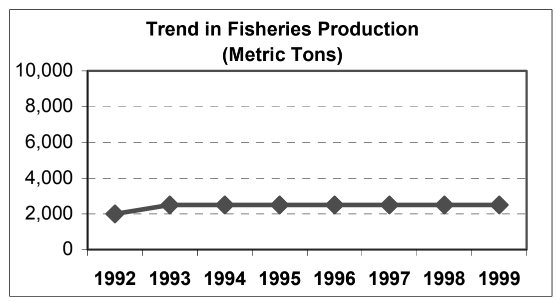
	1992	**1995**	**1998**	**1999**
Total electricity production (GWh/year)	12,200	2,321	2,538	2,615
From hydroelectric	24.6%	61.2%	61.2%	61.2%

IRRIGATION	**1992**	**1995**	**1998**	**1999**
Irrigated land ('000 ha)	2.0	2.0	2.0	3.0
Irrigated land per capita (ha)	0.0005	0.0006	0.0005	0.0008
Irrigated land as share of cropland	0.2%	0.3%	0.3%	0.5%



Trends in Irrigated Area (ha)

FRESHWATER FISHERY	**1992**	**1995**	**1998**	**1999**
Fishery production (metric tons)	2,000	2,500	2,500	2,500
Fishery production per capita (kg)	0.51	0.73	0.68	0.65



Trend in Fisheries Production (Metric Tons)

FINANCING THE WATER SECTOR		**1994**	**1995**	**1997**
Average cost recovery:				
Irrigation water services				
Municipal water services				
* These are ball park estimates.				

Average water price (US cent/m3)	**1997**
Municipal	
Industry	

BULGARIA

Socio-Economic and Geographic Context

Bulgaria is situated at the south-eastern edge of the Balkan Peninsula. It covers an area of approximately 11.1 million hectares, with a 378 km of coastline. About one-third of the country is hilly and mountainous, and its flatlands are located in the north (Danubian Plateau) and the center (Thracian Plain). Its climate ranges from continental (predominantly in winter, especially in the north and west) to Mediterranean (predominantly in summer, especially in the east and south). The average precipitation is 650 mm, but varies from 480 mm on the Black Sea coast to 1,800 mm in the mountains. Rainfall occurs mainly in summer in the North, in autumn and winter in the South and is evenly distributed during the year in the Black Sea coastline.

During the 1990's the population in Bulgaria declined considerable. In 2000, the estimated population was 7.95 million—770,000 less than the 1990 population. Bulgaria is heavily urbanized, with about two-thirds of the population living in urban areas. Historically, water resources have played a key role in the economy of Bulgaria: between 20%-30% of the cropland have been irrigated.

Water Resource Base

Bulgaria has three main hydrological drainage areas: the south extending to the Aegean Sea (42% of the total area), the north extending to the Danube (42%) and the east extending to the Black Sea (16%). For the purpose of water management, Bulgaria is divided into four basins: the Danube, the Black Sea, the Eastern Aegean Sea and the Aegean Sea. About 86% of its territory is in international basins shared with all neighboring countries: Turkey, Greece, FYR Macedonia, Serbia and Montenegro, and Romania.

Surface and groundwater resources. In general, rivers are short with the exception of the Danube. Average annual runoff from surface water streams totals 20.4 BCM, ranging from 9 BCM during a dry year to 35 BCM during a wet year. Annual groundwater availability is estimated at 6.4 BCM. Its overall water resources amount to 21.3 BCM or 2,680 m^3 per capita per year. Resources are unevenly distributed over time and space. This unbalance distribution causes shortage of water in many localities.

According to the National Environmental Strategy 2001, a change in the hydrological balance has been observed during the past decades: the average runoff for the period 1961-99 has decreased by 7% compared to that of the period 1935-84. Moreover, a 40% decrease was observed during the period 1985-95 compare to that of the period 1935-84.

Wetlands. In the past, large valuable wetlands along the Danube river were destroyed as a result of dykes and drainage works in riparian zones. The Government has developed an action plan for the restoration and protection of wetlands, and has committed to restore some of the areas that were previously destroyed for future generations. In 2000, Bulgaria, Romania, Moldova and Ukraine signed a Declaration on Cooperation to protect key wetlands and flood plain forest along the Danube as part of the Lower Danube Green Corridor initiative supported by the World Wide Fund for Nature (WWF).

Water quality. Although the quality of surface rivers improved considerably during the first half of the 1990s as a result of a reduction of industrial production in a number of industrial plants and investments in pollution control, the quality of surface water is still a serious concern. Out of the 253 monitoring stations throughout the country, 24% of them failed to meet the required criteria.

Groundwater sources are mainly used by households and to a lesser extent for industrial and irrigation purposes. Due to several years of droughts, certain zones of Bulgaria are currently relying on groundwater for irrigation. In some cases, this has led to depletion of the groundwater levels—reaching up to 4 m drop in some localities. In general, groundwater quality is reasonable good. Pollution problems exist at certain localities. Cases of pollution of groundwater with nitrates, petrol products phenols and pesticides have been registered.

Water Use and Management by Sector

Drinking water supply and sanitation. About 99% of Bulgaria population has access to piped water supply. About 88% of all settlements are supplied with piped water: 100% of cities, 84% of villages. A number of small villages (with population less than 200 inhabitants) have no piped water supply systems -- mainly in the mountain areas where few people are left as a result of migration. About 76% of the piped water is supplied from surface water, and 24% is from groundwater sources.

During the past decade, about 1.2 million of people located in about 500 settlements, who mostly depend on unregulated river sources, have experienced water rationing in one way or another. The regions of Vratsa, Gabrovo, Pernik Blagoevgrad, and Montana are the most seriously affected. Settlements close to the Rila mountain are also experiencing shortage, despite the fact that the region is characterized as water abundant. Large cities such as Vratsa, Lovech, Gabrovo, and other have experienced severe rationing—people have water 2 hours a day.

Bulgaria has approximately 30 water treatment works, and the principal form of treatment is disinfection using chlorine. In general raw quality seems to be of good quality, but has recently experienced some deterioration. In the past, a high proportion of water quality samples were in compliance with Bulgarian standards reported by the regional Hygiene and Epidemiological Institutes (HEIs). HEI reports for 1995-97, however, show that some samples from principal water sources failed to meet Bulgarian standards[2].

Some of the most pressing problems with drinking water quality are as follows. First, some water supplies in rural areas contain high levels of nitrates, which are thought to affect children's health. Average connection rate for cities (more than 2,000 inhabitants) is only 62%. This applies to 3% of the population connected to drinking water supply systems, although the problem has declined recently because of new groundwater protection zones. Second, arsenic contamination has occurred in the Topolnitza river as a result of copper enrichment operations at a plant near Pirdop, which has affected the quality of drinking water in Pazardzik (around 78,000

2 Burgas, Pazardzik, Shumen, Ruse, Jambol and Haskovo failed to pass chemical standards. Haskovo and Smoljian failed to pass microbiological standards.

inhabitants). Third, oil contamination is affecting the Pleven area (about 120,000 inhabitants). Fourth, water supply to settlements along the lower Maritsa below Plovdiv (about 160,000 inhabitants) and along the Danube (about 340,000 inhabitants) suffers from serious microbiological contamination.

In 1998, about 67% of the population was connected to the public sewerage system, and only part of the sewerage system was connected to wastewater treatment plants. As a result, about 36% of the wastewater discharged into the public system was not treated at all. Currently, only 13 out of the 28 towns with population greater than 50,000 inhabitants have wastewater treatment facilities, and only 26 towns out of the 97 towns with population greater than 10,000 have wastewater treatment plants. A National Program has been formulated for the construction of priority urban wastewater treatment plants for cities above 10,000 inhabitants. So far, little progress has been made in its implementation.

Irrigation. Until 1989, irrigation facilities were built in about 0.8-1.25 million ha. Within the irrigated area, drainage systems were constructed in 0.13 million ha. The area fit for irrigation drastically decreased during the 1990s, reaching 0.64 million ha in 1996. Irrigation was heavily depended on pumping. The degree of usability of the irrigation systems has been continuously decreasing. In 2001, actual area irrigated reached only 58,000 ha.

Water use for irrigation experienced a drastic reduction during the 1990s: from 1.2 BCM in 1991 to less than 100 MCM in 1997. The irrigation infrastructure has deteriorated because of the break up of large farms and the lack of finance for restructuring irrigation systems to meet the needs of small farmers. Average water losses in irrigation systems are 57%, reaching as much as 75% in some regions. Raising prices of irrigation has also contributed to the decline in irrigation activities. Farmers are reluctant to pay at rates ranging from USD0.01-0.085 per m^3, in particular when the irrigation systems are not functional.

Institutional factors have contributed to the abandonment of the irrigation systems. First, the irrigation systems were built to serve large production units, but now the systems are supposed to provide water to many farmers. The system cannot respond to the various demands. Second, clear mechanisms to enforce property rights relations are lacking at the local level. While the legislation is in place to transfer irrigation facilities to water users who are willing to undertake their management, the irrigation infrastructure is still controlled by the state or local municipalities. Third, the irregularity of water supply together with the instability of agricultural prices has contributed to the abandonment of irrigation systems. Fourth, although water shortage has not contributed to the decline in irrigation water use, it is expected that this would play an important role in the near future.

There are plans to rehabilitate economically viable schemes that are managed by water users associations, responsible for the networks and crop selection. The long-term target is to restore about 400,000 ha irrigated land.

Hydropower. The gross theoretical hydropower potential is 26,400 GWh/year, while the technically feasible potential is 15,000 GWh/year. About 30% of this potential has been developed so far. According to recent assessments, most of the hydropower potential—about 90% -- is concentrated in the southeast region. Hydraulic infrastructure has impacted the aquatic ecosystems in reservoirs and downstream. There are plans to build a new dam on the Arda river in cooperation with Turkey.

Floods and Droughts. Bulgaria has had a number of serious floods in the past. Intense summer storms, which are most probable from May to August, are an important cause of flooding, as is snowmelt (January to March) especially when accompanied by rainfall or snowfall, and ice blocking, a significant cause of flooding of the Danube. Flood damage generally comprises destruction of residential and farm buildings, roads, crops, domestic animals, and loss of reservoir capacity because of accumulated alluvium, and sometimes destruction of railway routes.

The riverside lowlands by the Danube are especially flood-prone, as are the fields and valleys near the mouth of the Danube and the Black Sea rivers, and the Upper Thracian and Burgas lowlands. The flood of the Danube in 1942 (caused by ice blocking) caused damages estimated at USD100 million, affecting about 19,000 people and damaging more than 4000 buildings. Among the floods of the smaller rivers, the Rositza flood of 1939 (caused by torrential rainfall) caused about USD25 million in damage and caused 47 casualties. The floods of 1957 (caused by heavy precipitation over several river basins) affected most of Bulgaria's river systems but were catastrophic along some rivers, the Maritsa in particular. This event flooded 52 towns and villages, destroying more than 3700 buildings, 31 railroad bridges, affecting 840 families and drowning six people. Damage was estimated at about USD100-150 million, 0.5% of national income.

From 1977 to 1988, compensation paid for floods was on the order of USD40 million. From 1993 to 1998, 120 floods were recorded, especially within the areas of the following towns: Montana, Vratsa, Gabrovo, Veliko Turnovo, Varna, Bourgas, Smolyan, Kurdjali and Plovdiv, among others. The total flood damages between 1990 and 2001 has been estimated at USD56 million. In the last 15-20 years, there has been a declining trend in flooding, apparently a consequence of a downturn in rainfall and overall water resources in some basins. However, weaker and locally calamitous flooding still occurs.

A program of river regulation and flood protection works was undertaken over the last half-century. More than 2000 reservoirs now regulate the water regime, with a joint capacity of more than 37% of mean annual river runoff. In the last decade, however, observations have been suspended at a number of the system's hydro-meteorological observing stations, even in significantly risky areas. Moreover, micro-dams built in 1950-1965, originally constructed to unreliable safety standards, are now poorly managed or totally abandoned. These now pose a growing risk of inundation.

Bulgaria is prone to droughts. One of the main features of the climate in the Danube Plain is insufficient precipitation, leading to dryness and frequent droughts. Droughts were very frequent during the last century and created many conflicts among water users and large losses to the agriculture sector. The country experienced several summer droughts, the most severe were registered in the 1980s (the driest decade of the century) and the 1940s (second driest decade). A decreasing trend in precipitation, particularly during the crop-growing season, has been observed since the end of the 1970s. The climate in Bulgaria has become drier in recent years. Between 1984-93, the country experience more than 5 drought years. The summer drought of 1993 affected the agriculture sector. Crop losses caused by the drought were estimated at USD260 million (2% of GDP). The summer of 1996 was characterized by precipitation deficit during the crop-growing season, which led to considerable decrease in yields of major agriculture crops, which in turn affected food supplies. In 1996, maize and wheat grain annual productions amounted 44% and 50%, respectively, of the average productions during the period 1961-90. Similar losses were experienced during the drought of 2000.

Continuous droughts have also impacts water supplies for drinking purpose. In 1994, the drought caused the dried up of all reservoirs feeding Sofia—at the time, water was supplied 24 hours every three days and the Government was contemplating cloud seeding to bring rain into the region. In 2000, about 450,000 experience rationing water because of the drought. Plans are under way to build six new dams (estimated cost USD22 million) to overcome water shortage.

Water Legislation and Policies

In 1997, a Strategy for Integrated Water Management was drafted for the period of 1997-2002. Although the Strategy provided a good basis of the institutional reform of the water sector, the lack of financial resources and technical capabilities prevented its implementation. Nonetheless, the most important step forward has been the adoption of a new Water Act in July 1999, which entered into force in January 2000. The New Water Act replaces the old Law for the Waters of 1969, meets both the national requirements, and is in line with European Union legislation.

The Water Act has changed fundamentally the way water is managed in Bulgaria. According to the new Water Act, waters in Bulgaria should be managed as a common, national and indivisible natural resource; and individual river basins are to be managed in an integrated way. The Water Act includes the elements on the planning; identifies four natural river basins; introduces the principles of water management based on river basins; calls for the establishment of water management directorates, river basin councils; call for the preparation of river basin management plans and a National Water Economy Plan. On the basis of the New Act, a licensing system was established for the use of water and water facilities. This system includes: licenses for the use of surface and ground waters; licenses for the use of water facilities such as the drinking water infrastructure, protection against floods, fish ponds, etc.; licenses for activities that may have an impact on the natural state of the resource base; and licenses for the discharge of wastewater.

The Water Act introduces a natural resources fee for the use of water and water facilities for business purpose[3]. This fee is payable by the holder of the license for the volume of water removed from the source where consumption is measured.

The effective implementation of the Water Act requires the preparation and adoption of a series of regulations and corresponding implementing acts, some of which are currently under preparation (e.g., for improvement of permitting system, development of regulation system for tariff setting in water services, monitoring and upgrading of laboratory facilities, among other); and institutional changes within the various institutions managing water.

3 When the use is for personal purpose, the fee is zero. Personal purpose has a narrow definition: amount of water taken can not exceed 0.2 liters per second and 10 cubic meter per 24 hours, when the water is used within the plot; or 0.20 ha with no more than 3,000 cubic meter per ha. .

Water Management Institutions

The new Water Act provides the institutional framework for water resources management at the national basin and sectoral levels. At the national level, the water management bodies are the Council of Ministers and the Ministry of Environment and Water. Representatives from the following institutions take part in the Council sittings: The Ministry of Environment and Water, the Ministry of Regional Development and Public Works, the Ministry of Agriculture and Forests, the Ministry of Industry, the Ministry of Transport and Communications, the Ministry of Health, the Ministry of Finance, the Ministry of Energetic and Energy Resources, the Bulgarian Academy of Science, municipalities, non-government organizations.

At the basin level, the water management bodies are the Directors of the four basin directorates. At each of the basin, four basin councils will be established, which will include representatives of the state administration, the municipal administration, the water users, NGOs, and scientific organizations. Four basin directorates were established in January 2002.

At the sectoral level, the Ministry of Agriculture and Forestry is responsible for the management of irrigation water and maintaining irrigation, drainage and flood control facilities. The Ministry of Regional Development and Public Works is in charge of implementing national policy for public works, in particular the development of water supply and sewerage systems. The Ministry of Transport is in charge of the control passenger and cargo traffic on the Danube River and Black Sea. The Ministry of Health controls the quality of drinking water and bathing water jointly with the Regional Hygiene Epidemiological Inspectors.

Now that a modern institutional framework for the management of water resources is in place, the challenge ahead is continuing strengthening water management efforts, in particular improving capacity and technical competence and public-participation in the decision-making process.

Transboundary and International Water Issues

Although only 1% of Bulgaria's renewable resources come from neighboring countries, about 86% of its territory is within international river basins. As a results, transboundary water issues are of particular concern to Bulgaria. Discharges from Bulgaria national territory reach the Danube River, Black Sea and the Aegean Sea. Due to limited affordability and lack of public resources, Bulgaria has lagged in the construction of new wastewater treatment facilities. According to available statistics, about 785 MCM of wastewater were discharged in 2001, out of which 56% was in complying with national standards, 6% was partially treated and 30% was discharged without treatment. In 1992, Bulgaria signed the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes, and in 1999, the Protocol on Water and Health.

At present, particular attention is being given to the water quality protection of the Maritsa River. This is a transboundary river and pollution from upstream has created international problems. This region of southern Bulgaria comprises about 20% of the area of the basin, and is home for about 25% of the total population. In addition, it is an important industrial region generating pollution that flows downstream into Greece.

After decades of negotiations, in 1996 an agreement was signed between Bulgaria and Greece on the use of the Nestos River. The agreement provides for Greece to use 29% of the average annual flow of the Nestos River for 35 years.

A joint monitoring program of the River Struma by Bulgarian and Greek experts was established in 1999 after the signing of a bilateral agreement between the two countries.

The solution of acute environmental problems on the Timok River, which is heavily polluted by mining activities in Serbia and Montenegro, whose waters are used for irrigation purposes, requires of bilateral agreements with FYR Macedonia and Serbia and Montenegro.

Key Issues and Challenges

The water resource management sector us undergone fundamental change in its legislation, policy and institutional framework in recent years. It will be essential to build the capacity of young water institutions so they can effectively implement the new Water Act. It is recommended that Bulgaria adopt a participatory planning approach when developing the river basin management plans and create good water balance in each river basin. The country should invest in awareness-raising campaigns to engage stakeholders in the planning process and gain their support for the implementation of the action plans. It should investigate the causes for the low utilization ratio of irrigation systems and its impacts on the rural poor, and assess the viability of rehabilitating the existing system.

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BULGARIA: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	8.72	7.95	6.82	6.47
Urban population	66%	67%	69%	71%
Rural population	34%	33%	31%	29%

Source: Aquastat database, FAO (2002).

	1990	2000	Goal for 2015
Access to piped water supply	98%	95%	97%
Urban	100%	100%	100%
Rural	94%	84%	92%

Note: Goal refers to MDGs.

	1995	2000	Goal for 2020
Access to sewerage	58%	67%	84%
Urban	n.a	90%	95%
Rural	n.a	20%	60%

Note: Goal refers to MDGs.

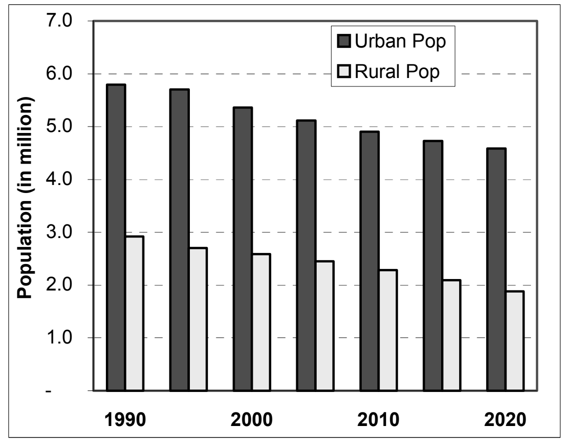
	1997
Share of poor in rural areas	43%

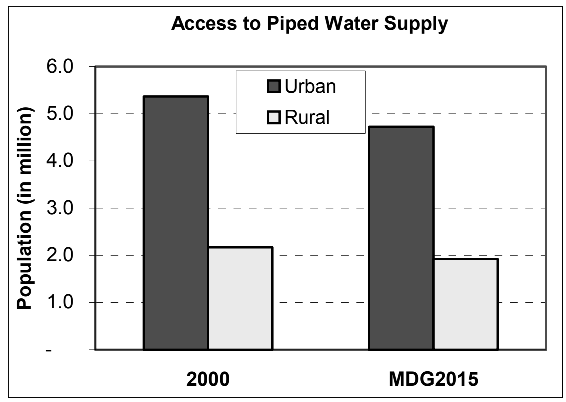
	1990	1994	1999	2000
GDP per capita (constant 1995 US$)	1716	1503	1443	1544
GDP total (billions of 1995 US$)	15.0	12.7	11.6	12.3
Share from agriculture	18%	11%	17%	n.a.
Share from industry	51%	33%	27%	28%

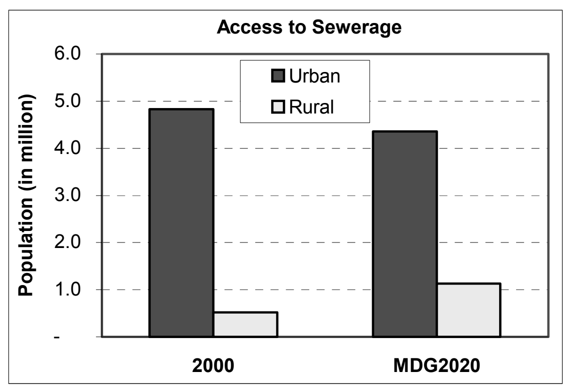
	1990	1994	1999	2000
Labor force (millions of people)	4.4	4.3	4.2	4.2
Share in agriculture	19%	23%	n.a	n.a
Share in industry	44%	35%	n.a	n.a

Average annual growth	1991-97	1998-00
Of GDP	-4.2%	3.6%
Of population	-0.7%	-0.6%

	1999
Infant mortality rate (per 1,000 live births)	14.6





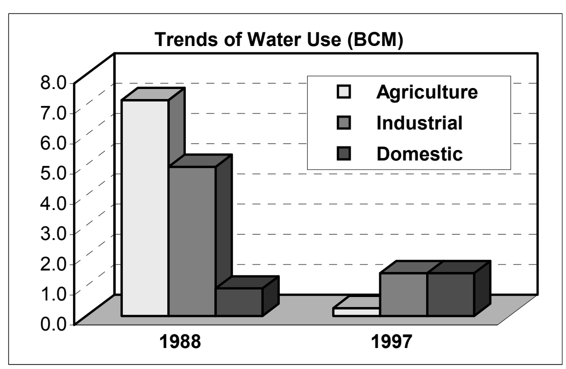


LAND AND WATER RESOURCES

Land area (millions of ha)	11.09
Land area in international basins (millions of ha)	9.52
Percentage of country in international basins	85.8%
Average precipitation (mm)	681
Average total volume of rainfall (BCM)	76
Total internal water resources (BCM)	21.0
Of which surface water (BCM)	20.1
Of which groundwater	6.4
Overlap between surface and groundwater	5.5
Total external water resources (BCM)	0.3
Of which surface water (BCM)	0.3
Of which groundwater (BCM)	0.0
Total water resources (BCM)	21.3
Of which total surface water (BCM)	20.4
Of which total groundwater (BCM)	6.4
Overlap between surface and groundwater	5.5
Dependency ratio	1.4%

	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	2,443	2,680	3,125	3,294

	1988	1997
Total annual water use (in BCM)	13.0	3.1
Agriculture	7.2	0.3
Industrial	4.9	1.4
Domestic	0.9	1.4



WATER QUALITY AND POLLUTION	1990-91	1998		
Wastewater produced (BCM)	1.73	1.14		
Wastewater treated (%)	42%	57%		
	1990	**1994**	**1997**	**1998**
Annual emissions of BOD per day (Tons)	149.4	99.0	103.1	107.9
Annual emissions of BOD per capita (kg)	6.3	4.3	4.6	4.8

AQUATIC ECOSYSTEMS

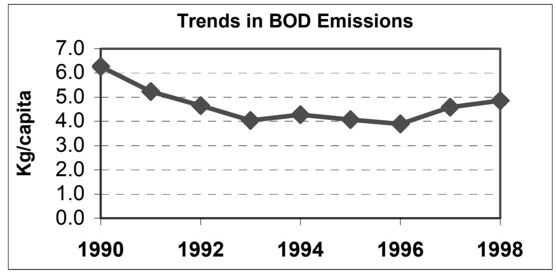
Wetlands designated as Ramsar sites (2002)		
In ha	20,306	
As % of land area	0.18%	
DAMS AND HYDROPOWER		
Reservoir capacity (BCM)	5.0	(15-30% natural runoff)
Irrigation dams	3.0	
Hydropower dams		
Reservoir capacity in cubic meters per capita	629	(in 2000)
Gross theoretical hydropower potential (GWh/y)	26,400	
Technically feasible (GWh/y)	15,000	
Economically feasible (GWh/y)	12,000	
Current production from hydropower (GWh/y)	3,300	(in 2000)

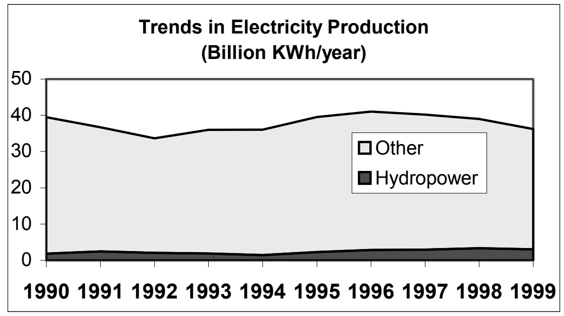
	1987	1990	1995	1999
Total electricity production (GWh/year)	40,916	39,449	39,569	36,217
From hydroelectric	6.14%	4.71%	5.79%	8.35%
IRRIGATION	**1992**	**1995**	**1997**	**1998**
Equipped Irrigated land ('000 ha)	579	673	636	582
Irrigated land per capita (ha)	0.07	0.08	0.08	0.07
Irrigated land as share of cropland	29%	18%	18%	18%
FRESHWATER FISHERY	**1992**	**1995**	**1998**	**1999**
Fishery production (metric tons)	32,118	12,806	23,198	18,336
Fishery production per capita (kg)	3.73	1.52	2.85	2.28

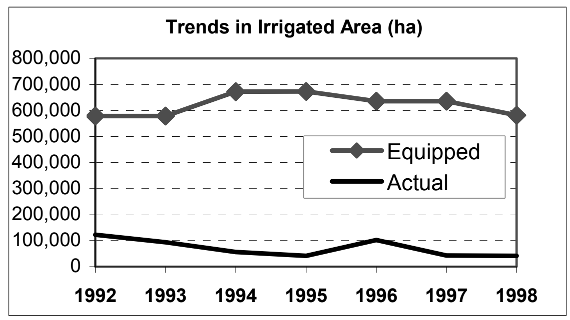
FINANCING THE WATER SECTOR

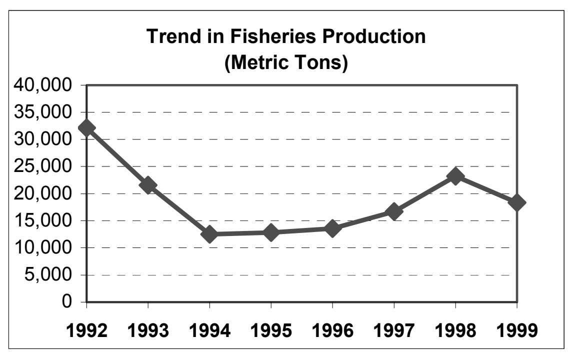
Average cost recovery:		
Irrigation water services	8%-47%	Overall costs
Municipal water services		
* These are ball park estimates.		

