

# Water: The Challenges

One-third of humanity lives in countries where water is scarce, and 1 billion people lack access to clean water. Today's water crisis takes many forms: having to walk long distances every day to fetch enough drinking water – clean or unclean – just to get by, suffering from avoidable malnutrition or disease caused by drought, flood or inadequate sanitation, or in terms of a lack of funds, institutions or knowledge to solve local problems of water use and allocation.

The World Water Assessment Programme (WWAP) monitors the state of the world's water with respect to socioeconomic and environmental needs and publishes its findings in a series of World Water Development Reports. The Reports are organized in terms of eleven challenge areas that are social, economic, political and environmental in nature. All need to be addressed by the water sector today in order to promote sustainable and equitable water management. Many of these challenges are interconnected, requiring integrated and holistic solutions.

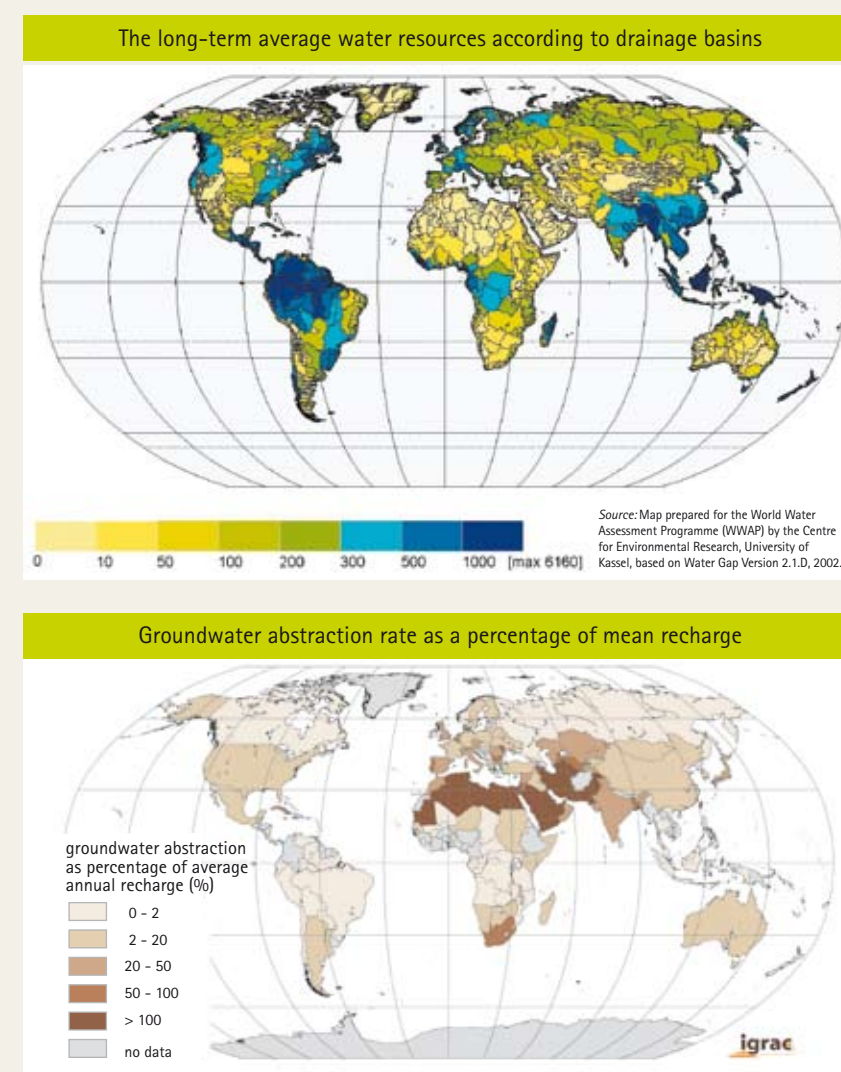


## THE WORLD'S WATER

In many areas, aquatic ecosystems are deteriorating rapidly and species are declining. Pollutants are being released continually into the water environment, both directly and indirectly by a range of different types of agriculture, industries from oil refineries to pharmaceutical plants, and untreated wastewater from other sectors, impacting both the quantity and quality of available water. Governance has an important role to play in creating the conditions that promote healthy and sustainable environmental and economic growth.