Average water price (US cent/m3)	1999-00
Water domestic users	31.2
Sewerage	8.5
Combined water, sewerage and treatment	50.0
Irrigation	1-8.5









CROATIA

Socio-Economic and Geographic Context

Croatia (with a total area of 5.65 million hectares) consists of two distinct geographical regions: the Danube Basin within the Black Sea catchment area (3.44 million ha or about 60% of the total area) and the Mediterranean region (2.21 million ha), which includes the Adriatic Sea coastline. The two regions are separated by mountains. Croatia's climate varies from mild, rainy winters and dry summers in the Mediterranean region, with precipitation ranging between 500 mm to 1,500 mm; to colder winters and more precipitation in the Northern and eastern parts of Croatia. The average precipitation is 1,080 mm.

Croatia's population was 4.65 million in 2000. Less than half of the population (42%) lives in rural areas. The tourism industry, whose success depends on the Adriatic Sea coastline and the offshore islands, contributes significantly to the economy and generates about 85% of Croatia's foreign exchange.

Water Resource Base

For the purpose of water management, Croatian territory is divided into four hydrological basins plus the Zagreb Metropolitan Area. These basins are the Sava River Basin, Drava and Danube Basin, Dalmatian Basin and the Littoral and Istria Basin.

Surface and groundwater resources. Croatia can be considered a water-abundant country. Its overall renewable resources amount to 71.4 BCM or 14,900 m^3 per capita, out of which about 60% are generated within Croatia and the remaining from upstream countries (namely, Slovenia, Austria, Bosnia and Herzegovina and Hungary). Resources are unevenly distributed throughout the country.

The major water resource is surface water, which is found in 20 rivers; 26 natural and artificial lakes; and the Adriatic Sea. The major water courses total 6,829 km. Most rivers flow into the Danube or one of its tributaries. The Danube river (coming from Hungary) flows through Croatia over a length of 188 km. The Drava and the Sava Rivers (both coming from Slovenia), which are the major tributaries to the Danube, flow through Croatia over 562 km and 505 km, respectively. Many rivers serve as borders with neighboring countries, e.g. the Dragonja, the Mura and the Drava, the Danube, the Korana, the Kupa, the Sutla, the Sava and the Una. The only transboundary rivers are the Bosut and the Neretva. The largest rivers belong to the Black Sea catchment area and the shortest to the Adriatic catchment area. The karst rivers such as the Mirna, the Raša, the Lika, the Gacka, the Zrmanja, the Krka and the Cetina provide mean annual volumes of water of some 10 BCM.

There is a significant seasonal and annual variability in river runoff. The year-to-year variability of annual runoff is very high. In dry years, the annual runoff is less than on quarter (21%) of the average year flow. The situation is more severe in the Adriatic basin. In addition, because of its geomorphology and its climate, Croatia is very prone to water damages, namely floods. In order to address distributional and seasonal fluctuations and meet the demands of households, industry and tourism, storage reservoirs (1.53 BCM) and long transmission mains were constructed.

The total surface area of natural and artificial lakes over 0.2 km² is approximately 81 km². The most famous natural lakes are the Plitvice Lakes representing a watercourse of the Korana River, which turned into a series of 16 cascading lakes with numerous travertine downstream beds in a vivid biodynamic process. This area is a natural park and included in the UNESCO World Cultural and Natural Heritage List. Lake Vransko near Biograd with the surface area of 30.7 km² is the largest natural lake in Croatia. The Vransko Lake on the Cres Island, 74 m deep, is the largest natural freshwater accumulation in the North-Adriatic region.

Croatia's coast of the Adriatic Sea is 5,835 km long, of which more than 1,000 of islands account for 4,058 km. Its territorial waters cover 31 km². The coastal regions are characterized by a large variety of flora and fauna, including numerous endemic species. Due to the mountain chains the catchment area of the eastern coast is very limited, so that only a small volume of freshwater from Croatia (20% of Croatia's rivers by the volume of water) drains to the Adriatic Sea.

Fishponds are an important water surface in Croatia. In the continental part of Croatia there are numerous carp fishponds with the surface area of some 131 km² and a volume of 400 MCM of water. the Sava catchment area there are 12 warm-water fishponds (surface areas ranging from 100 to 2,330 ha by individual sites) totaling 8,965 ha for which it is necessary to provide 283 MCM of water (yearly).

In the Drava and Danube catchment areas there are 4 warm-water fishponds with a surface area between 100 and 1,230 ha and 14 fishponds from 5 to 100 ha. The total surface area of the fish ponds mentioned is 4,083 hectares and their need for quality water amounts to 104.7 MCM. There are also 14 cold-water fishponds (for trout farming) with a surface area of 8 ha where 52 tons of fish per hectare are produced yearly.

Mineral and thermal waters used in Croatia for medicinal and recreational purposes and for drinking are insufficiently exploited resources. There are 11 thermal health resorts. A total of 7.0 MCM mineral water are used yearly, of which 0.3 MCM are sold on the market.

Groundwater resources are also abundant and represent about 20% of the total renewable resources. In the Sava and Drava basins, groundwater can be found in water-bearing strata in areas with alluvial formation. Karst formations predominate in the Dalmatian, Littoral and Istria Basins. Water from underground fissures appears on the surface as Karst springs. Despite the water abundance, there are quantity problems at key localities such as the Adriatic islands, which have poor water resources. They continuously experience water shortages during summer. In addition, a slightly decrease in the water table has been observed in the aquifer below Zagreb and an important one in the Drava river aquifer—4 m over 20 years.

Wetlands. The Lonja Plains Nature Park is situated in the central part of the Republic of Croatia and borders on the slopes of the Moslovačka Gora mountain and the Zagreb-Slavonski Brod motorway in the north and on the river Sava in the south. The Kopački Rit Nature Park is situated to the north-east of the Republic of Croatia, in the area called Baranja, an angle formed by the rivers Drava and Danube. The surface area of 177 km² is interspersed with numerous canals, ponds and lakes surrounded by willow groves, poplar and oak forests and other plant habitats. It lies on the border between two climatic areas—the continental climate of the Central-European type and the continental climate of the Pannonian plain. Kopački Rit is the best preserved and the most important floodplain of the Danube catchment area and an important factor for conservation of globally and regionally threatened species:

Croatia has a wealth of wetland habitats particularly those whose origin is connected with rivers. The most important areas are flood zones of the Sava, Drava, and Danube basin in which extensive and for the most part well-preserved wetland habitats have developed, two of which are included in the Ramsar list of wetlands of international importance: Lonjsko Polje and Kopacki Rit. Lonjsko Polje is in the central course of the Sava River. It is 506 km^2. This large lowland floodplain of the river Sava together with its tributaries Lonja, Struga, Pakra, Ilova, Trebež, Česma and many smaller streams make this natural landscape one of the most valuable wetland areas in Europe. Kopacki Rit has an area of 177 km^2 and is located at the mouth of the Drava River into the Danube. It is the best preserved and the most important floodplain of the Danube catchment area and an important factor for the conservation of globally and regionally threatened species. A third wetlands of global significance, and a Ramsar site, is the delta of the Neretva River located at the mouth of the Neretva River on the Adriatic Sea. The majority of the Neretva River (195 km out of a total length of 220 km) lies in Bosnia Herzegovina. The delta itself is shared by Croatia and Bosnia and Herzegovina. The delta wetlands cover 200 km^2 with 120km^2 located within Croatia.

Along the entire Croatian coastline there is a series of smaller wetlands.

Water Quality. Croatia has a systematic program for monitoring the quality of surface waters (rivers, lakes and storage reservoirs) and groundwater (water springs). It is conducted by 15 authorized laboratories, including the Main Economic Laboratory of Croatian Waters at 454 measuring stations. Despite a comparatively well distributed measuring network the existing monitoring could be improved.

The quality of groundwater is generally considered good throughout the country. Only a few number of cases of pollution have been reported. Nitrate pollution has been reported in Istria during the period of fertilizer spreading, but the standards are still met. The situation is serious in the upper Drava aquifer, where nitrate concentrations are constantly reported higher than Croatian standards for drinking water. In the case of surface water, the reduction of industrial activity and the drastic decline in the use of fertilizers and pesticides in agriculture have considerable eased the pollution on water sources. The quality of rivers in the Pannonian watershed is normally a level lower than that desired due to bacterial pollution. The worse situation is encountered in the Sava River. Waters downstream of Zagreb are bacteriologic ally polluted. Algae blooms are not uncommon in some locations mass fish kill takes place specially during the summer season. The Drava and the Mura rivers are of poor quality before they enter Croatia. Danube waters are of relatively good quality In the Istrian and Dalmatian Littoral basin, rivers are mostly very clean upstream, but deteriorate considerably downstream due to untreated wastewater discharges.

The reports on the state of the sea and its water quality (the Northern Adriatic, the areas of Zadar, Šibenik, Split and Dubrovnik) indicate that a considerable part of the Croatian portion of the Adriatic Sea is still oligotrophic and clean. This is partly due to the fact that in the past decade there was a considerable decline in the industrial production in the Adriatic coastal region as a consequence of the transition process. At the same time the number of tourists went down considerably, thus reducing the amount of urban pollution. However, the ports of big cities and the industrial zones along the coast are often polluted by organic and inorganic substances of which petroleum hydrocarbons are the most noticeable pollutants. The sources of marine pollution are inhabitants (urban areas), tourism, maritime transport, industry, agriculture, cattle breeding and discharges of polluted waters from rivers and ground waters.

Water Use and Management by Sector

Total water use was estimated at 1.82 BCM in 1996, with water for industry and cooling accounting for 53%. Industrial water (0.26 BCM) is abstracted from surface sources, and the rest comes from the public supply system. Cooling water (0.7 BCM) goes mostly for electric production as well as the chemical and refining industries. Public water supply accounting for 29% or 0.53 BCM and is predominantly drawn from groundwater and springs. Irrigation is almost negligible, accounting for less 9 MCM. Fish and fish breeding in fish ponds are well developed in Croatia and the related water use accounts for 17% of total water use.

Drinking Water and Sanitation Coverage. Between 1991 and 2000, population with access to public water supply increased from 62% to 73%. There are significant differences in service delivery regionally. In addition, during the summer season, both areas the high karst region and the islands in the Adriatic Sea experience shortage of drinking water. Significant numbers of people still take water from local sources such as shallow wells, collect rainwater and during the summer are served by tanker trucks. About 50% of the shallow wells are at risk of microbial contamination.

Sewerage coverage is 52% countrywide, and shows considerable regional variation. Combined sanitary and rainwater systems predominate in the city centers with systems that are more than 50 years old. About 15% of the population is connected to primary and secondary treatment plants. In rural areas wastewater flows to septic tanks. In 1997, only 21% of total municipal wastewater was treated—about 81% was subject to mechanical treatment, about 6% was biologically treated and 13% was pre-treated industrial discharge. Large quantities of untreated wastewater are discharged directly into the sea and rivers, causing the contamination of recreational wasters. The level of health risk in the tourist areas along the coast is high.

Industry is supplied by water partly from the public water supply system and partly by its own water abstraction facilities. The volumes of water abstracted by the industry itself are estimated at about 300 MCM yearly. Due to the decline in industrial production there is also the trend towards the reduction of the water volumes abstracted.

Irrigation and Drainage. Until 1990, irrigation systems were built on 5,420 ha of agricultural land. This represents 0.8% of the total agriculture land that requires irrigation. Irrigation has received considerable importance in the economic development plan as part of the development of multipurpose water management systems. The recent drought events, which put in question the viability of conventional crop farming in Croatia[4], have prompted the government to study the irrigation sector in more detailed. The constant increase in population, the relatively low availability of land, and constant loss of agricultural areas due to urban development are also calling for the expansion of irrigation to increase the crop yields. It is under consideration to expand irrigation systems to 160,000 ha by year 2025.

4 Both Slavonia and Baranja have been experiencing severe droughts—60% of the years were dry.

Until 1990, basic drainage by open drains was carried out on 0.6 million ha. A large portion of the country is subject to excessive humidity—about 1.8 million ha. About 62% of the area is covered with drainage systems, but the infrastructure has deteriorated since the 1990s as a result of the war, the uncertainty of land tenure changes and shortage of financial resources.

Hydropower. In 1986, the gross theoretical hydropower potential in Croatia was estimated at 20,000 GWh/year, the technically feasible potential at 12,000 GWh/year and the economically potential at 10,500 GWh/year. So far, about 51% of the technically feasible potential has been developed and there are plans to expand the current hydropower capacity. On average hydropower supplies about 54% of power production in the country. Artificial lakes have been created as storage lakes for hydropower plants, for water supply, protection against floods and several other purposes. Artificial lakes have a total surface area of 68 km^2 and the useful volume of water totaling 1.5 BCM.

Floods. As a consequence of high precipitation, some areas of Croatia are subject to frequent flooding, whether flash floods, groundwater/overspill of water channels in river valleys, or flooding of poljes. Flash floods are most likely to occur during the season of high intensity precipitation, from May to September, groundwater floods from November to March, flooding of poljes in karst from October to April.

Zagreb is regularly flooded. The low-lying part of the city is flooded by the Sava River, the upper town by flash floods originating in storm torrents from the Medvednica Mountains, and the central part by flash floods when the city sewage system fails to drain overspill from the six creeks in city center. (Seventeen flash floods were recorded in Zagreb in the 20th century.) The Sava River flood of 1964 killed 17, required evacuation of 40,000, and cost about USD100 million. The flood of 1989 (a flash flood) killed five, required evacuation of 5000, and did damage estimated at USD25 million.

Damage caused to Zagreb by Sava River flooding is expected to be lower in future as a result of a program of flood control, now about half complete, which diverts the Sava in flood to uninhabited areas naturally exposed to flooding, where inundation is ecologically valuable for conservation of the relief basins' natural landscapes. Part of this area has been designated the Lonjsko Polje Nature Park. It appears the new system prevented the Sava River flood that damaged Slovenia in November 1990 from causing major flooding in Zagreb, potentially worse that that of 1964. When complete, the flood control system is expected to protect not only Zagreb but also the Central Posavina region, which was flooded three times during the 1990s.

A system of reservoirs in the Medvenica mountains is designed to limit flood damage from storm torrents. The system is not complete. Flash floods continue to recur in Zagreb (the most recent was in 1998) due to inadequate drainage in the city center.

Other areas which flood are: the town of Karlovac is regularly flooded by the Kupa River; Vukovar and Osijek were flooded in 1965 and agricultural production was devastated; the Istria peninsula is subject to floods and experienced catastrophic high water in 1993 that did damage estimated at USD30 million. Split, Rijeka, Šibenik and Dubrovnik are subject to frequent flash floods. The Vrgorsko Polje has flooded three times in the last twenty years. The small karstic North Adriatic islands also flood: besides destruction to urban areas, one tourist lost his life during the flood of 1990.

In general, the view of combining the multipurpose use of river streams with flood protection objectives tends to prevail in Croatia. Most of the protection works have been built following this view.

Water Legislation and Policies

Overall legislation on water management consists of two laws, the Water Resources Management Act issued in 1995 and the Water Management Financing Act, and 36 regulations and secondary legislation (as of April 4, 2001).

The Water Resources Management Act. It lays the institutional framework for water management activities, regulates the legal status of water and its ownership; the various means in which water is managed; assigns responsibilities to various levels of government, local authorities and legal subjects; and establishes a water agency—the Croatian Waters company of Hrvatske Vode .

The Water Act introduces the concept of managing water at the basin level, by dividing Croatia into four water basins or territorial units for water management purposes (which contain one or more catchment areas of minor watercourses and include both surface and groundwater) plus the city of Zagreb as and independent unit. It also provides for the regulation of watercourses and the protection against the negatives effects of flood and declares that the provision of tap water to the population has absolute priority over any other water use. With regard to pollution protection, the Water Act regulates the protection of wells, aquifers and well-inflow areas, by setting up sanitary protection zones around sources of water used for public supply. It declares that these sanitary zones are under the responsibility of the municipalities.

The Water Act requires the preparation of 20-year development plans for each of the five water management areas. These plans should specify the needed investments to meet the water management objectives. The first water plan for the management of the Sava River basin is currently under preparation.

The Water Management Financing Act. In turn, this Act regulates and assigns responsibilities for fundraising authorities for the financing of water management activities. It covers the funds for the cost of the administration of water management, maintenance of existing facilities and planning and investment in new facilities. In addition, the Act identifies funding sources. The principle that the beneficiaries of water management activities should pay in relation to the benefits received is the foundation of the Act.

Water Management Institutions

The two government institutions that have direct responsibility for integrated water management in Croatia are: the State Water Directorate and the Croatian Waters company Hrvatske Vode. In addition, there is a parliamentary committee and the National Water Council, which were established by the 1995 Water Act to discuss policies, strategies and implementation of laws regarding water management. These bodies however are not active yet.

The State Water Directorate (SWD). This body is responsible for administrative and other issues related to integrated management of water resources and water management systems and for incorporating water resources management and development issues within the overall economic development framework. Within the sphere of water pollution, the State Water Directorate is responsible for the protection of water sources from pollution and the protection of the sea from land-based pollution sources. In addition, SWD is responsible for planning and coordinating the development and construction of large water supply, sewage and wastewater systems; and for the monitoring of water resources. The SWD proposes to the Government the level of water use fee and water protection fee, which would be incorporated to the total price of delivered water.

The Croatian Waters Company. It has overall responsibility for carrying out activities related to the management of national and local water sources. It acts in close collaboration with local enterprises in the catchments areas and coordinates and finances the implementation of surface water quality program by authorized laboratories. It performs public services and other tasks as defined in the water management plan and in accordance with the funds provided for such purposes. The SWD supervises the work of Croatian Waters company.

Other Institutions. The sectoral ministries that have also an important role in water management and that should be included in any discussions related to integrated water management are:

- The Ministry of Environmental Protection and Physical Planning is responsible for issues related to general environmental policy, for correlation of water issues with other environmental issues and for harmonization of regional physical development and planning.

- The Ministry of Agriculture and Forestry is responsible for agriculture, food and tobacco industry, dealing with producing, market and use of the products for agricultural production (fertilizers, pesticides, etc).

- The Ministry of Health is responsible for the Public Health Institutes, who in turn are responsible for monitoring and control of waters and wastewaters.

- The Ministry for Public Works, Reconstruction and Construction is responsible for development of strategic infrastructure projects and investment programs of national interest.

- The Ministry of Economy, Ministry of Tourism, and Ministry of Finance also participate in any discussion related to water resources management.

On the local level, municipal and county governments are responsible for the design and implementation of infrastructure projects including water supply and sewerage/waste water treatment systems.

Transboundary Issues

Non-point agriculture pollution sources in Slovenia, Hungary and Austria have transboundary effects on the Drava River as its flow into Croatia. Its water regime is being affected by the construction of hydropower plans in Slovenia, Hungary and Austria. Hazardous waste disposal at Gyor in Hungary has transboundary impacts on the Danube basin.

The Sava basin is polluted by wastewater and non-point agriculture sources in Bosnia and Herzegovina and Slovenia. The nuclear power plant on the border with Slovenia is another source of pollution. Croatia, in turn, contributes to the pollution of the Sava basin with loads of nutrients from industrial and municipal waste without treatment and agriculture runoff.

Croatia is especially active with neighboring countries in issues related to freshwater bodies. Croatia is an active member of the International Commission for the Protection of the Danube River. In addition, Croatia has entered into bilateral arrangements with its neighbors to jointly manage shared waters. For example, a joint Croatian-Hungarian Water Management Commission was established in 1994 to address water management issues in the Drava, Mura and Danube. Several sub-commissions were established to deal with pollution control, and water quality control. Another example is the standing commission for the joint management of transboundary groundwater on the Karst area between Croatia and Slovenia.

Key Issues and Challenges

The eastern region of the Adriatic is still one of the best preserved coastal areas of the European part of the Mediterranean. However, at present mainland wastewaters are the major source of coastal pollution. The coastal waters near the mainland are more polluted with wastewaters than the island coastal waters. Preservation of the coastal water resources will be key to the growth of tourism in Croatia and will require substantial investment in wastewater treatment. There is however a shortage of funds for investments of this magnitude.

Preservation of the Adriatic coast and its waters will also require transboundary cooperation in areas such as maritime transport, marine spills, and conservation of transboundary wetlands.

Croatia has joined with its neighbors in the Sava River Commission, which should help address, the transboundary issues of navigation, floods, and water pollution.

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CROATIA: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	4.78	4.65	4.62	4.58
Urban population	54%	58%	64%	67%
Rural population	46%	42%	36%	33%

Source: Aquastat database, FAO (2002).

	1991	2000	Goal for 2015
Access to clean water	62%	73%	87%
Urban	n.a.	91%	96%
Rural	n.a.	50%	75%

Note: Goal refers to MDGs.

	1996	2000	Goal for 2020
Access to sewerage	48%	52%	76%
Urban	n.a.	71%	86%
Rural	n.a.	26%	63%

Note: Goal refers to MDGs.

	1998
Share of poor in rural areas	37%

	1990	1995	1999	2000
GDP per capita (constant 1995 US$)	5438	4059	4969	5146
GDP total (billions of 1995 US$)	26.0	18.8	21.7	22.5
Share from agriculture	10%	11%	10%	n.a.
Share from industry	34%	33%	33%	33%

	1991	1996	1997	1998
Labor force (millions of people)	2.2	2.1	2.1	2.1
Share in agriculture	5%	20%	18%	17%
Share in industry	45%	29%	30%	30%

Average annual growth	1991-97	1998-00
Of GDP	-2.2%	2.0%
Of population	-0.4%	0.0%

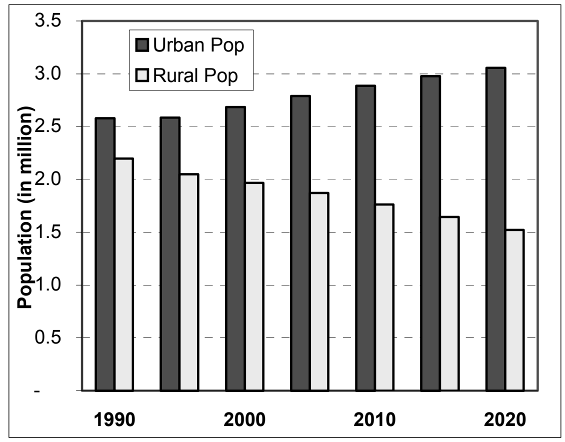
	1999
Infant mortality rate (per 1,000 live births)	7.7

LAND AND WATER RESOURCES

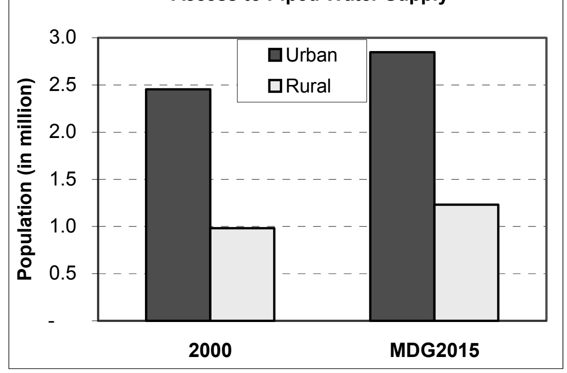
Land area (millions of ha)	5.65	
Land area in international basins (millions of ha)	3.56	
Percentage of country in international basins	63.0%	
Average precipitation (mm)	1,089	
Average total volume of rainfall (BCM)	62	
Total internal renewable water resources (BCM)	37.7	
Of which surface water (BCM)	27.2	
Of which groundwater	11.0	(wide range 30.3-5.6 BCM)
Overlap between surface and groundwater	0.5	
Total external renewable water resources (BCM)	33.7	
Of which surface water (BCM)	33.7	(does not include Danube River
Of which groundwater (BCM)	0.0	
Total renewable resources (BCM)	71.4	
Of which total surface water (BCM)	60.9	
Of which total groundwater (BCM)	11.0	
Overlap between surface and groundwater	0.5	
Dependency ratio	47.2%	

	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	14,943	15,342	15,448	15,600

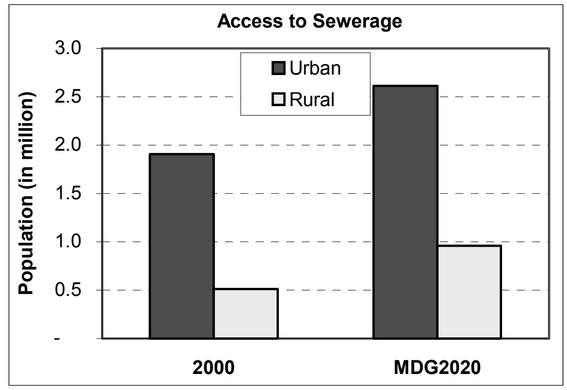
	1990	1996
Total annual water Used (in BCM)	2.65	1.82
Irrigation/fishponds	0.42	0.33
Industrial/cooling	1.76	0.96
Domestic	0.47	0.53



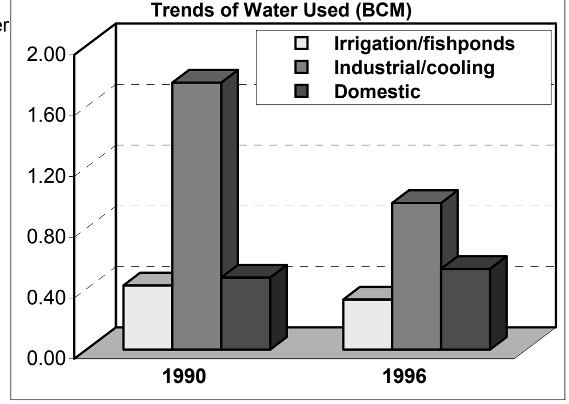
Access to Piped Water Supply



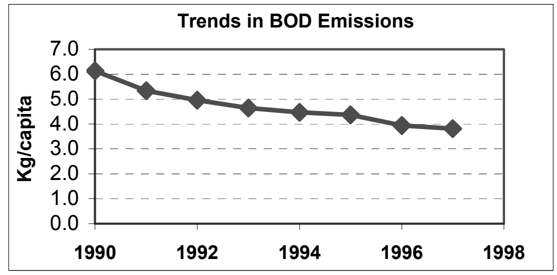
Access to Sewerage



Trends of Water Used (BCM)

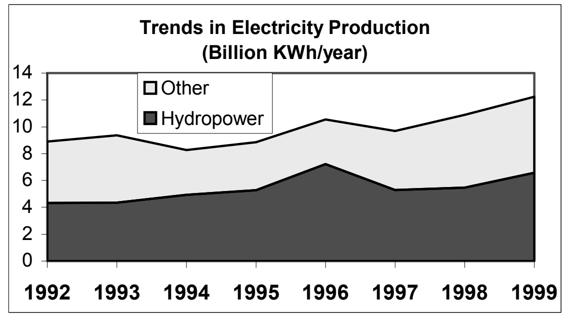


WATER QUALITY AND POLLUTION	1997			
Wastewater produced (BCM)	0.29			
Wastewater treated (%)	20%			
	1990	**1995**	**1996**	**1997**
Annual emissions of BOD per day (Tons)	80.0	55.3	50.0	48.4
Annual emissions of BOD per capita (kg)	6.1	4.4	3.9	3.8



AQUATIC ECOSYSTEMS

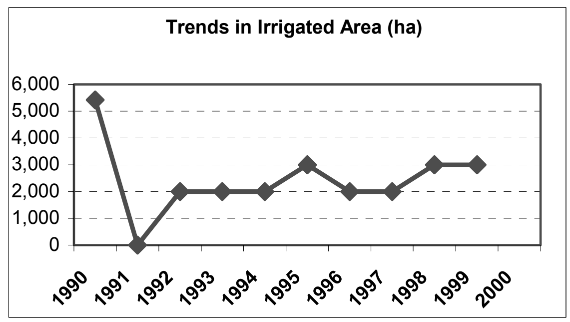
Wetlands designated as Ramsar sites (2002)	
In ha	80,455
As % of land area	1.42%



DAMS AND HYDROPOWER

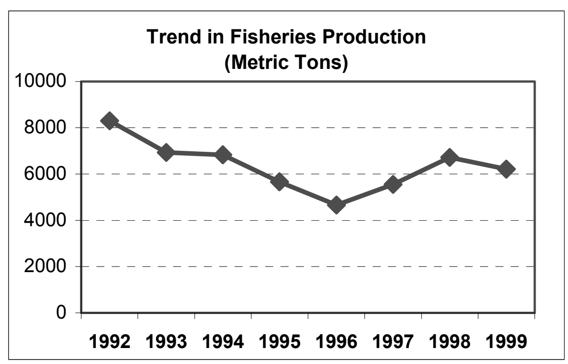
Reservoir capacity (BCM)	1.53	
Irrigation dams		
Hydropower dams		
Reservoir capacity in cubic meters per capita	329	(in 2000)
Gross theoretical hydropower potential (GWh/y)	20,000	
Technically feasible (GWh/y)	12,000	
Economically feasible (GWh/y)	10,500	
Current production from hydropower (GWh/y)	6,107	(in 2000)

	1992	**1995**	**1998**	**1999**
Total electricity production (GWh/year)	8,894	8,863	10,898	12,239
From hydroelectric	48.8%	59.4%	50.2%	53.8%



IRRIGATION	**1990**	**1995**	**1998**	**1999**
Irrigated land ('000 ha)	5.4	3.0	3.0	3.0
Irrigated land per capita (ha)	0.001	0.001	0.001	0.001
Irrigated land as share of cropland	n.a.	0.2%	0.2%	0.2%

FRESHWATER FISHERY	**1992**	**1995**	**1998**	**1999**
Fishery production (metric tons)	8,293	5,669	6,718	6,213
Fishery production per capita (kg)	1.82	1.22	1.44	1.34



FINANCING THE WATER SECTOR

Average cost recovery:	**2000**	
Irrigation water services	0%	
Municipal water services	50%	(100% O&M and urgent investments)
* These are ball park estimates.		

Average water price (US cent/m3)	**1997**	**2000**	
Households	66.4	57.0	28-82
Industry	96.7	91.0	58-140
Irrigation	0.0	0.0	

Water user abstraction charges (US cents/m3)	
Households	10-15
Industrial user	13-20

Effluent charges (US cents/m3)	
Households connected to public water supply	About 25% of water consumption bill
Industrial user	13.3
Power plants	0.013

FORMER YUGOSLAV REPUBLIC OF MACEDONIA

Socio-Economic and Geographic Context

The Former Yugoslav Republic (FYR) of Macedonia, with a total area of 2.6 million ha, is a landlocked country situated in the southern Balkan Peninsula. This is a region of high seismic activity. About two-thirds of the country is hilly and mountainous. The average elevation is 850 meters above sea level (masl), and more than 30% of the territory is above 1,000 m. Its average precipitation is about 730 mm, but its is unevenly distributed in space and time. Rainfall varies from 400 mm in the center and east of the country to 1,400 mm in the west; and occurs mainly from October to December and from March to May. About 75% of the country is classified as a semi-arid region. Agriculture activities are limited by water availability. During the 1990s, the country experienced severe droughts every year with the exception of 1995.

In 2000, the estimated population was about 2.03 million, with 41% living in rural areas. The existing of rural areas is closely linked to agriculture, which employs about 15% of the labor force. Water resources have played a key role in the economy of FYR Macedonia: about 10-16% of the cropland has been irrigated, and about 20% of the total electricity generating capacity is produced by hydropower.

Water Resource Base

FYR Macedonia has four main hydrographic catchment areas: Vardar (covers about 80% of the country), Drin, (in the west covering 13% of the territory), Strumica (in the south east covering 6% of the country) and Juzma Morava (less than 1%). About 98% of its territory is in international basins shared with all neighboring countries: Serbia and Montenegro, Greece, Albania and Bulgaria.

Surface and groundwater resources. Its overall water resources amount to 6.4 BCM during a normal year or 4.8 BCM during a dry year. Annual per capita water availability is about 3,150 m^3. Most of the water comes from rivers and is carried in the Vardar basin. The rivers of the country drain to three basins: the Aegean Basin, the Black Sea Basin and the Adriatic Basin. Within the main river valleys there are about 60 registered springs with a flow greater than 100 l/sec. Although groundwater does not have a major impact in the overall water balance, it is the predominant source for drinking water. Data on the quantity and quality of groundwater sources is extremely limited.

Water resources are unevenly distributed over time and space. This unbalance distribution causes shortage of water in many localities, particularly in the Strumica catchment area, where lack of water affects all economic activities and threatens human health: about 40% of the demand is not met during an average dry year and water quality has been reported below biological minimum standards in periods when the rivers dry up.

FYR Macedonia has three large tectonic lakes. The largest of the tectonic lakes is Lake Ohrid located in the Drin catchment area, with a surface of 357 km^2, which about one-third of its surface lies in Albania. This lake is more than 2 million years old and has unique species. The second largest lake is Lake Prespa, also located in the Drin catchment, with a surface of 320 km^2. It is situated to the east of Lake Ohrid. FYR Macedonia shares this lake with Albania and Greece. During the past 15 years, a significant decline of the level of the lake has been observed, causing environmental and water resources management concerns. The smallest tectonic lake is Lake Doiran, located in the Vardar catchment, with a surface of 47 km^2. It is situated in the southeast of the country, and also is shared with Greece. As with Lake Prespa, the water level of this lake is receding quickly as a result of continues dry years and overuse of water for irrigation. After the drought of 2001, the level of the lake was at its lowest point ever: 3.5 m below its optimal level. This is affecting the biodiversity of the lake.

Located in a temperate region, it is expected that FYR Macedonia will be affected by global warming. Considerable increase in hydrological and climate extremes will be observed in the future.

Water quality. The quality of water sources varies between satisfactory and poor. Water quality of both surface and ground waters is relatively clean in the upper reaches of rivers, but deteriorates rapidly in the middle and lower reaches. Pollution of rivers is high in areas downstream of densely populated areas, as a result of untreated municipal and industrial wastewater discharges. Wastewater treatment is almost non-existing in FYR Macedonia. There are some areas where the water quality is higher than the maximum admissible limits. Monitoring data from 1978 to 1997 indicates a considerable increase in the content of nitrate of surface water -- though the nitrates are within the regulation limits. Similarly, surface water bodies show low level of dissolved oxygen especially in Bregalnica and Crma Reka regions. There is no regular monitoring of water quality or industrial discharges.

Karstic springs and aquifers used by 60% of the populations are somehow protected because their watersheds or protection zones are usually in high mountain areas. Wells located in areas where the land is intensively used for agriculture, in particular cattle breeding, are threatened by pollution. For example, high levels of nitrate (up to 15 mg/l) were found in wells in Prilep and Radovish. Recent data on groundwater quality is scare. The last monitoring data collected in 1981 revealed that most sources were of satisfactory quality at that time. At present little is know about the current condition of groundwater sources countrywide.

Agriculture has been reported as a significant polluter of water resources. Large cattle-breeding farms in particular pig farms in the Northern part of the country discharge their untreated effluents into water bodies.

Water Use and Management by Sector

In 1996, overall water abstraction reached 1.85 BCM, of which about 74% was for irrigation, 12% for domestic and municipal water supply and 15% for industry. Industrial water use has decreased considerable during the 1990s as a result of the economy crises.

Drinking water supply and sanitation. About 70% of the population has access to piped water supply with close to 100% connection for the urban population and 28% for the rural population. The remainder of the rural population relies on local facilities (individual wells, pumps, village fountains, springs). The main piped water sources are the Karstic springs (60%). Other sources are surface water (20%) and aquifers or wells (20%).

The quality of drinking water in rural settlements is a serious concern. Monitoring of groundwater sources used for drinking water supply conducted by the Ministry of Health reveals that although no serious sanitary-hygiene problems exist, about 5% of the monitored wells have experienced microbiological contamination. Since they have failed to meet the quality limits, they can not be used for drinking purpose. The contamination resulted mostly because of absence of sanitary protection zones around water wells, or when available, because the sanitary protection zones were not strictly enforced.

Seasonal water shortage is another problem affecting the sector. There are a large number of cities and villages that face drinking water shortage during the dry season. A recent example is the situation faced by the town of Prilep during the summer of 2001, when water for all users had to be supplied by tankers.

Only a few towns (e.g., Ohrid, Struga, Resen and Dojran) have sewage system with a wastewater treatment plan. The rest discharges their untreated wastewater directly into rivers causing serious water quality problems downstream. There are projects to build wastewater plans in Skopje, Bitola and Strumica, but so far, little progress has been made in their implementation.

Irrigation. With the only exception being the western part of the country, water deficiencies occur during the summer season through out the country. During the growing period, evapotranspiration is much higher than rainfall—640 mm compared to 190 mm. Irrigation is necessary for agriculture. A large irrigation system has existed since 1958, but at present it is not used to its full potential. The irrigation systems built so far theoretically cover an area of 164,000 ha. Since schemes were not completed or properly maintained, only 127,00 ha could be effectively irrigated. During the period 1990s, only 30-60% of this area was actually used. Low level of budget does not allow to pay for the maintenance of the systems that are more than 30 years old. The systems built during the 1970s have badly deteriorated because of the poor quality of the original design and poor maintenance. The irrigation systems have high water losses, sometimes more than 50%.

There are plans to rehabilitate/complete economically viable systems to allow production in 170,000 ha. According to the Agriculture Development Strategy, the area to be irrigated will be doubled by year 2020. This will cause a considerable increase in irrigation water. Multipurpose reservoirs are being planned to provide water for irrigation purpose as well as to facilitate maintenance of minimum water flows in rivers, particularly during drought years.

Erosion. Most of the territory of FYR Macedonia is vulnerable to strong erosion processes. Total amount of erosive sediments is estimated at 17 MCM, out of which about half is estimated to end up in rivers, reservoirs and lakes. According to recent research, about 3 MCM of reservoir storage is lost every year as a result of soil erosion. While measures to protect rivers and reservoirs from erosion were implemented since the 1900s, measures to control erosions were initiated in 1945. Any future project for the rehabilitation and/or restructuring of the irrigation sector should include control erosion measures, reforestation of catchment areas or other measures to manage sediments in reservoirs.

Hydropower. The gross theoretical hydropower potential is 8,860 GWh/year, while the technically feasible potential is 5,500 GWh/year. About 30% of this potential has been developed so far. Hydropower accounts for about 20% of the total electricity production in the country. Since the hydropower production is not fully developed and the heavy dependency on imported electricity (about 45%), there are plans to rehabilitate old dams and build a new dam.

Floods. FYR Macedonia's geography tends to concentrate and discharge surface water rapidly. As a result, flash flooding from intense summer rainfall is more frequent than flooding that follows the extensive rainfall characteristic of the other seasons. But prolonged rainfall occasionally causes catastrophic floods, usually in November-December or May-June. The areas most at risk from flooding are stretches of the rivers through the plain valleys, where river beds are usually shallow and have low capacity. Given FYR Macedonia's rugged terrain, the river valleys are also where economic activity and high-value investments are found. Skopje and the region around it, to take an example, have experienced nine major floods in the last 150 years. The trend toward building on low ground, underway for many decades, continually increases flood risk.

Regulation of riverbeds near large urban and industrial areas was dimensioned in the 1970s to evacuate high water with a return period of 100 years, and in rural areas, to evacuate water with a return period of 20-50 years. Moreover, additional protection is sometimes required by local regulations or by regulations covering industry or transportation infrastructure. But those dimensions do not characterize the level of actual flood protection. Built 30-40 years ago, many systems are now in bad shape and do not provide the planned level of flood protection. The 1979 flood, for example, affected a large area and did enormous damage, estimated at USD153 million (1979 dollars), about 7.3% of GDP. Most damage was done in Tetovo and Skopje. In those areas, the return period of the high water was estimated at 50-100 years.

Today, there are a number of cities and large towns in areas of high flood risk, including the Skopje area, Pelagonija, Strumica and the coastal area of Ohrid Lake near Struga (regions with high groundwater). Many more towns are at risk from floods of moderate likelihood. A dam is being built on the Treska River, the Kozjak dam, to improve flood control of the Skopja region. The retention volume of the dam is estimated at 500 MCM, out of which 100 MCM will be for flood control.

Comprehensive data on the areas flooded in the past and on the annual cost of flood damage in FYR Macedonia are not available. According to available data, no lives have been lost in FYR Macedonia's floods.

Water Legislation and Policies

In the 1970s a Water Management Plan was prepared for the long-term management and development of water resources in the country. Implementation of the plan started in 1975, and is supposed to be replaced in 2004. A new water master plan is under preparation by the Water Fund for the Ministry of Agriculture, Forestry and Water Resources Management. This plan will describe the short-term and medium-term vision of the water sector, and will address important concerns such as water allocation, development of agriculture and hydropower and rural development.

The main piece of legislation on water resources management is the 1998 Law on Water and its several by-laws. The Law on Water defines the management and control of water use, protection and prevention of water contamination, protection against floods, as well as financing of water management activities. The law introduces the following important instruments and institutions: creation of a water fund to finance water resources development and works of public interest; establishment of public water management enterprises and water users' associations; introduction of wastewater standards and pollution charges according to the polluter-pay principle; and appointment of water management inspectors. Until now, only the Water Fund has been set up. The law also introduces the concept of permits for water extraction and discharge and obliges the polluter to build wastewater treatment facilities. Unfortunately, until now none of these provisions have been enforced because of the absence of implementing ordinances.

Although the Law on Water is relatively new and introduces modern concept, it is currently subject to revision in order to harmonize and align it with the relevant European Union environmental directives, including the Water Framework directive, e.g., the concept of hydrographic basin management is not contemplated in the current law.

The use of economic incentives is of major importance to improve the efficiency of water use. However, the level of acceptance that water has an economic value and that everyone should pay for it is very low. Public awareness about the importance of water will help increase the level of acceptability.

Water Management Institutions

The 1998 Law on Water formally charges the Ministry of Agriculture, Forestry and Water Resources Management through its Water Administration with the overall management responsibility for water resources—both surface and groundwater and quality and quantity aspects. Management and issuing of water abstraction licenses and discharge permits for all uses, monitoring of hydrological regime, development and operation of flood control and drainage infrastructure and other action of public interest are responsibilities of the Water Administration.

In addition, there are at least 4 additional ministries that share the management of the resource.

- The Ministry of Environment and Physical Planning responsible for protecting water bodies against pollution.

- The Ministry of Health responsible for controlling drinking and bathing water quality.

- The Ministry of Transport responsible for public water supply and wastewater treatment infrastructure for municipalities, including authorization of building permits issues to industrial facilities and monitoring of wastewater facilities

- The Ministry of the Economy responsible for the construction of dams and hydropower plants.

Dispersion of water management aspects among various ministries prevents the adoption of an integrated approach to water resources management.

In theory, technical aspects of water management are supposed to be handled by two public water enterprises and water users associations.

- Municipal Public Enterprises are responsible for managing drinking water supply, sewage and wastewater treatment systems in cities and villages. For the services provided consumers pay a water charge. Collection rates have dropped considerable during the past 5 years, and at present these enterprises can not afford proper maintenance of the systems they operate. A new law that will allow the participation of the private sector through concessions is before Parliament for consideration.

- Public Water Management Enterprise was created in 1998. This entity was supposed to have 24 local offices (former water management organizations) and was supposed to be responsible for supplying irrigation water to farmers, providing bulk water supply to municipalities and industries, managing flood protection infrastructure, and implementation of measures against water erosion and drainage. The former water management organizations never become local offices of the new enterprise—they are still independent organization. Funding is provided by the State Budget and water user charges. The Public Water Management Enterprise is being restructured. The proposed changes are to make the 24 water management organizations (in theory the local branches) autonomous water authorities—those the cover the same rives catchment area will be merged -- and transform the central office into the regulatory body. The autonomous water authorities will be headed by a council conformed by representatives from different stakeholders.

- Water Users Associations have been established to manage secondary water infrastructure. For the services received, farmers pay a fee to the WUAs, which is supposed to cover 100% of the total cost of operating and managing the system.

Unfortunately, so far the segment of the Water Law that regulates the institutions in the sector has not been implemented and/or enforced. This has created a legal and institutional vacuum that the World Bank is addressing through the FYR Macedonia Irrigation Rehabilitation and Restructuring Project. This project aims at assisting the FYR Macedonian Government to enact special laws on Water Management Enterprises and Water User Associations.

Transboundary and International Water Issues

FYR Macedonia assigns a high priority to enhance cooperation in the management and use of transboundary rivers and lakes shared with its neighboring countries. Cooperation with Albania is well advanced in relation to the management and protection of Lake Ohrid. In 1996 a bilateral institutional framework was signed between Albania and FYR Macedonia for the management of Lake Ohrid. Since 2002, both countries established watershed management committees for Lake Ohrid, with are cooperating since then. Since the Lake Ohrid's watershed also includes Greece and the quality and hydrological conditions of Lake Ohrid are linked to those of Lake Prespa, it is desirable to upgrade the Albania/FYR Macedonia agreement to add Greece. In February 2000, FYR Macedonia, Albania and Greece agreed to the protection of Lake Prespa and their surroundings. Bilateral cooperation between FYR Macedonia and Greece concerning Lake Doiran is ongoing. A specific memorandum of understanding has been drafted.

Key Issues and Challenges

FYR Macedonia should consider the following actions to improve the management of its water resources:

- Strengthen the legal and institutional framework for water resources management and move towards an integrated water resources management approach.

- Adopt a balance approach to water management, which considers measures in the supply side and demand side. This is particular relevant for the irrigation sector, where plans are underway to expand the land under irrigation instead of making more efficient use of current systems.

- Identify river basins and sub-basins and develop water management plans through a participatory planning approach. The ongoing experience with the management of Lake Ohrid through a participatory watershed management approach is very relevant in this respect..

- Continue rehabilitation of irrigation infrastructure, including introduction of measures to reduce water losses. In addition, any future project for the rehabilitation and/or restructuring of the irrigation sector should include control erosion measures, reforestation of catchment areas or other measures to manage sediments in reservoirs.

- Improve knowledge of groundwater sources in terms of quantity and quality.

- Strictly enforce sanitary protection zone to avoid contamination of groundwater sources—main source for drinking water.

- Adopt measures to conserve transboundary lakes and wetlands to allow for their sustainable use.

- Undertake joint action for the protection and conservation of Lake Doiran.

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FYR MACEDONIA: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	1.91	2.03	2.08	2.08
Urban population	58%	59%	62%	64%
Rural population	42%	41%	38%	36%

Source: Aquastat database, FAO (2002).

	1995	2000	Goal for 2015
Access to piped water supply	67%	71%	86%
Urban	100%	100%	100%
Rural	17%	28%	64%

Note: Goal refers to MDGs.

	1990	2000	Goal for 2020
Access to sewerage	n.a.	46%	73%
Urban	n.a.	68%	84%
Rural	n.a.	13%	57%

Note: Goal refers to MDGs.

	1996
Share of poor in rural areas	59%

	1992	1995	1999	2000
GDP per capita (constant 1995 US$)	2,571	2,263	2,441	2,535
GDP total (billions of 1995 US$)	4.9	4.4	4.9	5.1
Share from agriculture	17%	13%	13%	12%
Share from industry	40%	32%	33%	33%

	1990	1994	1998	1999
Labor force (millions of people)	0.9	0.9	0.9	0.9
Share in agriculture	22%	9%	n.a..	n.a.
Share in industry	40%	49%	n.a.	n.a.

Average annual growth	1991-97	1998-00
Of GDP	-1.8%	3.6%
Of population	0.6%	0.7%

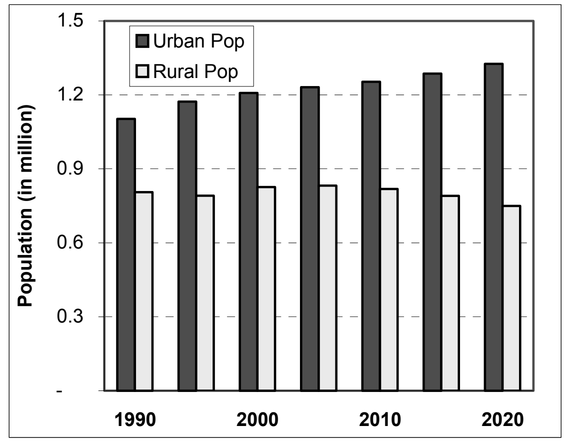
	1999
Infant mortality rate (per 1,000 live births)	14.9

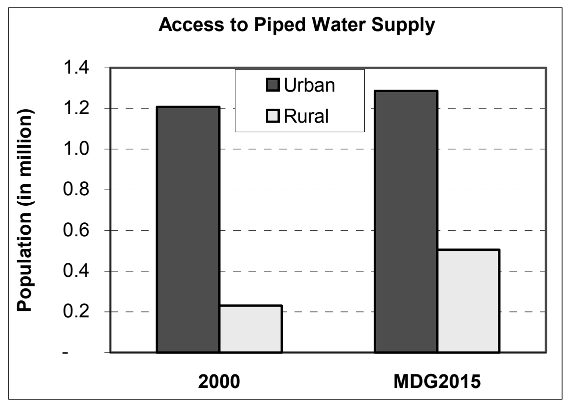
LAND AND WATER RESOURCES

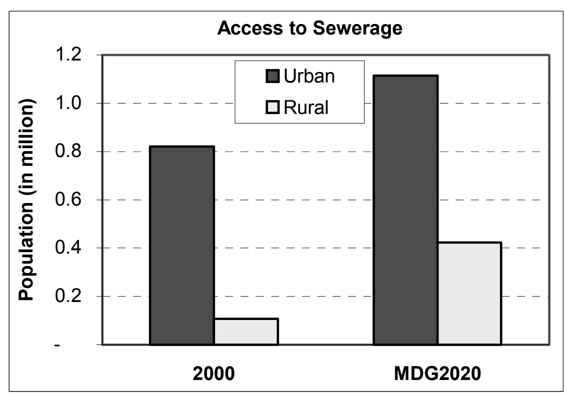
Land area (millions of ha)	2.57
Land area in international basins (millions of ha)	2.51
Percentage of country in international basins	97.7%
Average precipitation (mm)	700
Average total volume of rainfall (BCM)	18
Total internal renewable water resources (BCM)	5.4
Of which surface water (BCM)	5.4
Of which groundwater	n.a.
Overlap between surface and groundwater	n.a.
Total external renewable water resources (BCM)	1.0
Of which surface water (BCM)	1.0
Of which groundwater (BCM)	0.0
Total renewable resources (BCM)	6.4
Of which total surface water (BCM)	6.4
Of which total groundwater (BCM)	n.a.
Overlap between surface and groundwater	n.a.
Dependency ratio	15.6%

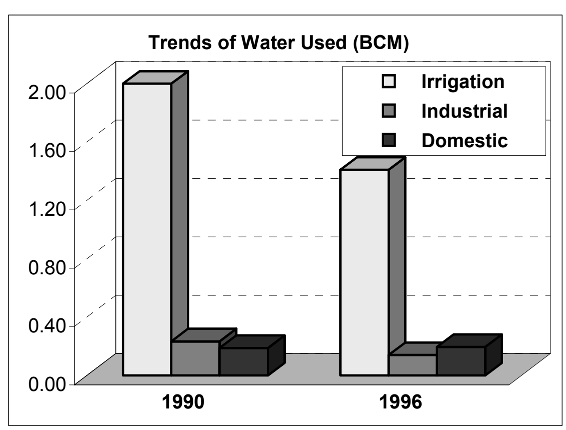
	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	3,353	3,147	3,084	3,083

	1990	1996
Total annual water used (in BCM)	2.44	1.75
Irrigation	2.02	1.41
Industrial	0.23	0.14
Domestic	0.19	0.20