The long-term average water resources in a river basin are used as an indicator of the water available to basin populations. The use of the river basin as the basic unit allows comprehensive water planning and management activities. The development of reservoirs can help countries to better manage extreme events and disasters such as floods and droughts.

Global groundwater volume stored beneath the Earth's surface represents 96% of the Earth's non-frozen freshwater. Groundwater feeds springs and streams, supports wetlands, maintains land surface stability in areas of unstable ground, and acts as an overall critical water resource serving our water needs. While the benefits derived from groundwater abstraction are significant, over-abstraction can result in such negative effects as reduced spring yields, dried up rivers and poorer water quality. This map illustrates the potential availability of groundwater resources in shared aquifers.

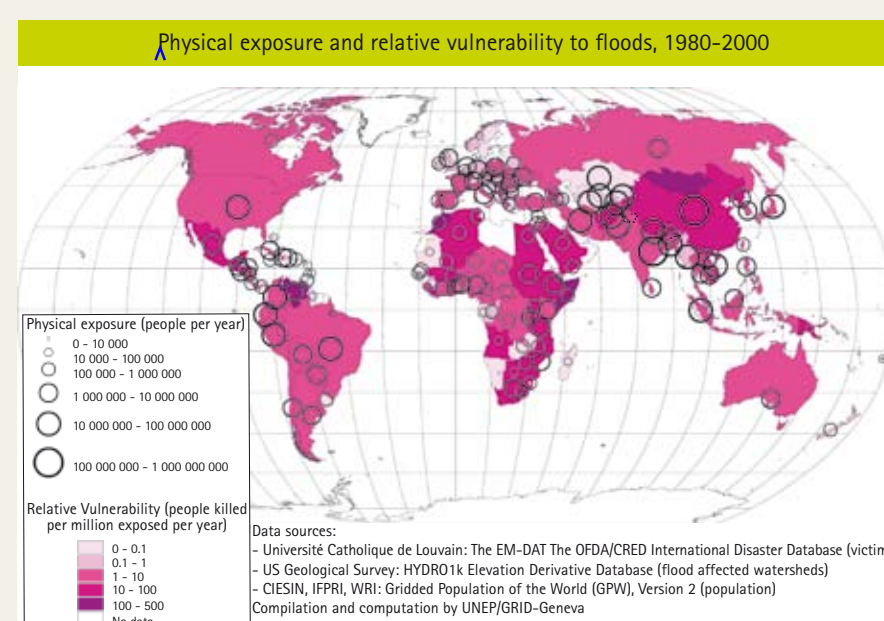


## GOVERNANCE:

Today's water crisis is largely a governance problem. The response of countries to water-related disasters and shortages, the allocation of transboundary water resources, the management of national water resources, and the development of capacity and knowledge, should be the shared responsibility of governments and civil society. Effective and equitable water management is impeded by many factors, such as sector fragmentation, corruption, insufficient aid and investment in the water sector, inadequate institutions and lack of stakeholder participation. An integrated approach to water management is recognized as the best way to overcome these obstacles.