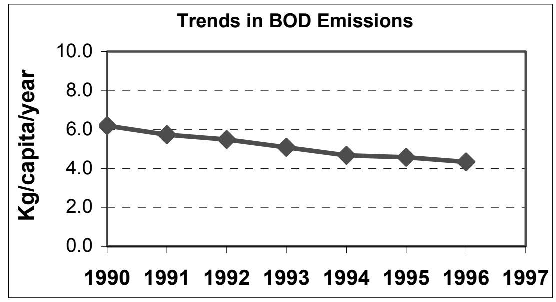








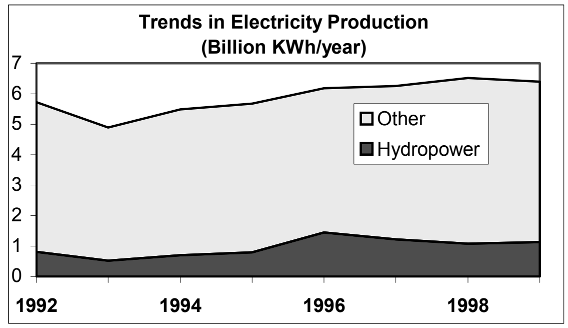
WATER QUALITY AND POLLUTION	1996			
Volume of wastewater from all sources (BCM)	0.53			
Treated discharge	~10%			
	1990	**1994**	**1995**	**1996**
Annual emissions of BOD per day (Tons)	32	25	25	23
Annual emissions of BOD per capita (kg)	6.2	4.7	4.6	4.3



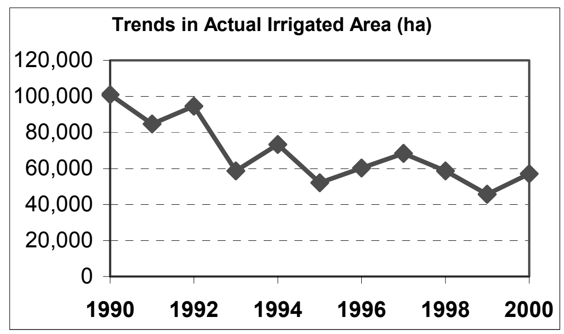
AQUATIC ECOSYSTEMS	
Wetlands designated as Ramsar sites (2002)	
In ha	18,920
As % of land area	0.74%

DAMS AND HYDROPOWER	2001	
Reservoir capacity (BCM)	1.70	
Irrigation dams (BCM)	0.50	
Hydropower dams (BCM)	1.20	
Reservoir capacity in cubic meters per capita	836	(in 2000)
Gross theoretical hydropower potential (GWh/y)	8,863	
Technically feasible (GWh/y)	5,500	
Economically feasible (GWh/y)	n.a.	
Current production from hydropower (GWh/y)	1,300	(in 2000)

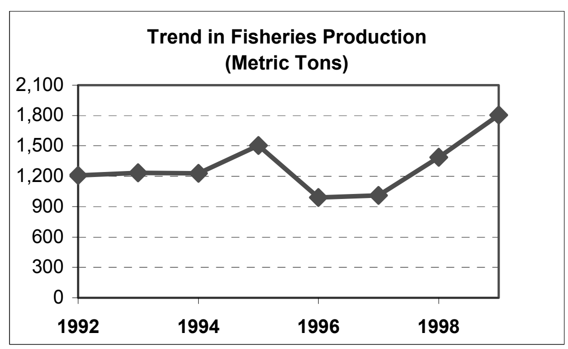
	1992	1995	1998	1999
Total electricity production (GWh/year)	5,721	5,681	6,523	6,395
From hydroelectric	14.3%	14.0%	16.5%	17.7%



IRRIGATION	1990	1995	1998	2000
Irrigated land ('000 ha)	101.06	52.16	58.68	57.05
Irrigated land per capita (ha)	0.053	0.027	0.029	0.028
Irrigated land as share of cropland	16.6%	8.6%	10.0%	10.7%



FRESHWATER FISHERY	1992	1995	1998	1999
Fishery production (metric tons)	1,209	1,505	1,388	1,804
Fishery production per capita (kg)	0.63	0.77	0.69	0.89



FINANCING THE WATER SECTOR		
Average cost recovery:	**1995**	**2000**
Irrigation water services		
Municipal water services	<100% O&M costs	
* These are ball park estimates.		
Average domestic tariff (US cent/m3)	20	14-53
Average industrial tariff (US cent/m3)		28-100
Raw water charge		

ROMANIA

Socio-Economic and Geographic Context

Romania has a total area of 23.8 million ha and is located in Southeastern Europe. It borders the Black Sea, between Bulgaria and Ukraine, and is crossed by the Carpathian Mountains. Its territory is divided among hills (37%), mountains (30%) covering the center and northwest, and plains (33%) covering the south and east part of the country. The climate is transitional from temperate in the southwest to continental in the northwest. Average precipitation is about 700 mm, ranging from high rainfall in mountains areas (1,000-1,400 mm) to low rainfall in the coastal areas (below 400 mm).

In 2000, its population was estimated at 22.4 million people, with 55% living in urban areas. Since 1989 the total population has been declining constantly and it is expected that by 2020 it will reach 21 million.

Water Resources Base

Water resources play a key role in the economy of Romania: between 35-40% of the total electricity production is generated from hydro-power plants mostly on the Danube river; and about 30% of the cropland is irrigated. Romania's water system is broadly developed. Quantitatively, its water resources are sufficient to cover its water demand.

Surface and groundwater resources. Romania has 4,864 watercourses with a total length of about 79,000 km. Many of the important rivers are transboundary. The main river is the Danube which has a length of 1,075 km in Romania (37% of its total length) with 220 km forming the border between Romania and Serbia and Montenegro; 480 km forming the border between Romania an Bulgaria, 134 km forming he border with Ukraine, and 0.3 km on the border with Moldova. The river is regulated over most of its course. A surface area of about 98% of the country lies within the Danube river basin, and most of the water drains into the Black Sea. Theoretical renewable resources in Romania amount to 128-134 BCM or about 5,700-6,000 m^3 per capita per year. Internal renewable resources are 42.3 BCM, and the remaining come from transboundary rivers, namely the Danube and Prut rivers. Since not all the water from the Danube can be taken because of its navigational character, potential available resources are limited to 40.3 BCM or 1,800 m^3 per capita per year. There is significant seasonal and annual variability in rivers run-offs. In order to address the variability, abut 1,300 reservoirs, mostly of multipurpose character for flood protection, drinking and industrial water supply, irrigation and hydropower generation, with a total volume of 14.0 BCM, have been built. Romania also faces spatial imbalance of its water resources—without modification of natural flows only 12% of potential available resources could have been used.

In general, the water regime of the rivers is characterized by high flows during February through May and low flows during the rest of the year. Repeated and intense floods constitute one of the characteristics of the hydrologic system. The highest frequency of floods is found during the March-June period, while the least frequency is during January and August till September.

Romania has 194 natural lakes totaling an area of 132,730 ha and a water volume of 2,265 MCM. A number of lakes are used for therapeutic purposes and have an international reputation, e.g. Techirgohiol and Amara.

The potential of groundwater resources has been estimated at 8-9 BCM . Of this, about one-third can be used under current technical and economical conditions. The most important groundwater resources can be found in the following basins: Danube (32.4%), Siret (10.8%), Arges (9.4%), Olt (7.2%) Ialomita (7%), Mures (6.4%) and the littoral area (5.2%). According to a survey of groundwater quality, both shallow and phreatic aquifers are at a high risk of pollution in the short- and long-term. At present, a large number of rural communities can not used groundwater as a source of water supply because of nitrates concentrations are exceeding the maximum admissible limits.

Wetlands. The Danube Delta is the second largest delta in Europe. Of its 799,000 ha, most (679,000 ha) is in Romania with the rest in the Ukraine. It serves as a buffering interface between the Danube river catchment (805, 300 $km^{2)}$ and the Western Black Sea (5,165 km^2) and is a unique place not only in Europe, but also among other deltaic ecosystems due to its high biodiversity, to its renewable natural resources and to its beautiful scenery doubled by its cultural sites. Because of its high biodiversity value, it has been declared a protected area and a World Natural Heritage Site. In 2000, Romania, Bulgaria, Moldova and Ukraine signed a Declaration on Cooperation to protect key wetlands and flood plain forest along the Danube as part of the Lower Danube Green Corridor initiative supported by WWF.

Water quality. Overall, quality of surface water sources is relative good. The quality of the rivers has improved considerably over the last decade due mainly to the reduction of pollution activities. However, in 2000 about 11% of the total length of watercourses that are monitored were still rated as heavily polluted. The degradation of river water quality has been caused primarily by untreated wastewater discharges from municipalities. In addition, both surface and groundwater are threatened by diffuse pollution from agricultural activities, pollution from large pig farms, as well as accidental pollution caused by different hazardous substances which has been a particular transboundary issue.

Water Uses and Management by Sector

Overall water use has declined considerably in Romania during the past decade as a result of economic restructuring. Between 1989 and 1999, total water use declined from about 20 BCM to 10 BCM, respectively. Most of the decline was observed in the agriculture sector. Agriculture water use (including irrigation, fish pond supply ad other small uses) experienced a nine-fold reduction: from 9 BCM in 1989 to less than 1 BCM in 1999. Industrial water use also experienced a considerable decline during the same period: from about 8.6 BCM to about 5.7 BCM. Water withdrawn for domestic purposes has remained unchanged.

Drinking water and sanitation coverage. About 92% of the urban population and 34% of the rural population receive drinking water from public supply systems. Surface water is the major source of drinking water supply (71%). Water consumption by households still remains high at 500-800 lcd. Level of losses in the distribution network are high—50-60%. Wastewater from municipalities and industrial plans receives little treatment at present. Of the total volume of 3 BCM of wastewater that needs to be treated, only 18% receives adequate treatment, 50% receives insufficient treatment and 32% receives no treatment at all. The capital Bucharest does not have a wastewater treatment facility in operation (one is under construction since 1989).

Irrigation and drainage. Development of large scale irrigation schemes started in the 1960s. By 1989, irrigation systems were built in about 3.2 million ha of agricultural land. The Danube River provides 75% of the water for irrigation needs. By year 2002, only 30% of the once equipped area was operational but only 17% was actually utilized. Most of the decline in irrigation water use is due to the substantial reduction of subsidies for irrigation, difficult water management on small plots which resulted from the land restitution, vandalization of some schemes (mainly pumping stations and electrical cables), the lack of enough funds for proper maintenance, and the rising water prices and irrigation costs. Average efficiency level of irrigation systems is 40-50%. Since establishment of water users' associations started in 2000, the demand for irrigation services increased significantly (from 6% to 17%). About 3.2 million ha are also equipped with drainage systems, of which two-thirds are gravity and one-third is pumped. Most of the pumped drainage but only a small part of gravity drainage facilities are operational at present.

Hydropower. The gross theoretical hydropower potential is about 70,000 GWh/year, and the technically feasible hydro potential is 40,000 GWh/year, out of which about 26% is from the Danube. So far, about 40% of the technically feasible potential has been developed. At present hydropower represents about 36% of the electric power production in the country. A marked increased in hydropower production has been observed during the past decade. If this trend continues, shortage may be experienced by other water-using sectors during the summer season.

Floods and droughts. Floods often affect Romania and there is a tendency for increased flood level and frequency in the last decade. Floods have occurred in about 50% of the years during the last 100 years. During the past decade, floods were recorded almost every year. In the period 1991-2002, floods resulted in material losses estimated in total at over USD1 billion and killed more than 200 people. Severe floods occurred as well in 1969, 1970, 1975 and 1981. Typical damage has included destruction of hundreds or thousands of houses, damage to many more, damage to hospitals, schools, and other social infrastructure, destruction of roads, bridges and railways, damage to cultivated land, contamination of wells, weakening or rupture of dams, severing of electricity and communications. Subsistence farmers and poor rural areas have been affected severely and repeatedly in these events. Romania's northwestern counties are the most often affected.

Romania has two principal flood seasons: in the spring, flooding is caused by rain and snowmelt, and in the summer, by rainstorms. Without flood protection works, about 13% of Romania would be in danger of flooding -- of which, about 80% endangered by river overflow, and about 20% by hillside torrents. Of the threatened area, about 40% is nominally defended against flooding according to national standards, and, at the other end of the spectrum, about a quarter has no protection at all. The warning system is not robust, study of risks is under-funded, construction is permitted in known flood plains, defense works are not undertaken or proceed slowly, and flood protection works damaged in a flood are not always repaired to meet the next challenge. A World Bank project is in preparation to address flood readiness in Romania. It is currently scheduled to reach the Board in FY2004.

In the Danube flood plain, about 450,000 ha are protected against floods and excessive humidity with flood control structures and drainage systems. This has caused a change in the hydrological regime of the wetlands and marshes, specially in the wetlands of the Danube Delta. In the 1950s, about 400,000 ha of wetlands were converted to agricultural land, out of which about 80,000 were along the Danube River. With regard to drained land, the current Government policy is to return part of the embanked and drained areas along the Danube back to their original wetland state.

Droughts are also a source of concern in Romania. On average they have a periodicity of 12-15 years with 1-3 extremely dry years. A marked tendency of increase of duration, intensity and frequency has been observed during the last couple of decades. From the perspective of water resources, 8 years with hydrological droughts were observed during the period 1982-2000, affecting the river basins in the southern part of the country. The runoff of these basins was about 50% of the monthly annual average, while in the plain areas, the runoff was only 30%. These droughts caused severe damage to the agriculture (agriculture drought) and energy sector as well as shortage of drinking water supply. The agricultural areas in the southern part of the country have experienced production reduction of between 40-60%.

According to recent studies on climate change, there will be progressive warning tendency of the atmosphere associated with the extension of the drought and dryness phenomenon in the Southeastern part of Europe. This phenomenon will be exacerbated by increase in water resources use and pollution. The evaluation of these trends as well as future evolution of the drought and dryness phenomenon is particular important for Romania and other potentially affected countries.

Erosion of the coastline. The Romanian seashore is being affected by the reduction of sediments carried by the Danube as a result of the construction of reservoirs on the Danube and tributaries. This is affecting the ecosystems along the Black Sea and is causing steady erosion of the coastline. Consequently, the country has to undertake permanent protection works for securing the beach. Some of the hydraulic infrastructure (small and large dams) are considered to be not completely safe, posing a risk to communities and the social and economic infrastructure in case of an accident. Improving the safety of dams is also the focus of the ongoing World Bank operation mentioned above.

Water Legislation and Policies

Romania's water management system was established by the 1995 Water Strategy, the 1996 Water Law and the 1995 Law on Environmental Protection. The water current water policy is based on international recognized principles of good water management: manage water at the river basin level, address both water quality and quantity management issues jointly, encourage participation of stakeholders in the decision-making process, apply the polluter-pay principle, and treat water as a precious heritage that must be defended, protected and treated.

The 1996 Water Law established the ownership of water by keeping water assets in the public domain. It also established the river basin concept for the management of the resources of both surface and groundwater, introduced the water use rights through water management licenses and wastewater discharges for no more than 5 years, and assigned the highest priority to drinking water over the use of the resource. At present, Romania is transposition EU environmental directives into the legislative framework including the water framework directive.

Several economic incentives are also used for managing the use of the resource. The water extraction charges vary according to source of water and the use. Pollution charges are also levied on a set of pollutants. When limits set in the licenses are exceeded, penalties and fines for non-compliance are imposed, which are used as income for the Water Fund. Other economic instruments include services charges—drinking water supply, sewerage, wastewater treatment, financial incentives for modernization and rehabilitation of water quantity and quality improvements, and taxes allowances (State subsidies and exemption from import duties on environmental technology).

Water Management Institutions

Three main institutions conform the water management system: the Ministry of Water and Environmental Protection (MoWEP); the National Water Authority "Apele Romane," which has river basin branches and provincial offices; and the local Environmental Protection Inspectorates. Other ministries have also some responsibilities for water resources management: the Ministry of Health and Family monitors drinking water quality, the Ministry of Public Works, Transport and Housing regulates navigation and navigation-related activities, and the Ministry of Agriculture, Food and Forestry, responsible for irrigation and drainage through SNIF.

The MoWEP prepares and formulates the national strategy and policies in water resources management and protection with the input of relevant ministries. Its main functions include: strategic planning, formulation of the national water management and development programs, preparation of legislation and policy; allocation and managing national budget resources for water management and infrastructure development; set-up standards and monitors compliance; setting up of the license and permit system; and international cooperation and cooperation on transboundary water bodies.

The State Water Inspectorate within MoWEP in turn is responsible for the inspection and control of implementation of the legal provisions. The local Environmental Protection Inspectorates are responsible for issuing licenses and permits as well as for inspection and control of water quality and emissions into water bodies.

The National Administration "Romanian Waters" ("Apele Romane"), a public company that is 100% owned by the State through the Ministry of Waters and Environmental Protection, is in charge of the implementation of the national water management strategy. It is responsible for the management of 11 river basins (through regional branches and local offices). Apele Romane aims at self-sufficient. The costs of its operation are covered by the water charges paid by water users, while investments are partially covered by the state budget. Its branches act within the river basins and their provincial offices have special responsibilities for the preparation of plans for river basin management, flood and drought control among other functions.

Responsibility for drinking water supply, waste-water disposal and treatment lies with the local authorities. The water users (municipalities and industries) are obliged to prepare, and apply if necessary, their own plans for the prevention and control of accidental pollution that might occur as a result of their activity.

Transboundary and International Water Issues

Romania shares several transboundary river basins up or downstream with Hungary, Moldova, Ukraine and Serbia and Montenegro and has some key transboundary issues. Transboundary water pollution by accidents is been a significant issue particularly since the Baia Mare Cyanide spill in 2000 which caused considerable transboundary pollution. The accident in Baia Mare emphasized that water is a common asset shared by various countries and that problems in one of them concern all. An international task force was established by the Governments of Romania and Hungary, the EU Commission and the United Nations to assess the accident and make recommendations. Based on the recommendations, Romania intends to develop a harmonized trilateral plan for emergency response with Hungary and Ukraine for the rivers within the upper Tisza river basin.

Protection of the Black Sea and Danube delta against pollution by nutrient and hazardous substances is of much concern and requires transboundary solutions. The Romanian seashore is being affected by the reduction of sediments carried by the Danube as a result of the construction of reservoirs on the Danube and tributaries. This is affecting the ecosystems along the Black Sea and is causing steady erosion of the coastline. Consequently, the country has to undertake permanent protection works for securing the beach. Some of the hydraulic infrastructure (small and large dams) are considered to be not completed safe, posing a risk to communities and the social and economic infrastructure in case of an accident. Improving the safety of dams is also the focus of the ongoing World Bank operation mentioned above.

Romania has signed bilateral agreements with its neighbors Hungary, Ukraine, Serbia and Montenegro on cross-border waster management, mainly in regards to hydro-technical issues.

Romania is Party to the UNECE Convention on the Protection and Use of Transboundary Waters and International Lakes, which is complemented by regional and bilateral agreements, as well as to the Convention on Cooperation for the Protection and Sustainable Use of the Danube River. Within the framework of cooperation of the International Commission for the Protection of the Danube River, Romania supports the implementation of the integrated river basins management approach for the Danube.

Key Issues and Challenges

Recommendations for improving water resources management on the country level include:

- Advance further river basin management.

- Improve the safety of hydraulic infrastructure, namely large dams and flood protection infrastructure through installation of modern monitoring equipment.

- Increase access to wastewater treatment facilities by increasing available funding for construction of new facilities.

- Carry our preventive measures to reduce the risk of floods and accidents.

Challenges in transboundary water resource management will continue to occur in flood control, environmental protection and pollution control, biodiversity conservation, and accident prevention and mitigation.

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ROMANIA: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	23.21	22.44	21.44	21.03
Urban population	54%	55%	59%	61%
Rural population	46%	45%	41%	39%

Source: Aquastat database, FAO (2002).

	1995	2000	Goal for 2015
Access to piped water supply	53%	66%	84%
Urban	80%	92%	96%
Rural	20%	34%	67%

Note: Goal refers to MDGs.

	1994	2000	Goal for 2020
Access to sewerage	49%	52%	76%
Urban	n.a.	86%	93%
Rural	n.a.	10%	55%

Note: Goal refers to MDGs.

	1998
Share of poor in rural areas	67%

	1992	1995	1999	2000
GDP per capita (constant 1995 US$)	1,377	1,564	1,461	1,489
GDP total (billions of 1995 US$)	31.4	35.5	32.8	33.4
Share from agriculture	18%	21%	15%	13%
Share from industry	44%	42%	36%	36%

	1990	1995	1998	1999
Labor force (millions of people)	10.6	10.6	10.7	10.7
Share in agriculture	29%	40%	40%	43%
Share in industry	44%	31%	29%	n.a.

Average annual growth	1991-97	1998-00
Of GDP	-1.6%	-1.8%
Of population	-0.4%	-0.2%

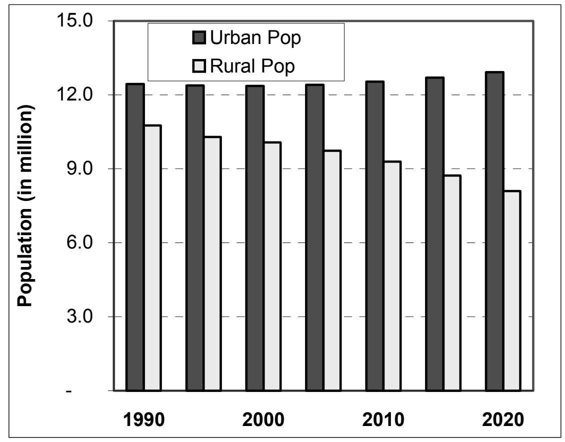
	1999
Infant mortality rate (per 1,000 live births)	18.6

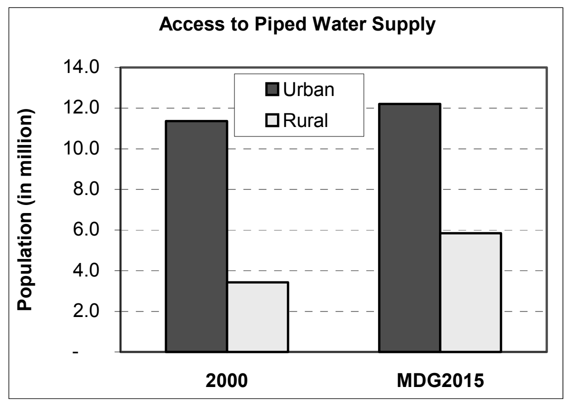
LAND AND WATER RESOURCES

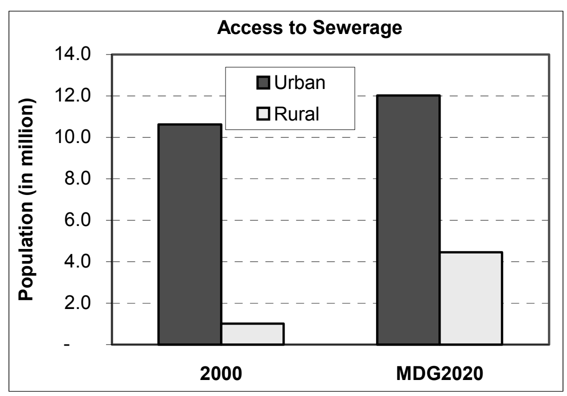
Land area (millions of ha)	23.8
Land area in international basins (millions of ha)	22.9
Percentage of country in international basins	96.0%
Average precipitation (mm)	701
Average total volume of rainfall (BCM)	167
Total internal renewable water resources (BCM)	42.3
Of which surface water (BCM)	42.0
Of which groundwater	8.3
Overlap between surface and groundwater	8.0
Total external renewable water resources (BCM)	169.6
Of which surface water (BCM)	169.6
Of which groundwater (BCM)	0.0
Total renewable resources (BCM)	211.9
Of which total surface water (BCM)	211.6
Of which total groundwater (BCM)	8.3
Overlap between surface and groundwater	8.0
Dependency ratio	80.0%

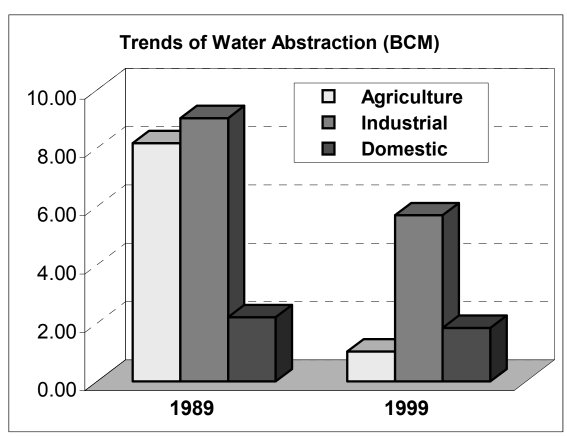
	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	9,129	9,442	9,882	10,076

	1989	1999
Total annual water used (in BCM)	19.40	8.57
Agriculture	8.17	1.03
Industrial	9.03	5.70
Domestic	2.20	1.84

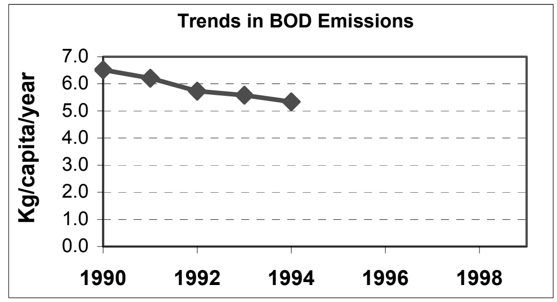






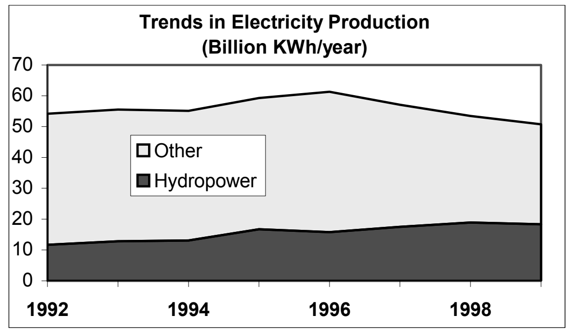


WATER QUALITY AND POLLUTION	1999			
Wastewater discharge requiring treatment	3.0			
Subject to treatment	40%	18% adequate treatment		
	1990	**1992**	**1993**	**1994**
Annual emissions of BOD per day (Tons)	414	362	350	333
Annual emissions of BOD per capita (kg)	6.5	5.7	5.6	5.3



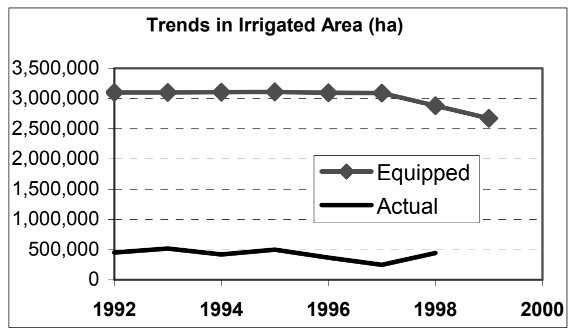
AQUATIC ECOSYSTEMS	
Wetlands designated as Ramsar sites (2002)	
In ha	664,586
As % of land area	2.79%

DAMS AND HYDROPOWER	2000	
Reservoir capacity (BCM)	14.00	(mostly multipurpose)
Irrigation dams (BCM)		
Hydropower dams (BCM)	4.75	
Reservoir capacity in cubic meters per capita	624	(in 2000)
Gross theoretical hydropower potential (GWh/y)	70,000	
Technically feasible (GWh/y)	40,000	
Economically feasible (GWh/y)	~30,000	
Current production from hydropower (GWh/y)	16,000	(in 2000)

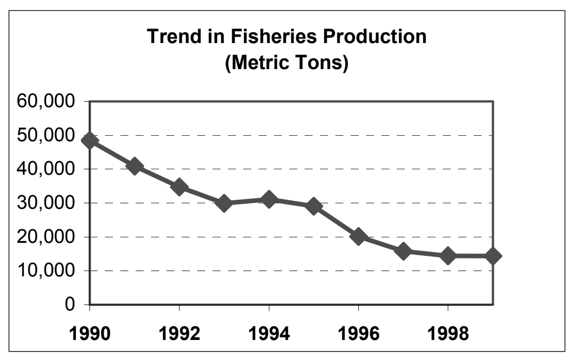


	1992	1995	1998	1999
Total electricity production (GWh/year)	54,195	59,266	53,496	50,713
From hydroelectric	21.6%	28.2%	35.3%	36.1%

IRRIGATION	1992	1995	1998	1999
Irrigated land ('000 ha)	3,100	3,110	2,880	2,673
Irrigated land per capita (ha)	0.134	0.137	0.128	0.119
Irrigated land as share of cropland	31.1%	31.4%	29.3%	27.2%



FRESHWATER FISHERY	1990	1995	1998	1999
Fishery production (metric tons)	48,436	29,031	14,481	14,403
Fishery production per capita (kg)	2.09	1.28	0.64	0.64



FINANCING THE WATER SECTOR		
Average cost recovery:		
Irrigation water services		
Municipal water services	100% O&M costs	
* These are ball park estimates.		
	2000	
Domestic water-related services (US cent/m3)		
Combined water and sewerage	18-48	
Waterwater	20-30	vary by location
Extraction charges - inland rivers (US cent/m3)		
Households, industry and livestock	0.61	
Irrigation	0.05	
Power plants	0.004	
Extraction charges - Danube river (US cent/m3)		
All except irrigation	0.07	
Irrigation	0.05	
Extraction charges - groundwater (US cent/m3)		
Households	0.30	
Industry	0.67	
Irrigation	0.05	
Livestock	0.40	

SERBIA AND MONTENEGRO (A note for Kosovo is attached to this note)

Socio-Economic and Geographic Context

Serbia and Montenegro are located in southeastern Europe in the heart of the Balkan peninsula. Serbia is considerably larger (88,361 km^2) than Montenegro (area 13,812 km^2) covering 85% of the total land area. Within Serbia there are two semiautonomous provinces, Vojvodina (21,506 km^2) in the north and Kosovo (10,887 km^2) in the South. (Water resources issues in Kosovo are presented in the attached note). Serbia and Montenegro is bounded by the Adriatic Sea with 199 km of coastline and by seven countries: Albania, Bosnia and Herzegovina, Croatia, Hungary, Romania, Bulgaria, and FYR Macedonia. Forest and woodland cover 17% of the country's area and 40% is arable land.

Of Serbia and Montenegro's current total population of 10.65 million, approximately 10 million reside in Serbia and 650,000 in Montenegro. Population trends with significant impacts on water resources, particularly demand for urban drinking water services, are: (i) the urbanization of the population now at 69% (52%) with increasing populations in the six large cities all already experiencing significant problems in wastewater management; and (ii) the influx of refugees (700,000) and internally displaced people from Kosovo (300,000) which puts pressure on an already stressed system of water supply and sanitation.

Water Resources

Surface and groundwater resources. The country has an annual per capita water flow of about 18,400 m^3 per capita. The country is poor in terms of internally renewable water resources, since about 85% of available water originates outside its territory. Yearly groundwater reserves total about 284 m^3 per capita. Groundwater sources are extremely important especially for Serbia where they are estimated to supply 90% of domestic and industrial needs, and 70% of drinking water needs. In many areas of Serbia and Montenegro, groundwater cannot be used for drinking purposes without prior treatment. This is particularly true in certain areas close to the Morava and Danube Rivers in the Vojvodina Region.

Annual rainfall in the Danube river basin in Serbia and Montenegro is about 74.0 BCM on average; of this quantity about 23.5 BCM runs off and the remainder of 50.5 BCM accounts for evapotranspiration. There is also an annual inflow of about 154.5 BCM so that the total annual run-off of the Danube, at the exit from Serbia and Montenegro is about 178 BCM. Hydrological balances are highly inequitable in terms of time and space. During the growing season rainfall in some regions is only about 28% of the annual average.

The transboundary rivers Sava (206 km in Serbia and Montenegro); Drina (220 km in Serbia and Montenegro) and Morava (308 km all in Serbia and Montenegro), along with the Danube, form the main water resources of the country. The Danube river basin covers 87% of the country's territory. The Danube River flows 588 km within Serbia and Montenegro of which about 138 km constitute the border with Croatia and about 213 km constitute the border with Romania. The Sava crosses the Vojvodina region through the Pannonian plain, runs through the capital city of

Belgrade and exits the country through the Balkan Mountains, at the Iron Gate gorge, finally flowing into the Black Sea. In Montenegro the most important river systems are the Moraca, Zeta, Lim, Tara, and Piva. Serbia and Montenegro's water resources include lakes and the Adriatic coastal waters. Lake Skadar is the largest lake on the Balkan peninsula with a surface area of 391 km^2. About two-thirds of the lake is located in Serbia and Montenegro, the rest is in Albania. The lake is an open freshwater lake of tectonic-karst origin, and is drained by the Bojana/Buna River into the Adriatic Sea. The water volume oscillates from 2.6 and 4.4 BCM and the water surface, in intervals, from 368 to 542 km^2. Overall, 21 rivers flow into Serbia and Montenegro and 6 flow out

Water flow varies seasonally which has required the formation of reservoirs on the rivers Drina, Danube and Lim. There are 60 reservoirs (about 20 of them larger than 10 MCM) and about 100 smaller reservoirs within the Danube River basin in Serbia and Montenegro. The total retention volume of all reservoirs is about 6.5 BCM. The annual average precipitation in the country is 734 mm, but there are wide variations. In Serbia annual precipitation varies from 550–650 mm in Vojvodina, to 800–1200 mm in the mountainous regions. All lower parts in Serbia, including the lower Drina basin, have yearly precipitation below 800 mm. In contrast, Montenegro has abundant precipitation of about 2000 mm, on the average, and locally up to 5500 mm, with a maximum of 8500 mm.

Approximately 70% of the drinking water is abstracted from groundwater resources.

Wetlands. In Serbia there are several large wetlands sited behind the embankments along the Danube. There are also several significant wetlands along the Sava River that are Ramsar sites. Construction of river dams has destroyed some valuable valley ecosystems and their biodiversity, not only because the new artificial ponds have developed quite different ecosystems, but also because the dams interrupted species migration, causing changes of natural species composition, both downstream and upstream (no fish corridors were constructed). Dike systems that were constructed in order to prevent floods changed the water regimes and caused loss of wetland communities. In Montenegro, Lake Skadar is geographically and ecologically connected with other aquatic habitats (Bojana/Buna River, Velipoja Reserve and Domni marshes, Delta of Bojana/Buna River, Veluni Lagoon), thus creating a large complex of wetlands. Lake Skadar is identified as one of the 24 transboundary wetland sites of international importance, known as "Ecological Bricks Sites" (Europe's Environment, Dobris Assessment, 1995). There is no defined nature conservation policy in Serbia and Montenegro.

Water Quality. The quality of water resources is generally unsatisfactory and is deteriorating. Since the 1990s water quality in most Serbian rivers has deteriorated from second class (suitable for bathing and drinking purpose only after treatment) to third class quality (suitable for irrigation and industry). Examples of very clean water - Class I and I/II - are very rare, and are situated in mountainous regions. Much of the decline in water quality is attributed to high levels of pollution in those water sources entering Serbia and Montenegro. In general, no river entering the country has water quality that can safely be used for drinking with out advance treatment. Some of the rivers are so heavily polluted that their water cannot be used for irrigation. It is estimated that each year over 550-600,000 tons of BOD_5, 300-350,000 tons of Nitrogen, 20-30,000 tons of phosphorus and 14 million tons of sediment enter Serbia and Montenegro through transboundary rivers. Serbia and Montenegro then contributes more to the Danube basin's nutrient load in the annual amounts of 43,303 tons nitrogen and 14,128 tons of phosphorus. Thus, although Danube waters coming into the country are polluted by other upstream countries, Serbia and Montenegro are considered amongst the most significant of Danube polluters, contributing about 13% of the Danube nutrient pollution. The main point sources of water pollution in the Danube river systems and especially in Vojvodina (the catchment areas of the Tisza, Timis and Sava rivers).

The discharge of untreated municipal and industrial wastewaters within Serbia and Montenegro has resulted in significant pollution of water resources. River stretches downstream of major settlements show marked decline in water quality as the result of untreated municipal and industrial discharges. Point sources of pollution in the Danube River basin in Serbia and Montenegro include the over 7,000 settlements and communities. There are very few large cities (greater than 100,000 inhabitants) in the Serbian Danube river basin. Almost 90% of settlements are less than 2,000 population. The principal municipal point source polluters are the settlements with over 10,000 inhabitants, making up only 2.2% of the total number of settlements but causing more than 90% of total pollution load. Most of the small and medium industries are located in these settlements. Non-point source pollution contributes more than 50% of total water pollution. These sources deliver 70% of total nitrogen, 50% of total phosphorus, and 90% of fecal and coliform bacteria.

The water quality of most of Montenegro's rivers, namely the Moraca, Zeta, Lim, Tara and Piva, and that of Lake Skadar, are generally within the required level during most of the year. However there are hot spots of water pollution. The most polluted water bodies in Montenegro are two rivers, the Vezisnica and the Cehotina, in the vicinity of the industrial town of Pljevla in northern Montenegro. The deterioration of water quality of coastal waters is of significant concern given the negative impact this could have on the potential tourism trade. While the quality of coastal marine waters off Montenegro is generally satisfactory, especially in open stretches, the more confined bays with human settlements are affected by wastewater discharges and often do not meet bacteriological standards for bathing water in the summer. No information on groundwater resources in Montenegro is available.

Deterioration of the water supply infrastructure, including the disinfection systems (chlorination), has contributed to a decline in the quality of piped drinking water supplies. The problems with contaminated water supplies are prominent in Serbia where 29% of samples from piped systems in 2001 did not meet the physical/chemical or bacteriological standards. The country's municipalities reporting the best water quality are the large cities (Belgrade, Novi Sad, Nis and Podgorica) where there are more financial resources to adequately operate and maintain the water supply systems. The municipalities recording the poorest water quality often correspond to those housing refugees and Internally Displaced Persons (IDP), though it is not known whether this is due to prior problems with water infrastructure or to increased demands on the system. Medium size towns and rural areas have the most difficulty providing safe and adequate supplies of safe drinking water. In contrast to the big city water utilities, water companies in medium size cities and rural areas have limited access to financial resources and are not expected to attract private sector interest immediately.

Water Use and Management by Sector

Drinking Water and Sanitation Coverage. Water and wastewater infrastructure was well developed in the pre-existing Federal Republic of Yugoslavia. Service levels today, on an average, reflect this legacy with 87% of the population receiving drinking water supplies directly to their homes or yards, and 88% having access to a sewage or septic tank system. However, there are significant differences in service delivery regionally and also between urban and rural populations particularly in terms of drinking water supplies where urban/rural coverage figures are 97% and 68%, respectively.

Most of the population have access to sanitation: 57% linked to a sewage system, 31% to a septic tank. The rate of urban/rural sewage system coverage is 88% to 22%. Rural areas rely primarily on septic tanks for sanitation. However wastewater treatment is almost non-existent. Ten years of little maintenance and no investments in the wastewater supply sector has resulted in a situation whereby most municipal and industrial wastewaters are discharged, largely untreated.. It is estimated that only 13% of the total number of treatment plants work with satisfactory results. Overall, only about 12% of municipal wastewater is treated. Lack of access, *per se*, to water and sanitation is a public health issue for some populations, particularly those living in urban slums which are often located adjacent to poorly managed landfills, and largely inhabited by IDPs, Roma and refugees.

Irrigation. Irrigation as a water user does not play a key role in water resources. Only about 2% of arable land (160,000 ha) is served by irrigation systems. There are however numerous small private farmer built and managed irrigation schemes whose total water use is unknown.

Hydropower. The Iron Gate dams shared by Serbia and Montenegro and Romania are the single largest hydropower dam and reservoir system along the entire Danube. These serve for electric power generation and the improvement of navigation with a volume of 2.55 BCM and 0.87 BCM for Iron Gate I and II, respectively. Hydropower is about 37% of installed electricity production in Serbia and 75% in Montenegro.

Floods. Floods have always endangered large parts of Serbia, particularly the valleys of larger water courses in which the biggest settlements, the best farm land, infrastructure, and industry are located. The largest potentially flooded area lie around the rivers - Danube, Sava, Tisa, and Velika Morava. The total potentially flooded area is about 16,000 km² of which about 12,900 km² is lowland in Vojvodina. About 80% of potential flooded area is arable land and within it there are more than 500 settlements and many important industrial plants.

In Montenegro, plains comprise only 5% of the 3812 km² of the republic, of which only one third is periodically flooded. Although flooding is likeliest in the plains, it occurs irregularly in other areas. For example, the karstic structure of much of Montenegro can transport flood waters rapidly away from inundated areas, and likewise cause them to re-emerge later in other locations. Groundwater redistributes excess flow among catchments, making analysis of the water budget difficult. In comparison to the overall flood potential of the country, this is a minor contribution. However, locally it is of major importance for Montenegro, because of the general scarcity of farmland, which is entirely confined to the flooded plains. In addition to the farmland, numerous villages, traffic and communication lines are endangered by flooding, while in the region of Lake Skadar, flooding has detrimental effects on hygiene for the local population, In some regions, the surface runoff reaches 60–80 l/sec per km², or 44 l/sec per km² on the average (which is 6.4 times greater than the world average). However, uneven distribution of rainfall over the year causes seasonal flooding which is most intensive in the period from November to December, and somewhat less intensive in the period February to May

Extensive works have been done to build systems for flood mitigation systems and for regulation of water courses. Flood protection levees have been built along all the major rivers and their tributaries. More than 90% of the levees along the Tisza and Danube are built to handle 100-year floods. There are about 3,550 km of flood-defense embankments in Serbia and Montenegro. However, both direct and indirect damages due to floods and non-regulated rivers are still significant. The recent Serbia and Montenegro Agriculture Sector Review (2002) notes that the diversion of funds and equipment normally used for routine drainage maintenance to flood protection tasks such as repair of flood dikes, river training, bank protection and torrent control, has significantly limited the country's ability to maintain irrigation and drainage structures critical for agricultural development.

Water Legislation and Policies

In Serbia and Montenegro there is a body of water law at the federal level, and at each of the two republic levels. Serbia and Montenegro each have their own bodies of law, policies and institutional structure for water resource management. The Serbian Law on Waters covers protection of waters, utilization and management of waters, goods of general interest, conditions and methods for performing water-related activities, organization and financing of such activities, and supervision and monitoring for enforcement. The enforcement of the Law refers to surface and groundwater, including drinking water, thermal and mineral waters, border and trans-boundary water flows, and inter-Republic water bodies within the boundaries of Serbia. Regulations on Hazardous Substances in Waters, the Official Bulletin of SRS (No. 31/82), and Regulations on Methods and Sampling for the Assessment of Wastewater Quality, and the Official Bulletin of SRS (No. 47/83) govern surface and groundwater quality monitoring.

Water resources are managed in Montenegro according to several laws and a number of regulations. The key laws are:

- Law on sea and internal shipping (Off. Jour. of SRM, No. 13/78, 8/79, 19/87, 36/89, 13/91)
- Law on water supplying, removing of wastewater and depositing of solid waste in the territory of municipalities: Herceg Novi, Kotor, Tivat, Budva, Ulcinj and Cetinje (Off. Jour. of RM, No. 46/91)
- Law on the sea good (Off. Jour. of RM, No. 14/92)
- Law on waters (Off. Jour. of RM, No. 16/95, 22/95)

The Water Master Plan for Serbia (2002) presents an ambitious and expensive program of water supply infrastructure investments to 2012. Activities related to protection, reclamation and revitalization found water resources are also proposed. The investments are estimated at 947 million DM over the next 5 years.

Water Management Institutions

Like the body of law, water management institutions exist on the federal and republic levels. In the 1990s the water management system in the then pre-existing Federal Republic of Yugoslavia was revamped from one that was very decentralized developed on the hydrographic units, to one that is more strictly centralized and built according to the model of a state-centralized system. The State Water Management Company "Srbijavode" is the key institutional body of water management in Serbia. In Montenegro the situation is much different. Although the water management system of Montenegro is centralized as well, and fully incorporate in the Government structure, there is not institutional body like the "Srbijavode." A small number of experts inside the Ministry for Agriculture, Forestry and Water Management handle all water management issues. Responsibility for water management in Montenegro is shared among the Ministry of Agriculture, Forestry and Water Management, the Ministry of Environmental Protection and Spatial Planning and the municipalities. All water sector infrastructure belongs to the Republic. The Republic delegates its use and responsibility for service provision to municipalities, with each having its own water company. The Ministry of Environmental Protection and Spatial Planning has taken the lead for sector planning and organization, including the involvement of the private sector. Accentuated by the de jure and de facto shift of competencies from the federal level to the Republics, the responsibilities of the Department of Environment (within the Federal Secretariat for Labor, Health and Social Care) have diminished. The Department continues to play an important role in international matters, such as the negotiation and ratification of international environmental conventions and agreements, as well as obligations emanating from them, such as monitoring of transboundary water pollution.

Water quality monitoring is conducted by each republic's Hydrometeorological Institute, which is responsible for measuring and recording quantities of wastewater discharged, and submitting the data to the relevant public agency. Monitoring also includes tracking the performance of wastewater treatment facilities. Each of the republic's Institutes of Public Health have responsibility for monitoring drinking water supplies and the authority to close systems that do not produce water according to standards.

There is no federal or national agency that regulates water utilities, plans service needs or channels funds or support in a coordinated manner. Several ministries (agriculture, forestry and water management, civil engineering, health, and finance) control utility operations in the areas under their authority, all of them involved (including ministries that have no logical involvement with the sector, such as Justice), but none with real sector responsibility of leadership function. This, combined with the "de facto" complete decentralization of service provision to municipalities, results in fragmentation, lack of planning and advocacy for the sector. The multitude of uncoordinated laws and regulations applicable to the sector further contribute to its fragmentation.

Water management problems in Montenegro are essentially the same as those noted for Serbia; however Montenegro is piloting a new approach to management. It has recently introduced a private/public partnership in utility management in the coastal region and in the municipality of Cetinje. The Public Enterprise for Water Supply, Wastewater Treatment and Solid Waste Disposal (Crnogorsko Primorje—PEW) has entered into a consortium (Monte-Aqua) with private partners selected through international competitive bidding to rehabilitate, upgrade, extend and manage the water supply and sanitation services of the area under its responsibility. Phase I of this program started on January 16, 2001, with financing from the German Government (about USD7.3 million) for technical assistance and urgent investments in rehabilitation and improved operation. Six of the seven coastal municipalities have signed letters of intent to participate in the program according to the concept of public/private ownership.

Transboundary and International Water Issues

Flooding is a significant transboundary issue. Flooding in the plains of the transboundary rivers has caused damage exceeding affected counties' contribution to GDP. In 1965, for example, flooding on the Danube lasted four months and damaged the homes of 7000 people. The Tisza and its tributary, the Tamis, are known for large-scale flooding events that originate in snowmelt and heavy rains in the Carpathian region. These floods spread over Hungary and Romania and can reach Serbia and Montenegro as well. The Tamis/Tisza basin saw enormous floods in February 1999, April 2000 and March 2001. The Government cooperates with Hungary on flood control of the Tisza and with Romania concerning the Tamis. Flood mitigation on the Sava depends on improved coordination among Bosnia, Croatia and Serbia and Montenegro. Coordination with Slovenia concerning pollution of the Sava is also a concern

Serbia and Montenegro have been isolated from international and SEE regional water resource management activities for the past ten years. Previously Serbia and Montenegro was part of bilateral agreements with Danube countries. For instance, official cooperation between Serbia and Montenegro and Romania in water management started in 1932 and made official in 1955 where they cooperated mostly in relation to the hydroelectric plants of the Iron Gate I and II dams. The agreement on Water Management Cooperation between the pre-existing Federal Republic of Yugoslavia and Hungary was signed in 1955 and is conducted by the Yugoslav-Hungarian Water Management Commission. Although many tasks an duties are elaborated in these agreements, many issues are not, e.g. joint consideration and reconciliation of water control projects, state of the ecosystems in both countries. An important cooperative step is the implementation of the Agreement on the Tisza Water Control (described in the larger paper). There is an interest in extending the relationship around the Timok river.

Serbia and Montenegro is a signatory of many multilateral agreements dealing with the protection of the Danube waters, directly or indirectly, including: The convention on the Regime of Navigation on the Danube (1948); The Agreement on the Protection of Waters with the Tisza River Watership (1988); Convention on Cooperation in the Protection and Sustainable Use of the Danube River (1994); Convention on the Protection of Wetlands and Wetland Ecosystems (1986). The country has not yet ratified the Convention on the Cooperation for the Protection and Sustainable Use of the Danube River although the Ministry of Natural Resources and Environment has announced the start of regular cooperation with the International Commission for the Protection of the Danube River. The country is not a Party to the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

Nutrient Pollution is a transboundary issue to which Serbia and Montenegro is a significant contributor. Policies and incentives to reduce nutrient run off in the agricultural sector and improved municipal and industrial wastewater treatment in the

Danube Basin are needed to alleviate this problem. It has been proposed by UNECE that the Federal Secretariat for Labor, Health and Social Care design and implement a Danube Nutrient Reduction investment project consistent with the nutrient reduction targets called for by the Convention on Cooperation for the Protection and Sustainable Use of the Danube River.

Key Issues and Challenges

Because Serbia and Montenegro has been at a distance from transboundary processes and activities, not only due to the sanctions imposed by the international community, but also due to the political climate, the country does not have regulated relations concerning shared water resources with its neighbors, e.g. Bosnia and Herzegovina and Croatia, although there have been initiatives on each side to do so. In the past the country has not supported the initiatives of Hungary and Romania in regard to the revision of existing or signing new water treaties. Serbia and Montenegro should be included as soon as possible in the multilateral conventions relevant to water resources. The UNECE has recommended Serbia and Montenegro to sign for:

- The Sofia Convention of the Protection and Sustainable Use of the River Danube;

- The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes; and

- The UNECE Convention on the Transboundary Effects of Industrial Accidents.

One recent development that is a positive signal for improved transboundary cooperation is the Sava Basin Initiative, a Stability Pact Initiative for the Sava River Basin, which is designed to establish and develop an internationally recognized partnership between four countries: Bosnia and Herzegovina, Croatia, Slovenia and Serbia and Montenegro, and to support the countries' concerted effort to define, promote and organize the Sava Basin water and related resources. The first priority involves the re-establishment and development of navigation on the Sava River and its main tributaries, the Drina and the Una. By signing a Letter of Intent in Sarajevo on November 28, 2001, the four riparian countries of the Sava Basin committed themselves to establishing a suitable institutional framework. In October 2002 a draft institutional framework was discussed and is currently under review. An Action Plan is in preparation directed toward achievement of the objectives of the draft Framework Agreement. The goals of the Plan are:

- Establishment of an international regime of navigation on the Sava River and its navigable tributaries;

- Establishment of sustainable water management; and

- Undertaking of measures to prevent or limit hazards, and reduce and eliminate adverse consequences, including those from floods, ice hazards, droughts and incidents involving substances hazardous to water.

A key national level issue is the deteriorating trend in water, sanitation and wastewater management and water use. Rural areas rely heavily upon private water supply systems that are beyond the purview of any water quality monitoring program. Given the poor water quality in general, this situation could render rural communities and households susceptible to water related health problems. Lack of access to water and sanitation is a major public health issue, particularly for urban slums largely inhabited by internally displaced persons, Roma and refugees.

Another country-specific issue, with transboundary ramifications, is the deterioration of the coastal zone and its water resources in Montenegro. Eutrophication and bacterial contamination in tourist areas are documented and visible. The coastal areas also experience shortages of drinking water during the peak summer season. There is no coastal zone management plan to guide decision making on coastal development and pollution control. Montenegro's aspirations to develop its tourism sector (it is targeting 22 million tourist nights or four times the current figure by 2020) necessitate that these negative trends be reversed. Developments need to be supported by stricter application of water, sewerage and wastewater treatment standards, investment in wastewater treatment and land management planning. Water pollution control through improved wastewater treatment is a priority intervention Montenegro should prepare a coastal zone management plan integrating all sectoral plans including documents for infrastructure, environmental and landscape protection, as well as municipal services development.

Much of the decline in water quality is attributed to high levels of pollution in those water sources entering Serbia and Montenegro. In general, no river entering the country has water quality that can safely be used for drinking without advanced treatment. Apart from the Velika Morava river basin and several small streams, the major part of the country belongs to transboundary catchments. Thus management of the water resources for water quality, navigation, hydropower, requires close cooperation with those who share the river. Yet, as previously described, existing bilateral or regional agreements with neighboring countries on issues of water protection and management are either out of date or non-existent

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KOSOVO

Socio-Economic and Geographic Context

The population of Kosovo is about 2,200,000. There have been dramatic shifts of the population from rural areas to urban areas since 1999. An estimated two thirds of the population now live in urban areas as compared to about one third prior to 1999. There is no official estimate of GDP but it is clear that Kosovo ranks amongst the poorest parts of Europe.

Kosovo encompasses an area of almost 1.1 million hectare and is comprised of two large, distinct topographical units: Kosovi (656,000 ha) and Dukagjini (437,200 ha). Kosovo lies on highlands (500-600 masl) surrounded by mountains reaching an altitude of more than 2000 m. Lower mountains divide the highland plan into four watershed areas, from where waters flow to three different seas—Adriatic, Black Sea and Aegean basins. There is virtually no inflow to Kosovo form neighboring countries.

Before the Conflict, Kosovo was primarily rural with only 32.5% of the population living in urban areas, primarily Pristina. In the 1980s, Kosovo' economy was based primarily on the mining industry, production of lead, zinc and textiles and agriculture. Environmental issues were largely ignored and the environmental problems, which ensued, were further exacerbated by conflict in the region.

Water Resources Base

There is little information available about the present state of water resources and water use in Kosovo. In general, water resources are characterized as follows:

- Water resources are relatively small in Kosovo, compared to population and arable land.
- Seasonal variations in precipitation and river flows are high
- During the growing season (June-July), water use for irrigation is high, but flows in rivers are nearly at their minimum
- There is a large potential and need for irrigation, which might lead to serious lack of water.
- Rivers are very polluted (except rivers in the upper flow) and flows are low during the irrigation season in the vicinity of the Serbian and Albanian borders.
- Good quality ground or spring water resources are unevenly distributed (mainly in the western part) and are only partly available for water supply.

Surface and groundwater resources. Kosovo contains four river basins that drain into one of three seas: the Adriatic, the Aegean and the Black Sea. The main rivers are relatively small and originate in the nearby mountains. The Drin in the western part of Kosovo flows to the south to Albania and on to the Adriatic Sea. Precipitation varies from 600-1,400 mm per year. The western part of Kosovo belongs to the Ibar and the Binack Morava river basins, which are upstream areas of one tributary of the Danube.

Annual precipitation is generally less than 700 mm. In southern Kosovo the Lepenac river basin belongs to Vardar river basin and discharges into the Aegean Sea. The annual rainfall is 670-1,000 mm.

There are no natural lakes in Kosovo. Due to the high flow variations, six reservoirs have been constructed with a total volume of 2.7 MCM. There reservoirs serve water supply, fishery, irrigation, recreation and flood protection. Another 52 more reservoirs have been identified.

The geology of western and eastern Kosovo is different. The western part consists of porous rocks (limestone and marble rocks) and sediments. Here there is spring and ground water available which can be exploited. By the foothills of the mountains there are some areas with springs with good capacity and water quality. In the eastern part rocks and sediments are more impermeable and groundwater cannot be easily exploited.

Water Quality. River water quality in the lowland rivers is very poor due to lack of wastewater treatment and waste disposal, while the upstream rivers, flowing from the mountains, have relatively good water quality. The main rivers downstream of larger municipalities and industries are so heavily polluted that the water cannot be used for water supply or irrigation. Groundwater quality is also affected by pollution. The main sources of water pollution are human settlements, industry and agriculture. A significant degree of pollution enters the country through rivers. Although industries are not operating, the non-closed sites of heavy industry are still a source of environmental pollution. The sites are contained with metal processing waste and various chemical which are leaking into the surface and groundwater. Monitoring of the river quality of Kosovo's rivers carried out during 1980s showed that pollution of rivers by organic compounds was marked, especially in urban rivers and streams. During months when overall water volume decreases, some rivers have no or very low levels of dissolved oxygen. The rivers are also polluted with heavy metals such as lead and zinc, especially those in the region of Mitrovice/Mitrovia. Parts of the Prishtevka, Sitnica and Iber rivers are assumed to be "dead" rivers.

Wastewater from Kosovo's thermal power plants, the electric industry, the Trepca industrial complex and ferrous-nickel production were also discharged into the river systems. During the economic embargo against the pre-existing Federal Republic of Yugoslavia, surface water quality improved because many industries reduced activity or closed. Remaining sources of pollution are the mines, where acid mine drainage contaminates ground and surface water with heavy metals; tailings piles; and storage tanks of chemicals at industrial complexes. There is no reliable data about the degree of pollution or among to pollution load.

Groundwater is generally of high quality. The main water quality problems of spring water is hardness.

Water Use and Management by Sector

Drinking water & sanitation coverage. Overall, about 50% of the total population receives their drinking water supply from a public utility. The urban water supply coverage is 87%, a relatively low figure which is explained by a few towns where the coverage is extremely low. Only 8.4% of the rural population has access to the water distribution system. People in rural areas rely on village water supply systems, their own wells or on springs and surface water sources. Rural wells are generally in bad condition and the water quality is poor, due to organic contamination. Where available, water supply service is limited by several problems , such as pipe breaks, interrupted power supply, and limited storage capacity. Water distribution networks are generally very old and in poor condition from lack of replacement investment and maintenance. Only a few utilities are able to provide adequate amounts of water to the population. At the same time, because tariffs for water use are low and there is no metering, water consumption per capita is too high.

The annual water production of the public water utilities is reported to be about 85 MCM (before the conflict 110 MCM), accounting for 210 lcd , whereas the total water use is only 52 MCM (110-115 lcd). The production is at the same level with the EU average (250-300 lcd). However, only a few municipalities are able to provide adequate amount of water for the population. At the same time, due to lack of metering and low tariffs, some consumers use (and waste) huge quantities of water, assessed by any standard. Domestic water use represents the major share of water supplied by public water utilities. In nine municipalities (23%) the domestic use remains below 80 lcd, which indicates restricted supply, low living standard or very economical water use. In 12 municipalities (38%), the domestic use is between 80-150 lcd. Only in Pristina water use is more than 150 lcd. Water losses are reported to be very high from 26-63% of the water production (average 51%).

The raw water supply of the public water utilities is mainly (60%) abstracted from surface waters. Rural population and smaller municipalities mainly use ground or spring water. The only cities using spring water are Peja and Prizren. The quality of raw water from surface water in Kosovo is, in general, moderate, because water is abstracted from artificial reservoirs. Some water sources are reported to be polluted or potentially endangered by organic contamination, due to lack of wastewater treatment, neglected maintenance of sewerage systems, intensive deforestation, or agriculture. In most cases, the water source is bacteriologically unsafe.

Only 28% of the population is connected to a sewage system and this is almost all urban. In villages and other small settlements, wastewater is disposed of in open channels where the waste evaporates or seeps into the ground causing rainwater contamination and contamination of wells. There is a high incidence of communicable disease in some rural areas. There is no wastewater treatment of any kind in Kosovo. Industrial wastewater is also not treated and discharged directly into the rivers. Before the conflict in 1999 the rivers were more polluted from industry that today but because there is no reliable information about the present state of rivers, this effect is not quantifiable.

The donor community has provided assistance in water supply and sanitation since 1999. As one example, the Healthy Villages Project is an initiative of the World Health Organization (WHO) to improve the health of the people in villages in Kosovo. The project focuses on three objectives: community health education and improvement of water sanitation facilities in the villages; hygiene training; and water quality control and inspection. The project is being developed in 68 villages across Kosovo, with 729 rehabilitated wells, 52 new wells. 8 pumping stations, 7 spring catchments and 6 sewage systems.

Irrigation. Agriculture is a very important source of livelihood in Kosovo and the biggest water user is agriculture abstracting water for irrigation. The area of agricultural land potentially to be irrigated in Kosovo, totals about 205,000-278,000 ha, while the irrigated area, excluding farms that apply occasional and informal irrigation, totals 77,000 ha in six irrigation areas (26% of the potential). The six irrigation schemes have recently been rehabilitated through the European Agency for Reconstruction. In addition there are 40,000 ha south from Pristina, which is planned to be irrigated through Ibar-Lebenc system. About 60,000 ha are irrigated with sprinklers, others with flooding systems. Annual water demand is 3500-4000 m^3 per hectare, totaling 300 MCM. Most of water is used in July and August. Irrigation can use nearly all water from the main rivers during these months. There will not be enough water for irrigation without further construction of reservoirs, if the whole potential is going to be irrigated.

Because there is little use of fertilizers and pesticides at the moment, their impact on water quality is relatively low. However, this situation is likely to change in the near future and it is important that polices be developed now to address the potential risks from run-off of the chemicals into the soil and water system.

Water demand from rivers will increase as the irrigation systems become fully operation. Conflicts between illegal irrigation, water pollution and water supply will continue. However, there is no monitoring of the volumes abstracted, stored or transferred or on the downstream impacts on river flows and quantity. Impacts of irrigation include damage to habitats and aquifer exhaustion. There is a need to define limits for the volumes of water abstracted and to monitor the impacts on rivers and ecosystems.

Hydropower. Hydro power is not an important user of water in Kosovo. There is one small 33 MW hydropower station in Kosovo located in Kazivodo Lake in northern Kosovo. It is not known what future plans are, if any, for hydropower expansion.

Flooding. Flooding has not historically been a serious problem in Kosovo since it is located in highlands. The constructed reservoirs with a total volume of 2.700,000 MCM decrease the risk of floods. The last major flooding was in 1979.

Water Legislation and Policies

The necessary legislation for sustainable water management is largely lacking and former legislation of water management is not applicable to present institutional arrangements. In cases that are not covered by the constitutional framework for self-government (UNMIK/REG/2001/19), the laws in force dealing with water after March 22 1989 may be applicable if they are non-discriminatory. Consequently, legislation from the former Socialist Republic of Yugoslavia, the Federal Republic of Yugoslavia, and Serbia and Montenegro. Due to these different origins, the body of law is extremely complex.

The most important law on water management in Kosovo is the Law on Waters of 1976 which covers the main aspects of water use and management. The Law is largely outdated and no longer applicable to the present institutional arrangements.

A new Water Law is now under preparation with the assistance of USAID. The law will establish clear responsibilities for the central government and River Basin Authorities. The organization of River Basin Districts to decentralize water resources management is already an official policy of the Kosovo Water Authorities. All ministries and agencies have agreed to follow this modern approach to water management. The main responsibilities of the River Basin Authorities as regional development and regulatory bodies, will be licensing for water abstraction, permits for waste water discharges, enforcement of law and regulations, safeguarding of public interests, planning of river basin management, monitoring and dissemination of information (currently water operators are not paying for the water they abstract from water flows nor for the wastewater they discharge).

A draft Regulation on the Public Water Supply System was finalized in June 2002. This will regulate all public utility service providers of water services, with specifics regarding the sale, quality, and reliability of drinking and irrigation water and wastewater. This regulation along with the new Water Law will set the new legal framework of water activities in Kosovo

A water master plan was adopted in 1983 and approved for 20 years. This water master plan needs to be renewed and updated, which would be the main task of the newly created Water Management Division of the Department for Environmental Protection. A strategy for irrigation is needed as well.

Water Management Institutions

Until very recently, no water central authority was operational in Kosovo. The former Hydro-Economy Directorate, that concentrated all responsibilities for water resources management, ceased to exist before the conflict. In March 2002, the Ministry of Environment and Spatial Planning (MESP) was established and was give the responsibility for all water resource management responsibilities. Sectoral responsibilities have been split with MESP in charge of the development of water policies, water monitoring and protection; the Ministry of Agriculture, Forestry and Rural Development responsible for irrigation; the Ministry of Health in charge of monitoring and protection of drinking water quality; the Kosovo Trust Agency responsible for municipal administration; and the Public Utilities Regulatory Commission in charge of regulation. The 34 public water utilities are under the administration of this agency, which has plans to consolidate the water enterprises by reducing their number to four regional river-basin utilities to improve efficiency and cost-effectiveness.

Agency responsibilities are not well defined. Key areas still need to be defined and developed including creation of a database of water users and discharges and subsequent licensing arrangements; re-establishing the hydrometric network. To begin addressing these problems, the MESP has created a Water Management Board in August 2002 to coordinate inter-Ministerial activities and develop concerted approaches to water resources management

Before the conflict, the Hydro-meteorological Institute (HMI) was responsible for meteorological and hydrological monitoring but since the network was destroyed in 1998 no monitoring has taken place. The European Agency for Reconstruction has recently started a project to rehabilitate the hydrometric network and meteorological stations. River gauging stations will be rebuilt. The project will also build the capacity of the HMI. The gauging points to be rebuilt this year will serve as a basic network but new sites will be necessary in the future, especially on the borders with neighboring states. Other monitoring networks need restoring including the rainfall and the ground water monitoring networks.

In view of these deficiencies, the MESP has identified the following priorities for the water resource sector:

- Drafting of a new Water Law;
- Preparation of a new Water Master Plan;
- Development of River Basin Authorities;
- Re-building of the monitoring network;
- Capability building in water institutions; and
- Develop a strategy to "catch up" with European standards of water quality and pollution control

Donor co-financing has been secured for most of these priorities.

Transboundary Waters Issues

The Kosovo conflict had environmental impacts related to transboundary water resources. Neighboring countries, especially Bulgaria and Romania, downstream along the Danube feared the effects of pollution from targeted industrial facilities in Kosovo. Upstream of Kosovo, the UN Balkans Task Force found environmental hot spots in four areas—Pancevo, Kragujevva, Novi Sad and Bos—some of which created significant pollution of water resources shared with Kosovo. War and conflict related pollution only aggravated the existing situation whereby Kosovo was the receiver of significant pollution as well as the generator.

Key Issues and Challenges

The policy and institutional development of the water resource sector has moved forward in the past three years but implementation and enforcement of environmental and water policies is limited. Although there is a consensus of priorities within the ministry, a clearly structured integrated water resource management strategy could be useful.

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SERBIA AND MONTENEGRO: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	10.53	10.55	10.31	10.19
Urban population	49%	52%	55%	58%
Rural population	47%	48%	45%	42%

Source: Aquastat database, FAO (2002).

	1990	2000	Goal for 2015
Access to piped water supply	n.a.	83%	92%
Urban	n.a.	97%	99%
Rural	n.a.	68%	84%

Note: Goal refers to MDGs.

	1990	2000	Goal for 2020
Access to sewerage	n.a.	56%	78%
Urban	n.a.	88%	94%
Rural	n.a.	22%	61%

Note: Goal refers to MDGs.

	1999
Share of poor in rural areas	n.a..

	1994	1995	1999	2000
GDP per capita (constant 1995 US$)	n.a.	1,167	1,181	1,240
GDP total (billions of 1995 US$)	n.a.	12.3	12.6	13.2
Share from agriculture	31%	31%	25%	n.a.
Share from industry	40%	39%	38%	n.a.

	1990	1995	1998	1999
Labor force (millions of people)	4.9	5.0	5.0	5.1
Share in agriculture	n.a.	n.a.	n.a.	n.a.
Share in industry	n.a.	n.a.	n.a.	n.a.

Average annual growth	1991-97	1998-00
Of GDP	n.a.	-2.9%
Of population	0.1%	-0.1%

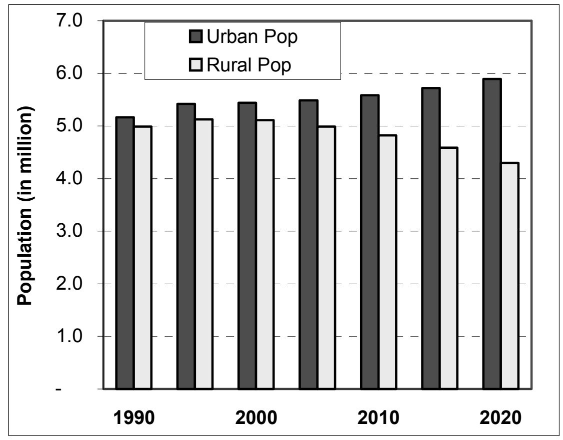
	1999
Infant mortality rate (per 1,000 live births)	..

LAND AND WATER RESOURCES

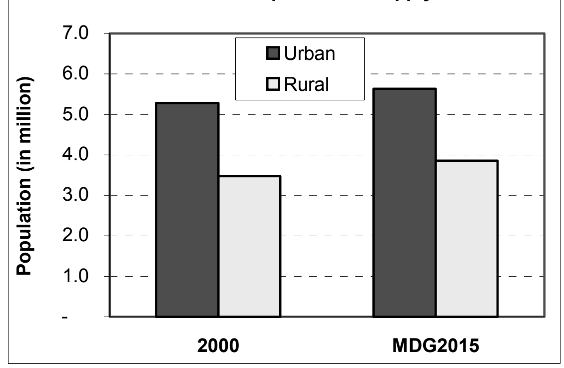
Land area (millions of ha)	10.2
Land area in international basins (millions of ha)	10.0
Percentage of country in international basins	97.4%
Average precipitation (mm)	724
Average total volume of rainfall (BCM)	74
Total internal renewable water resources (BCM)	25.1
Of which surface water (BCM)	23.5
Of which groundwater	3.0
Overlap between surface and groundwater	1.4
Total external renewable water resources (BCM)	164.5
Of which surface water (BCM)	164.5
Of which groundwater (BCM)	0.0
Total renewable resources (BCM)	189.6
Of which total surface water (BCM)	188.0
Of which total groundwater (BCM)	3.0
Overlap between surface and groundwater	1.4
Dependency ratio	86.8%

	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	18,007	17,968	18,392	18,603

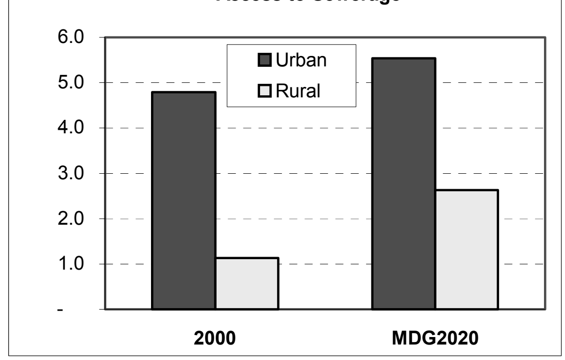
	1997
Total annual water used (in BCM)	8.40
Agriculture	0.76
Industry/cooling	6.23
Domestic	1.41



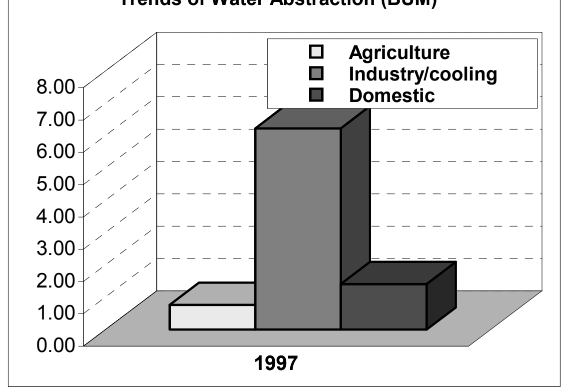
Access to Piped Water Supply



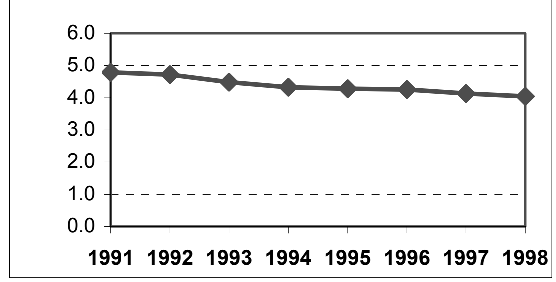
Access to Sewerage



Trends of Water Abstraction (BUM)



WATER QUALITY AND POLLUTION	1999			
Wastewater discharge requiring treatment (BCM)	2.86			
Subject to adequate treatment (BCM)	0.16	(0.7% indus, 15% municipal)		
	1992	1994	1995	1998
Annual emissions of BOD per day (Tons)	133	124	124	117
Annual emissions of BOD per capita (kg)	4.7	4.3	4.3	4.0

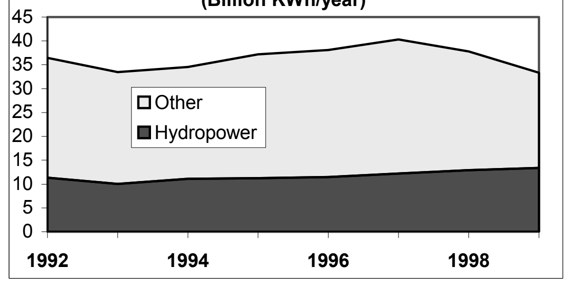


Trends in BOD Emissions

AQUATIC ECOSYSTEMS

Wetlands designated as Ramsar sites (2002)	
In ha	39,861
As % of land area	0.39%

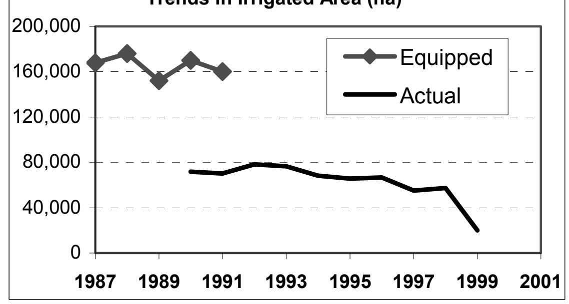
DAMS AND HYDROPOWER	1995	
Reservoir capacity (BCM)	7.78	
Irrigation dams (BCM)		
Hydropower dams (BCM)	4.75	
Reservoir capacity in cubic meters per capita	737	(in 2000)
Gross theoretical hydropower potential (GWh/y)	37,000	
Technically feasible (GWh/y)	27,000	
Economically feasible (GWh/y)	n.a.	
Current production from hydropower (GWh/y)	12,000	(in 2000)



Trends in Electricity Production (Billion KWh/year)

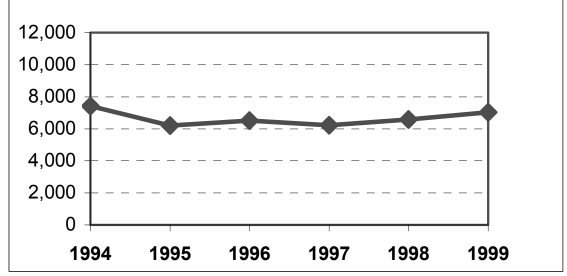
	1992	1995	1998	1999
Total electricity production (GWh/year)	36,488	37,176	37,808	33,370
From hydroelectric	31.1%	30.2%	34.1%	40.1%

IRRIGATION	1988	1989	1990	1991
Irrigated land ('000 ha)	176	152	170	160
Irrigated land per capita (ha)	0.017	0.015	0.016	0.015
Irrigated land as share of cropland	2.3%	2.0%	2.2%	2.1%



Trends in Irrigated Area (ha)

FRESHWATER FISHERY	1994	1995	1998	1999
Fishery production (metric tons)	7,423	6,210	6,589	7,033
Fishery production per capita (kg)	0.71	0.59	0.62	0.67



Trend in Fisheries Production (Metric Tons)

FINANCING THE WATER SECTOR

Average cost recovery:
- Irrigation water services
- Municipal water services

* These are ball park estimates.

	1997	
Drinking water tariff (US cent/m3)		
Households	11	(3.9-26)
Industry	42	(6.7-86)
Sewage tariff (US cent/m3)		
Households	4.60	(0.8-10.6)
Industry	19.60	(0.9-79.8)
Water abstraction charges (US cent/m3)		
Unprocessed water	0.5	
Drinking water for companies	0.8	
Mineral water manufactures	0.7	
Fishing ponds	4% wholesale price	
Hydropower	2.3% KWh price	
Wastewater discharge charges (US cent/m3)		
Industry discharging polluted wastewater	18.9	
Taxpayers discharging into sewerage systems	0.7	
Other taxpayers	5.3	
Thermal power plans -- cooling system	1.25% KWh price	

KOSOVO: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	**2000**	**2015**	**2020**
Total Population (in million)	1.90	2.00	2.50	2.60
Urban population	35%	45%	55%	60%
Rural population	65%	55%	45%	40%

Source: Aquastat database, FAO (2002).

	1990	**2000**	**Goal for 2015**
Access to piped water supply			
Urban	70%	90%	90%
Rural	5%	20%	53%

Note: Goal refers to MDGs.

	1990	**2000**	**Goal for 2020**
Access to sewerage	n.a.	28%	36%
Urban	n.a.	n.a.	n.a.
Rural	n.a.	n.a.	n.a.

Note: Goal refers to MDGs.

	1999
Share of poverty that is in rural areas	80%

	1990	**1995**	**2000**
GDP per capita (constant 1995 US$)	821	400	750
GDP total (billions of 1995 US$)	1.56	0.8	1.5
Share from agriculture	20	29%	
Share from industry	47	34%	

	1990	**1991**	**1995**	**1999**
Labor force ('000 of people)	248	120	100	150
Share in agriculture	17%	n.a.	n.a.	n.a.
Share in industry	50%	n.a.	n.a.	n.a.

Average annual growth	**1990-97**	**1998-00**
Of GDP	n.a.	n.a.
Of population	n.a.	n.a.

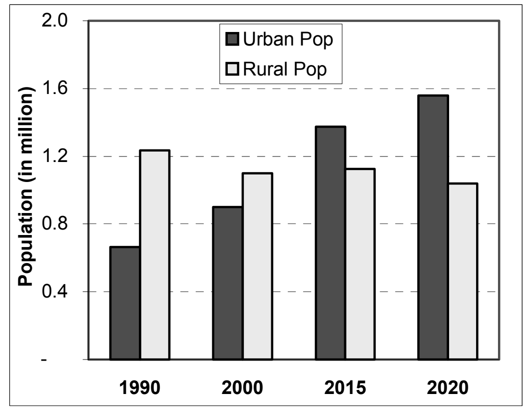
	1999
Infant mortality rate (per 1,000 live births)	n.a.

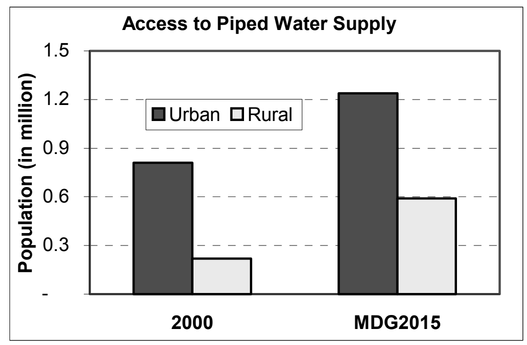
LAND AND WATER RESOURCES

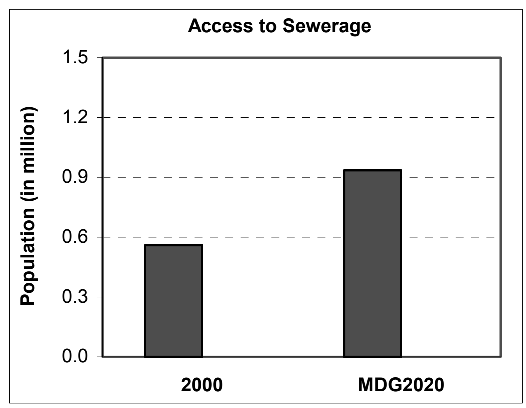
Land area (millions of ha)	1.087
Land area in international basins (millions of ha)	n.a.
Percentage of country in international basins	n.a.
Average precipitation (mm)	~600
Average total volume of rainfall (MCM)	6,522
Total internal water resources (MCM)	
Of which surface water (MCM)	412
Of which groundwater	
Overlap between surface and groundwater	
Total external water resources (BCM)	
Of which surface water (BCM)	
Of which groundwater (BCM)	
Total water resources (BCM)	
Of which total surface water (BCM)	
Of which total groundwater (BCM)	
Overlap between surface and groundwater	
Dependency ratio	

	1990	**2000**	**2015**	**2020**
Per capita water resources (cubic meters/year)	217	206	165	158

	1990	**1995**	**2000**
Total annual withdrawals (in BCM)			
Agricultural			
Domestic and industry			







WATER QUALITY AND POLLUTION

Wastewater produced (million cubic meters)	Pristina: 8.7;Prizren 4.2; Peja5; Gjilan 1.5 Gjakova 1.2;Mitrovica 2.5			
Wastewater treated	only partially in Obiliq			
	1990	**1992**	**1993**	**1994**
Annual emissions of BOD per day (Tons)				
Annual emissions of BOD per capita (kg)				

AQUATIC ECOSYSTEMS

Wetlands designated as Ramsar sites (2002)
In ha
As % of land area

DAMS AND HYDROPOWER

Reservoir capacity as of 1995	
Irrigation dams	2 dams
Hydropower dams	1dam
Reservoir capacity in cubic meters per capita	
Gross theoretical hydropower potential	
Technically feasible	
Economically feasible	
Current production from hydropower (MWh/h)	25

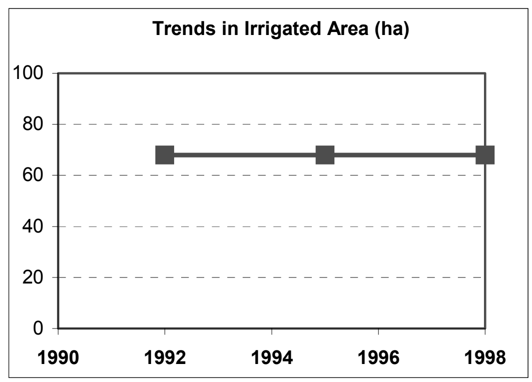
	1990	**1995**	**1998**	**1999**
Total electricity production (mw/h)	700	700	600	450
Share from hydroelectric				

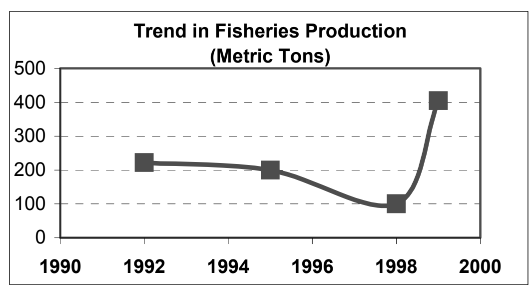
IRRIGATION	**1992**	**1995**	**1998**	**1999**
Irrigated land ('000 ha)	68	68	68	
Irrigated land per capita (ha)				
Irrigated land as share of cropland				

FRESHWATER FISHERY	**1992**	**1995**	**1998**	**1999**
Fishery production (metric tons)	222	200	100	405
Fishery production per capita (kg)				

FINANCING THE WATER SECTOR

Average cost recovery:	**2002**
Irrigation water services	
Municipal water services	
* These are ball park estimates.	
Average actual water price (US cent/m^3)	**2002**
Irrigation (US$ per Ha)	5-10
Domestic (US cent/m3)	0.39
Budget organizations	
Commercial	
Industry	
Industry using water as key raw material	
Untreated water	





Part 2

Water Fact Sheets for Non-Focus Countries

GREECE: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (in million)	10.16	10.56	10.47	10.33
Urban population	59%	60%	65%	67%
Rural population	41%	40%	35%	33%

Source: Aquastat database, FAO (2002).

	1990	1999	Goal for 2015
Access to piped water supply	n.a.	84%	92%
Urban	n.a.	91%	96%
Rural	n.a.	73%	86%

Note: Goal refers to MDGs.

	1990	1999	Goal for 2020
Access to sewerage	n.a.	98%	99%
Urban	n.a.	100%	100%
Rural	n.a.	94%	97%

Note: Goal refers to MDGs.

	1996
Share of poor in rural areas	n.a.

	1990	1995	1999	2000
GDP per capita (constant 1995 US$)	10,875	11,242	12,591	13,105
GDP total (billions of 1995 US$)	110.5	117.6	132.7	138.4
Share from agriculture	11%	10%	8%	n.a.
Share from industry	29%	23%	24%	n.a.

	1990	1991	1995	1999
Labor force (millions of people)	4.20	4.25	4.42	4.54
Share in agriculture	n.a.	n.a.	n.a.	n.a.
Share in industry	n.a.	n.a.	n.a.	n.a.

Average annual growth	1990-97	1998-00
Of GDP	1.5%	3.6%
Of population	0.5%	0.2%

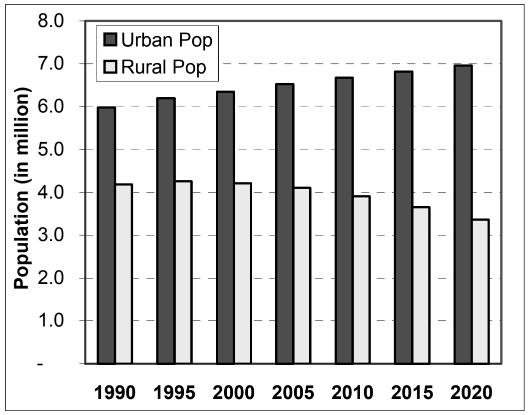
	1990	1995	2000
Infant mortality rate (per 1,000 live births)	9.7	8.2	5.4

LAND AND WATER RESOURCES

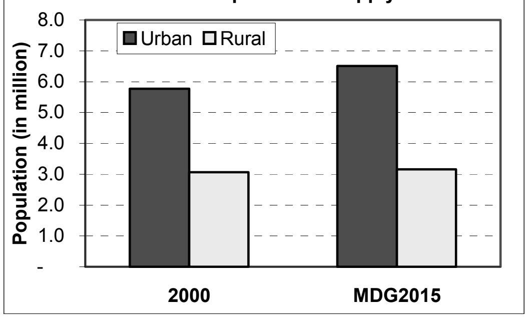
Land area (millions of ha)	13.20
Land area in international basins (millions of ha)	2.48
Percentage of country in international basins	18.8%
Average precipitation (mm)	652
Average total volume of rainfall (BCM)	86
Total internal water resources (BCM)	58.0
Of which surface water (BCM)	55.5
Of which groundwater	10.3
Overlap between surface and groundwater	7.8
Total external water resources (BCM)	16.3
Of which surface water (BCM)	13.5
Of which groundwater (BCM)	
Total water resources (BCM)	74.3
Of which total surface water (BCM)	71.8
Of which total groundwater (BCM)	10.3
Overlap between surface and groundwater	7.8
Dependency ratio	22%

	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	7,307	7,031	7,090	7,191

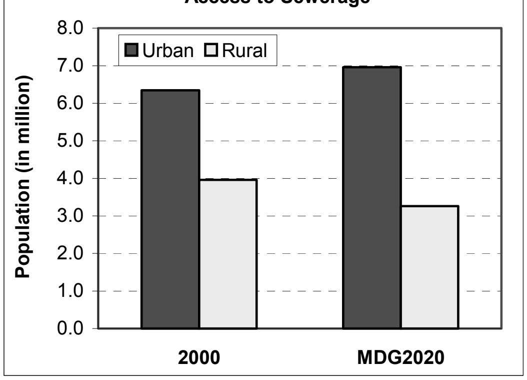
	1980	1991	2000
Total annual withdrawals (in BCM)	5.04	6.18	8.84
Agriculture	4.22	5.27	7.54
Industry and tourism	0.12	0.14	0.15
Domestic	0.70	0.76	1.15



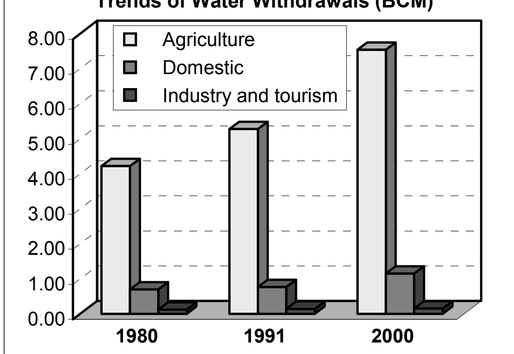
Access to Piped Water Supply



Access to Sewerage

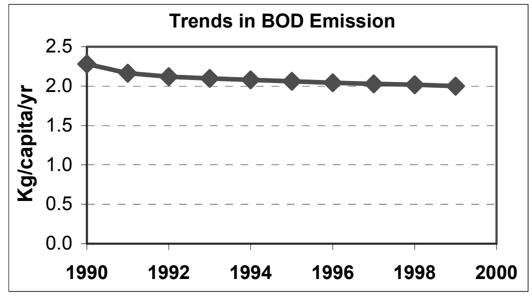


Trends of Water Withdrawals (BCM)



WATER QUALITY AND POLLUTION

Wastewater treatment coverage	45%			
Primary treatment	20%			
	1990	**1995**	**1997**	**1999**
Annual emissions of BOD per day (Tons)	63.5	59.0	58.3	57.7
Annual emissions of BOD per capita (kg)	2.28	2.06	2.03	2.00

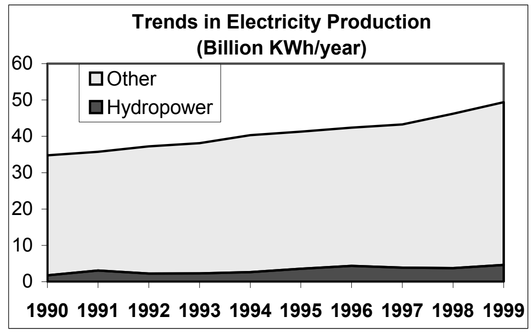


AQUATIC ECOSYSTEMS

Wetlands designated as Ramsar sites (2002)	
In ha	163,501
As % of land area	1.24%

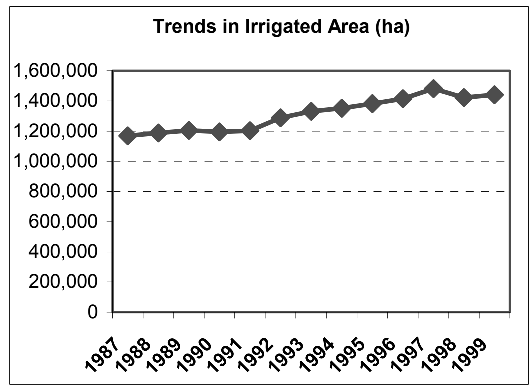
DAMS AND HYDROPOWER

Reservoir capacity as of 2002 (BCM)	12.50	
Irrigation dams		
Hydropower dams	7.30	
Reservoir capacity in cubic meters per capita	1,184	
Gross theoretical hydropower potential (GWh/y)	80,000	
Technically feasible (GWh/y)	15,000	
Economically feasible (GWh/y)	12,000	
Currrent production from hydropower (GWh/y)	5,000	(in 2000)



	1990	1995	1998	1999
Total electricity production (Million KWh)	34,775	41,298	46,180	49,382
Share from hydroelectric	5%	9%	8%	9%

IRRIGATION	**1990**	**1995**	**1998**	**1999**
Irrigated land ('000 ha)	1,195	1,383	1,422	1,441
Irrigated land per capita (ha)	0.118	0.132	0.135	0.137
Irrigated land as share of cropland	30%	35%	37%	37%

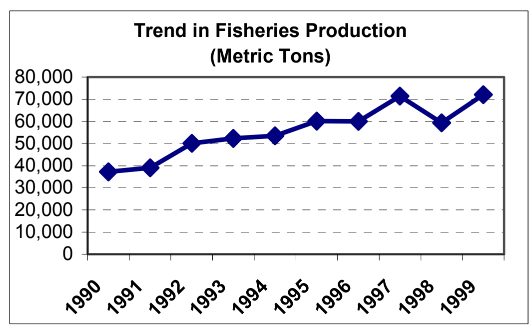


FRESHWATER FISHERY	**1990**	**1995**	**1998**	**1999**
Fishery production (metric tons)	37,148	60,126	59,298	72,023
Fishery production per capita (kg)	3.66	5.75	5.64	6.83

FINANCING THE WATER SECTOR

Average cost recovery:	**2000**	
Irrigation individual projects (60% irrigated land)	0	
Irrigation water services (40% irrigated land)	60%	of total expenses
Municipal water services	n.a.	

* These are ball park estimates.



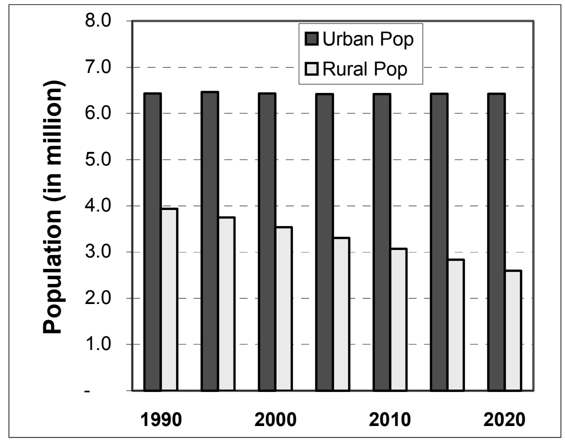
Average actual pricea (US cent/m^3)	**Mid-1990s**	
Water supply for households in Athens	77	
Water supply for households in Thessaloniki	82	
Water supply for industries in Athens	75	upto 1,000 m3
	92	more than 1,000 m3
	2000	
Irrigation fee (US$ per hectare)	100-240	per year surface water
	54-250	per year groundwater

HUNGARY: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

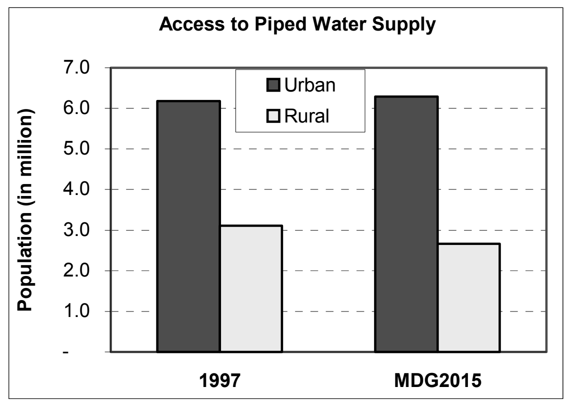
	1990	2000	2015	2020
Total Population (millions of people)	10.37	9.97	9.25	9.02
Urban population	62%	65%	69%	71%
Rural population	38%	35%	31%	29%

Source: Aquastat database, FAO (2002).



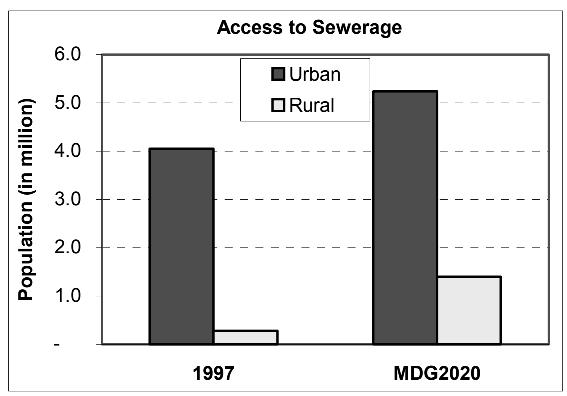
	1990	1997	Goal for 2015
Access to piped water supply	n.a.	93%	97%
Urban	n.a.	96%	98%
Rural	n.a.	88%	94%

Note: Goal refers to MDGs.



	1990	1997	Goal for 2020
Access to sewerage	n.a.	43%	71%
Urban	n.a.	63%	82%
Rural	n.a.	8%	54%

Note: Goal refers to MDGs.



	1997
Share of poor in rural areas	57%

	1990	1995	1998	2000
GDP per capita (constant 1995 US$)	4,857	4,343	4,849	5,326
GDP total (billions of 1995 US$)	50.3	44.7	49.6	54.4
Share from agriculture	15%	7%	6%	n.a.
Share from industry	39%	32%	34%	n.a.

	1990	1995	1998	1999
Labor force (millions of people)	4.7	4.8	4.8	4.8
Share in agriculture	18%	8%	8%	n.a.
Share in industry	37%	33%	34%	n.a.

Average annual growth	1991-97	1998-00
Of GDP	-0.7%	4.9%
Of population	-0.3%	-0.5%

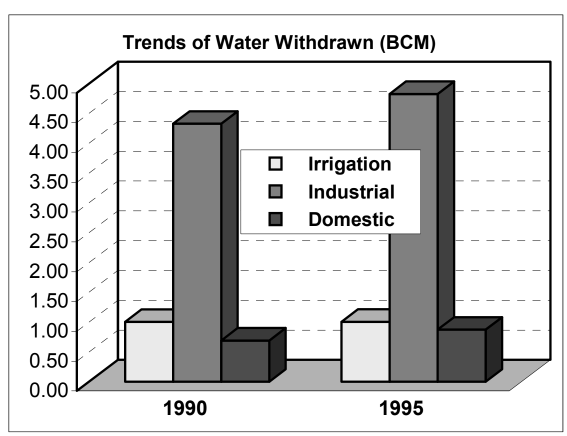
	1999
Infant mortality rate (per 1,000 live births)	8.4

LAND AND WATER RESOURCES

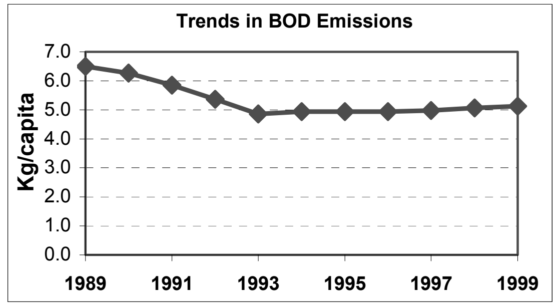
Land area (millions of ha)	9.30
Land area in international basins (millions of ha)	9.30
Percentage of country in international basins	100.0%
Average precipitation (mm)	640
Average total volume of rainfall (BCM)	60
Total internal renewable water resources (BCM)	6.0
Of which surface water (BCM)	6.0
Of which groundwater	6.0
Overlap between surface and groundwater	6.0
Total external renewable water resources (BCM)	98.0
Of which surface water (BCM)	98.0
Of which groundwater (BCM)	0.0
Total renewable resources (BCM)	104.0
Of which total surface water (BCM)	104.0
Of which total groundwater (BCM)	6.0
Overlap between surface and groundwater	6.0
Dependency ratio	94.2%

	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	10,034	10,433	11,238	11,529

	1990	1995
Total annual water withdrawn (in BCM)	6.02	6.70
Irrigation	1.00	1.01
Industrial	4.33	4.82
Domestic	0.69	0.87



WATER QUALITY AND POLLUTION	1999			
Population with sewerage connection	60%			
Population with wastewater treatment	22%			
	1990	**1995**	**1998**	**1999**
Annual emissions of BOD per day (Tons)	178	138	140	141
Annual emissions of BOD per capita (kg)	6.3	4.9	5.1	5.1

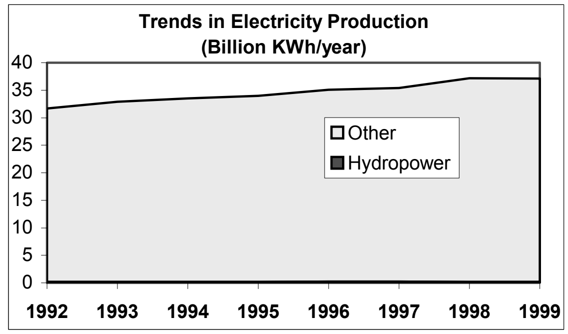


AQUATIC ECOSYSTEMS

Wetlands designated as Ramsar sites (2002)	
In ha	154147
As % of land area	1.66%

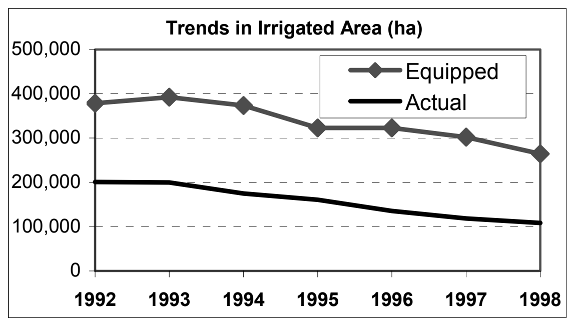
DAMS AND HYDROPOWER

Reservoir capacity (BCM)	0.065	large dams under operation
Irrigation dams (BCM)		
Hydropower dams (BCM)		
Reservoir capacity in cubic meters per capita	7	(in 2000)
Gross theoretical hydropower potential (GWh/y)	7,446	
Technically feasible (GWh/y)	4,590	
Economically feasible (GWh/y)	n.a.	
Current production from hydropower (GWh/y)	175	(in 2000)

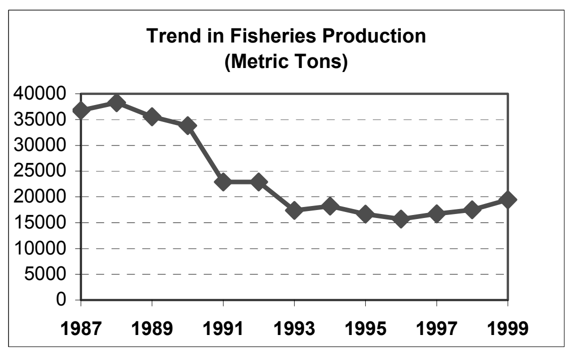


	1992	**1995**	**1998**	**1999**
Total electricity production (GWh/year)	31,685	34,017	37,188	37,154
From hydroelectric	0.5%	0.48%	0.42%	0.49%

IRRIGATION	1992	1995	1997	1998
Equipped irrigated land (million ha)	0.38	0.32	0.30	0.26
Irrigated land per capita (ha)	0.037	0.032	0.030	0.026
Irrigated land as share of cropland	4.5%	4.2%	4.2%	4.2%



FRESHWATER FISHERY	1987	1990	1995	1999
Fishery production (metric tons)	36,759	33,834	16,674	19,461
Fishery production per capita (kg)	3.50	3.26	1.63	1.94



FINANCING THE WATER SECTOR

Average cost recovery:	
Irrigation water services	
Municipal water services	100% O&M plus 15% investments
* These are ball park estimates.	
Households tariff (US cent/m3)	**1998**
Average water supply	64
Average sewerage and wastewater	77
Max - Min combined tariff	100-210

MOLDOVA: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	4.36	4.30	4.15	4.11
Urban population	47%	42%	45%	48%
Rural population	53%	58%	55%	52%

Source: Aquastat database, FAO (2002).

	1990	2000	Goal for 2015
Access to piped water supply	55%	59%	80%
Urban	97%	65%	83%
Rural	18%	55%	78%

Note: Goal refers to MDGs.

	1990	2000	Goal for 2020
Access to sewerage	n.a.	46%	73%
Urban	n.a.	55%	78%
Rural	n.a.	40%	70%

Note: Goal refers to MDGs.

	1997
Share of poor in rural areas	68%

	1992	1995	1999	2000
GDP per capita (constant 1995 US$)	1,056	713	623	637
GDP total (billions of 1995 US$)	4.6	3.1	2.7	2.7
Share from agriculture	51%	33%	28%	28%
Share from industry	31%	31%	19%	20%

	1990	1994	1998	1999
Labor force (millions of people)	2.1	2.1	2.1	2.1
Share in agriculture	34%	46%	n.a.	n.a.
Share in industry	29%	19%	n.a.	n.a.

Average annual growth	1991-97	1998-00
Of GDP	-11.8%	-2.7%
Of population	-0.1%	-0.2%

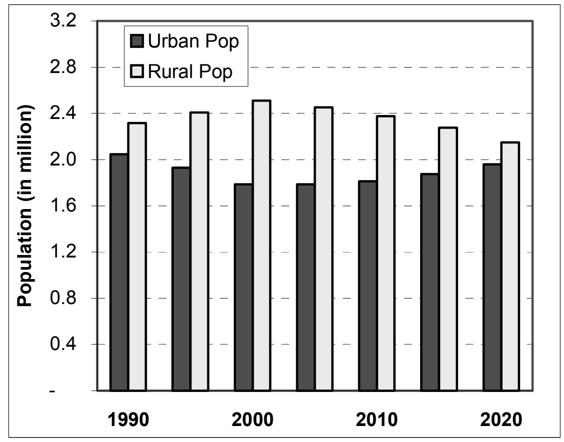
	1999
Infant mortality rate (per 1,000 live births)	18.2

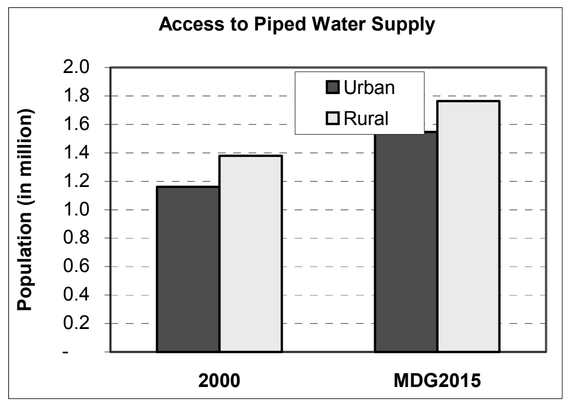
LAND AND WATER RESOURCES

Land area (millions of ha)	3.39
Land area in international basins (millions of ha)	3.39
Percentage of country in international basins	100%
Average precipitation (mm)	448
Average total volume of rainfall (BCM)	15
Total internal renewable water resources (BCM)	1.0
Of which surface water (BCM)	1.0
Of which groundwater	0.4
Overlap between surface and groundwater	0.4
Total external renewable water resources (BCM)	6.3
Of which surface water (BCM)	6.3
Of which groundwater (BCM)	0.0
Total renewable resources (BCM)	7.3
Of which total surface water (BCM)	7.3
Of which total groundwater (BCM)	0.4
Overlap between surface and groundwater	0.4
Dependency ratio	86.3%

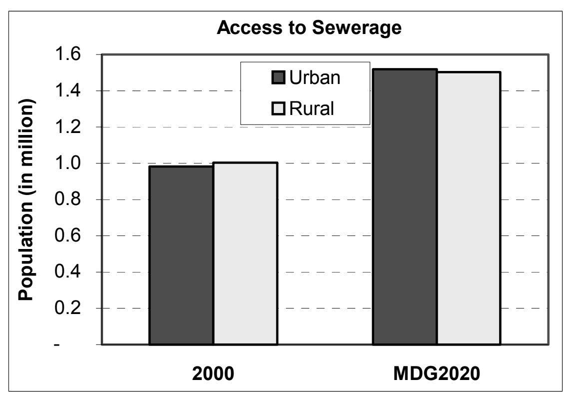
	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	1,673	1,700	1,758	1,776

	1990	1991	1995	1996
Total annual water used (in BCM)	3.83	2.98	1.87	1.77
Agriculture	1.03	0.51	0.49	0.35
Industry (thermal power)	2.52	2.20	1.14	1.17
Domestic	0.27	0.27	0.25	0.24

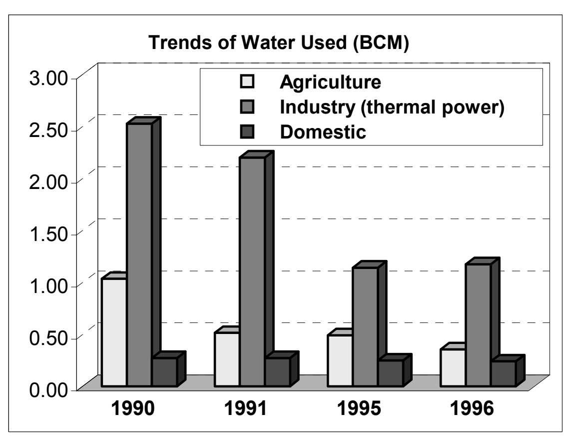




Access to Piped Water Supply

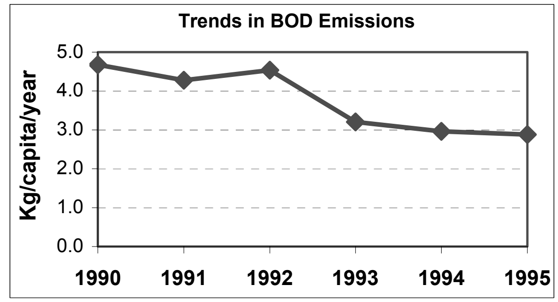


Access to Sewerage



Trends of Water Used (BCM)

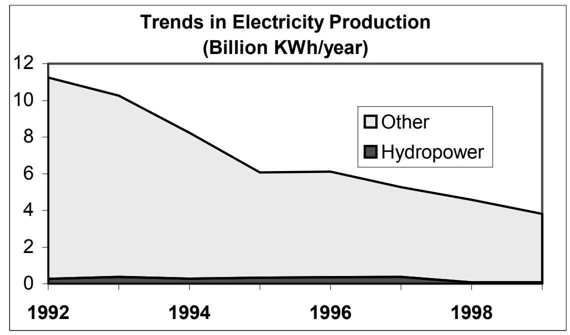
WATER QUALITY AND POLLUTION	**1993-94**			
Domestic and industrial wastewater discharge	350	MCM		
Wastewater treated to required standards	51%	(only 18% municipal waste)		
	1990	**1993**	**1994**	**1995**
Annual emissions of BOD per day (Tons)	56	38	35	34
Annual emissions of BOD per capita (kg)	4.7	3.2	3.0	2.9



AQUATIC ECOSYSTEMS

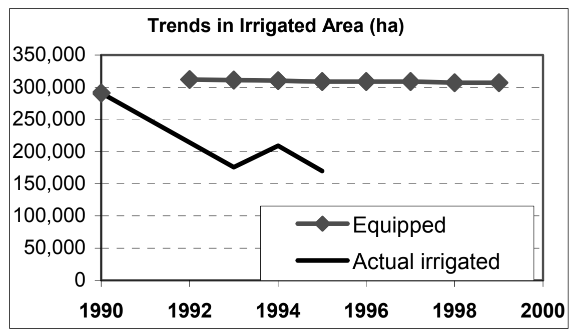
Wetlands designated as Ramsar sites (2002)	
In ha	19,152
As % of land area	0.57%

DAMS AND HYDROPOWER	**1995**	
Reservoir capacity (BCM)	1.80	
Irrigation dams (BCM)		
Hydropower dams (BCM)		
Reservoir capacity in cubic meters per capita	419	(in 2000)
Gross theoretical hydropower potential (GWh/y)	2,100	
Technically feasible (GWh/y)	1,200	
Economically feasible (GWh/y)	700	
Current production from hydropower (GWh/y)	~300	(in 2000)

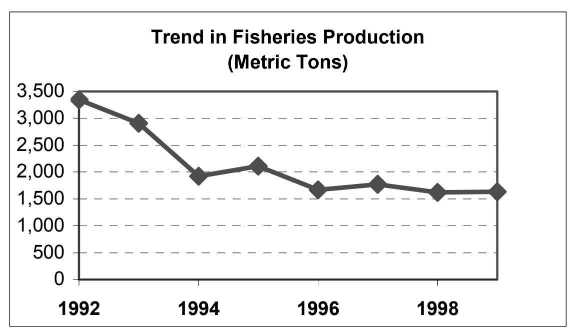


	1992	**1995**	**1998**	**1999**
Total electricity production (GWh/year)	11,248	6,068	4,584	3,814
From hydroelectric	2.3%	5.3%	1.8%	2.2%

IRRIGATION	**1992**	**1995**	**1998**	**1999**
Irrigated land ('000 ha)	312	309	307	307
Irrigated land per capita (ha)	0.071	0.071	0.071	0.071
Irrigated land as share of cropland	14.2%	14.1%	14.1%	14.1%



FRESHWATER FISHERY	**1992**	**1995**	**1998**	**1999**
Fishery production (metric tons)	3,345	2,110	1,620	1,630
Fishery production per capita (kg)	0.77	0.49	0.38	0.38



FINANCING THE WATER SECTOR

Average cost recovery:		
Irrigation water services		
Municipal water services		
* These are ball park estimates.		
Average water/wastewater tariff (US cent/m3)	**2002**	
Domestic water and wastewater services	10-50	
Other municipal water services	26-303	
Other municipal wastewater services	10-141	
Average raw water charges (US cent/m3)	**1998**	
Municipal purposes	3.0	within the limits
Irrigation and fishery purposes	1.50	within the limits
	X10	if exceed the limits
Hydropower purposes	0.08	

SLOVENIA: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	1.9	2.0	1.9	1.9
Urban population	50%	49%	52%	54%
Rural population	50%	51%	48%	46%

Source: Aquastat database, FAO (2002).

	1990	1997	Goal for 2015
Access to piped water supply	n.a.	76%	88%
Urban	n.a.	n.a.	n.a.
Rural	n.a.	n.a.	n.a.

Note: Goal refers to MDGs.

	1990	1997	Goal for 2020
Access to sewerage	n.a.	74%	87%
Urban	n.a.	n.a.	n.a.
Rural	n.a.	n.a.	n.a.

Note: Goal refers to MDGs.

	1999
Share of poor in rural areas	n.a.

	1992	1995	1999	2000
GDP per capita (constant 1995 US$)	8,331	9,419	11,160	11,659
GDP total (billions of 1995 US$)	16.6	18.7	22.2	23.2
Share from agriculture	5%	5%	4%	3%
Share from industry	41%	38%	38%	38%

	1990	1995	1998	1999
Labor force (millions of people)	1.0	1.0	1.0	1.0
Share in agriculture	6%	10%	n.a.	n.a.
Share in industry	46%	43%	n.a.	n.a.

Average annual growth	1991-97	1998-00
Of GDP	0.9%	4.6%
Of population	0.6%	-0.1%

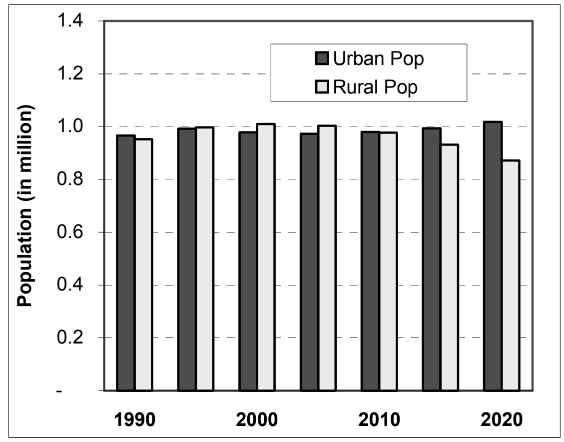
	1990	1995	1999	2000
Infant mortality rate (per 1,000 live births)	8.4	5.5	4.5	4.6

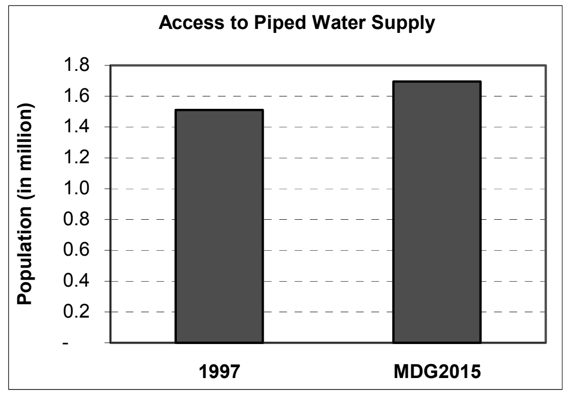
LAND AND WATER RESOURCES

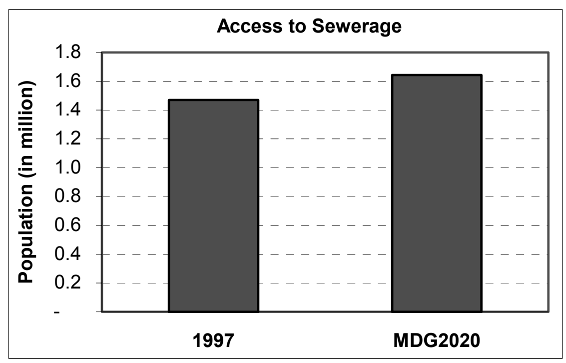
Land area (millions of ha)	2.0
Land area in international basins (millions of ha)	1.8
Percentage of country in international basins	89.9%
Average precipitation (mm)	1,590
Average total volume of rainfall (BCM)	32
Total internal renewable water resources (BCM)	19
Of which surface water (BCM)	19
Of which groundwater	14
Overlap between surface and groundwater	13
Total external renewable water resources (BCM)	13
Of which surface water (BCM)	13
Of which groundwater (BCM)	0
Total renewable resources (BCM)	32
Of which total surface water (BCM)	32
Of which total groundwater (BCM)	14
Overlap between surface and groundwater	13
Dependency ratio	41.4%

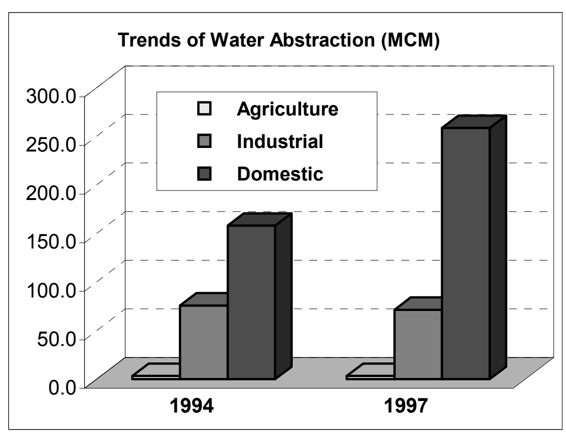
	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	16,616	16,031	16,547	16,862

	1994	1997
Total annual water used (in MCM)	237.4	333.2
Agriculture	3.4	3.4
Industrial	76.0	71.4
Domestic	158.0	258.4

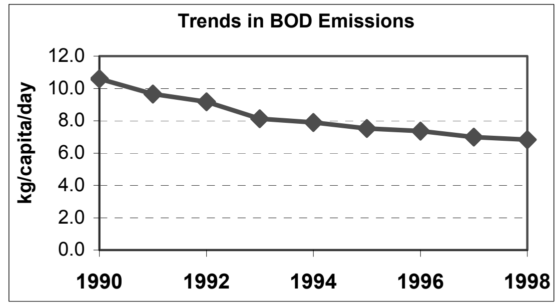






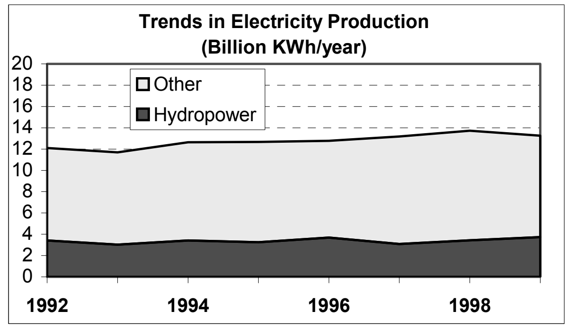


WATER QUALITY AND POLLUTION	1998			
Wastewater discharge requiring treatment (BCM)	*			
Treated	75%			
	1991	**1994**	**1997**	**1998**
Annual emissions of BOD per day (Tons)	53	43	38	37
Annual emissions of BOD per capita (kg)	9.7	7.9	7.0	6.8



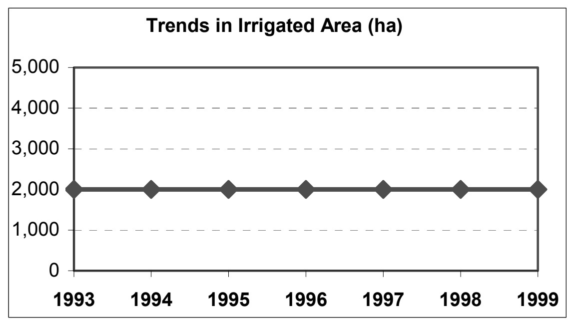
AQUATIC ECOSYSTEMS	
Wetlands designated as Ramsar sites (2002)	
In ha	955
As % of land area	0.05%

DAMS AND HYDROPOWER	2000	
Reservoir capacity (BCM)	0.2	
Irrigation dams (BCM)		
Hydropower dams (BCM)		
Reservoir capacity in cubic meters per capita	101	(in 2000)
Gross theoretical hydropower potential (GWh/y)	12,500	
Technically feasible (GWh/y)	8,800	
Economically feasible (GWh/y)	6,125	
Current production from hydropower (GWh/y)	3,587	(in 2000)

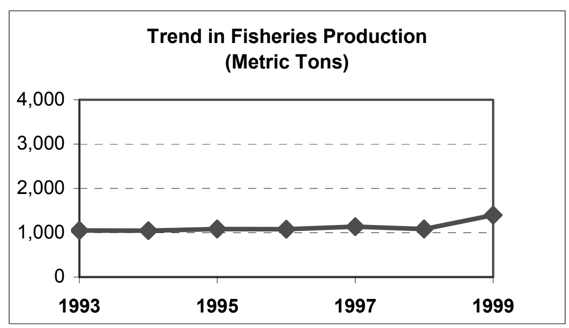


	1992	**1995**	**1998**	**1999**
Total electricity production (GWh/year)	12,086	12,654	13,728	13,262
From hydroelectric	28.2%	25.6%	25.1%	28.2%

IRRIGATION	1993	1995	1998	1999
Irrigated land ('000 ha)	2	2	2	2
Irrigated land per capita (ha)	0.001	0.001	0.001	0.001
Irrigated land as share of cropland	0.9%	0.9%	1.0%	1.0%



FRESHWATER FISHERY	1993	1995	1998	1999
Fishery production (metric tons)	1,051	1,085	1,083	1,395
Fishery production per capita (kg)	0.53	0.55	0.54	0.70



FINANCING THE WATER SECTOR	
Average cost recovery:	
Irrigation water services	90%
Municipal water services	
* These are ball park estimates.	
Raw surface water charges (US cent/m3)	
Domestic water supply (US cent/m3)	
Domestic sewage (US cent/m3)	

TURKEY: WATER FACT SHEET

SOCIO-ECONOMIC INDICATORS

	1990	2000	2015	2020
Total Population (millions of people)	56.1	66.7	79.0	82.9
Urban population	61%	66%	72%	74%
Rural population	39%	34%	28%	26%

Source: Aquastat database, FAO (2002).

	1995	2000	Goal for 2015
Access to piped water supply	50%	70%	85%
Urban	63%	73%	87%
Rural	28%	65%	83%

Note: Goal refers to MDGs.

	1990	2000	Goal for 2020
Access to sewerage	56%	67%	84%
Urban	n.a.	n.a.	n.a.
Rural	n.a.	n.a.	n.a.

Note: Goal refers to MDGs.

	1999
Share of poor in rural areas	n.a.

	1992	1995	1999	2000
GDP per capita (constant 1995 US$)	2,670	2,794	2,975	3,147
GDP total (billions of 1995 US$)	154.6	169.3	191.4	205.5
Share from agriculture	15%	16%	16%	15%
Share from industry	30%	28%	25%	25%

	1990	1995	1998	1999
Labor force (millions of people)	24.3	27.8	29.9	30.6
Share in agriculture	47%	48%	43%	n.a..
Share in industry	21%	21%	22%	n.a..

Average annual growth	1991-97	1998-00
Of GDP	4.4%	1.7%
Of population	1.8%	1.6%

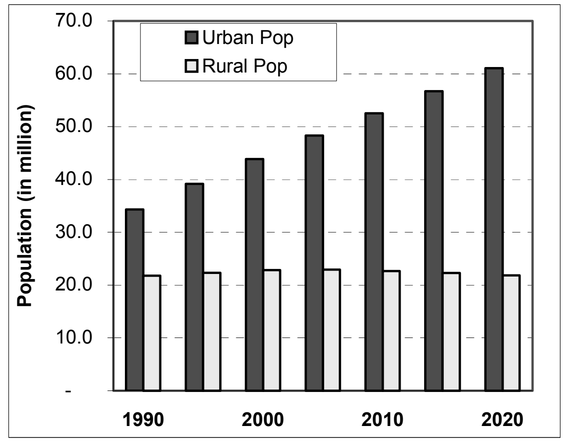
	1990	1995	1999	2000
Infant mortality rate (per 1,000 live births)	58.0	44.4	..	34.5

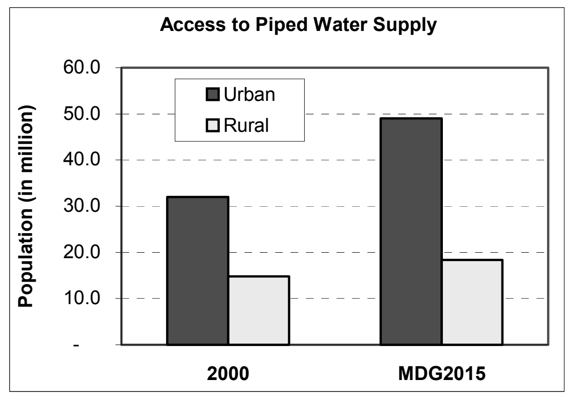
LAND AND WATER RESOURCES

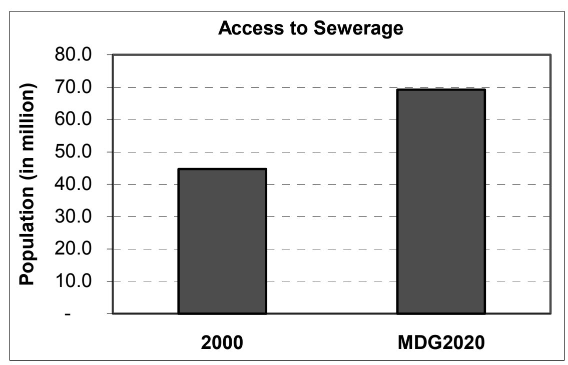
Land area (millions of ha)	77.5
Land area in international basins (millions of ha)	26.6
Percentage of country in international basins	34.4%
Average precipitation (mm)	643
Average total volume of rainfall (BCM)	498
Total internal renewable water resources (BCM)	196.0
Of which surface water (BCM)	192.8
Of which groundwater	20.0
Overlap between surface and groundwater	16.8
Total external water resources (BCM)	4.7
Of which surface water (BCM)	4.7
Of which groundwater (BCM)	0.0
Total renewable resources (BCM)	200.7
Of which total surface water (BCM)	197.5
Of which total groundwater (BCM)	20.0
Overlap between surface and groundwater	16.8
Dependency ratio	2.3%

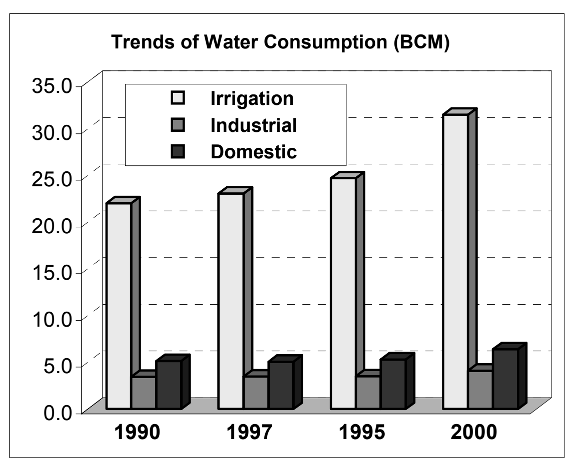
	1990	2000	2015	2020
Per capita water resources (cubic meters/year)	3,578	3,010	2,540	2,421

	1990	1997	1995	2000
Total annual water used (in BCM)	30.6	31.6	33.5	42.0
Irrigation	22.0	23.1	24.7	31.5
Industrial	3.4	3.5	3.5	4.1
Domestic	5.1	5.1	5.3	6.4

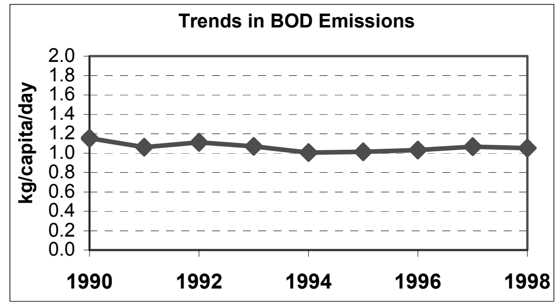






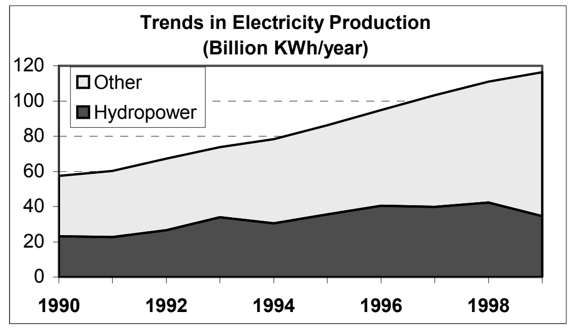


WATER QUALITY AND POLLUTION	1998			
Wastewater discharge requiring treatment (BCM)	2.40			
Treated (BCM)	0.1			
	1991	1994	1997	1998
Annual emissions of BOD per day (Tons)	166	166	186	186
Annual emissions of BOD per capita (kg)	1.1	1.0	1.1	1.1



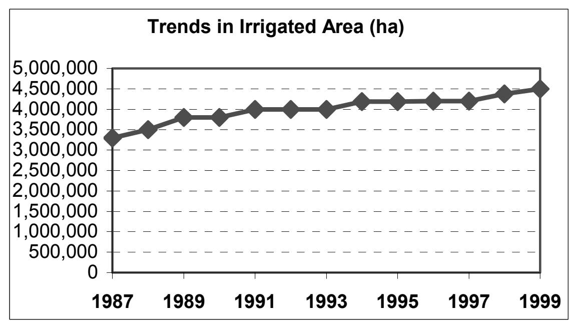
AQUATIC ECOSYSTEMS	
Wetlands designated as Ramsar sites (2002)	
In ha	159,300
As % of land area	0.21%

DAMS AND HYDROPOWER	2000	
Reservoir capacity (BCM)	131	
Irrigation dams (BCM)		
Hydropower dams (BCM)		
Reservoir capacity in cubic meters per capita	1,965	(in 2000)
Gross theoretical hydropower potential (GWh/y)	433,000	
Technically feasible (GWh/y)	215,000	
Economically feasible (GWh/y)	123,040	
Current production from hydropower (GWh/y)	42,216	(in 2000)

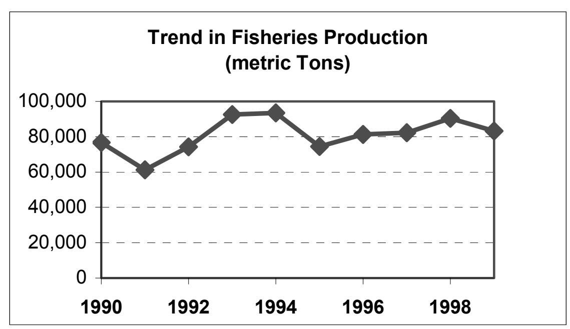


	1990	1995	1998	1999
Total electricity production (GWh/year)	57,543	86,247	111,022	116,440
From hydroelectric	40.2%	41.2%	38.0%	29.8%

IRRIGATION	1987	1990	1995	1999
Irrigated land ('000 ha)	3,300	3,800	4,186	4,500
Irrigated land per capita (ha)	0.063	0.068	0.068	0.069
Irrigated land as share of cropland	11.8%	13.7%	15.4%	16.9%



FRESHWATER FISHERY	1990	1995	1998	1999
Fishery production (metric tons)	76,708	74,349	90,370	83,297
Fishery production per capita (kg)	1.37	1.21	1.40	1.27



FINANCING THE WATER SECTOR	
Average cost recovery:	1996
Irrigation water services	90%
Municipal water services	
* These are ball park estimates.	
Raw surface water charges (US cent/m3)	
Domestic water supply (US cent/m3)	
Domestic sewage (US cent/m3)	