## MANAGING RISKS

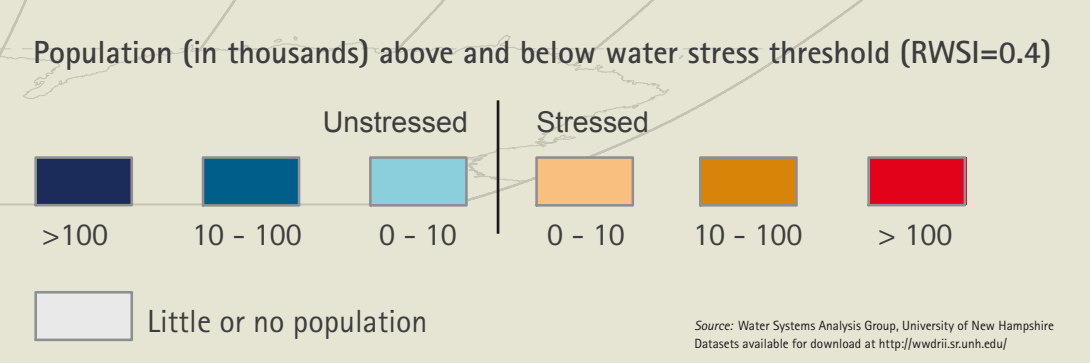
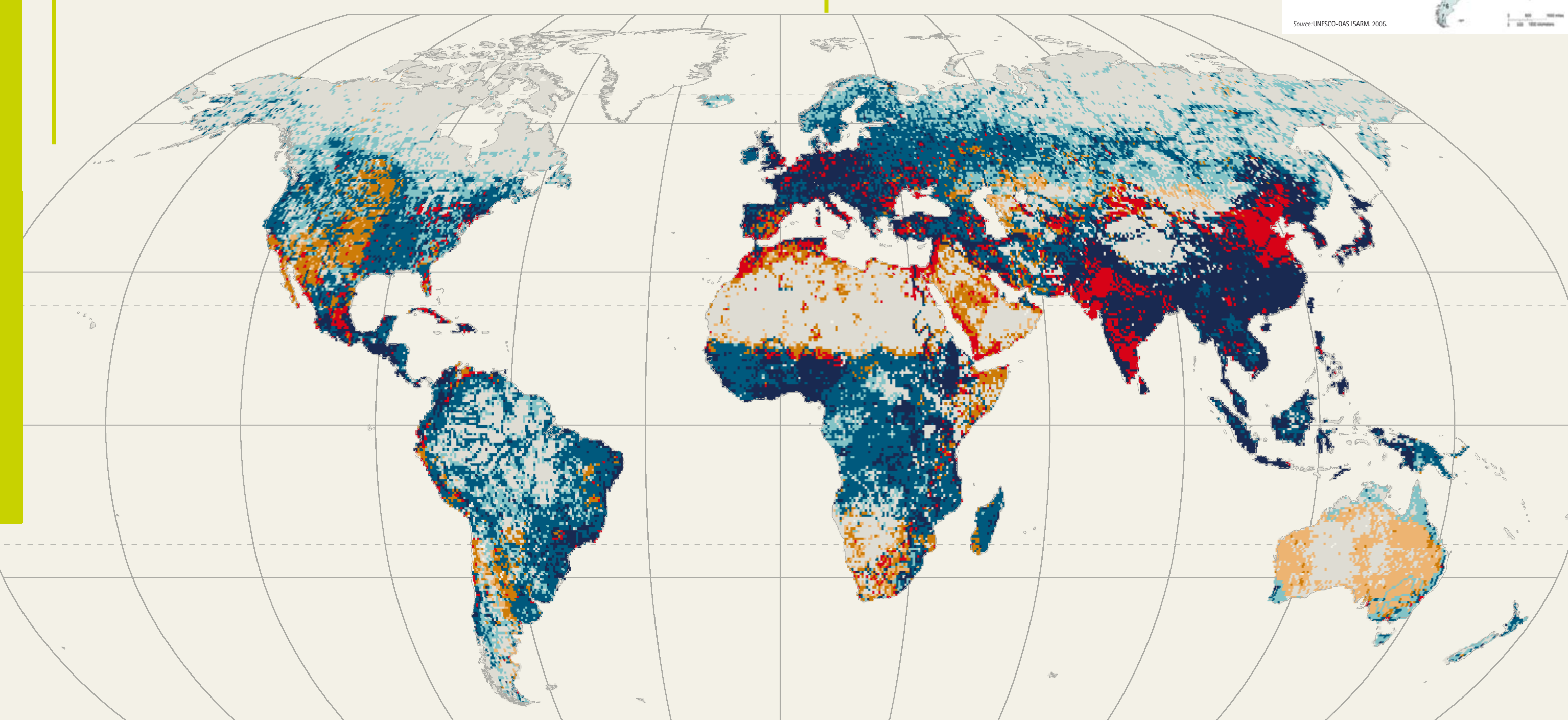
Over the last century, there has been a significant rise in water-related disasters, affecting an increasing number of people, particularly those living in developing countries. This has resulted in loss of life and livelihoods, and has impeded development. This map illustrates the disaster risk index (DRI), which uses the frequency of hazards and the number of people affected to illustrate a country's physical exposure to floods. Risk indicators like the DRI are indispensable for soundly managing preparation for floods, droughts, tsunamis and hurricanes.



## SHARING WATER

Water resources, surface and ground waters, do not respect political boundaries as one-third of all river basins are shared by more than two countries. Worldwide, there are 263 international river basins (59 in Africa, 52 in Asia, 73 in Latin America and the Caribbean, 17 in North America, 1 in Oceania). Overall, 145 countries have territories that include at least one shared basin.

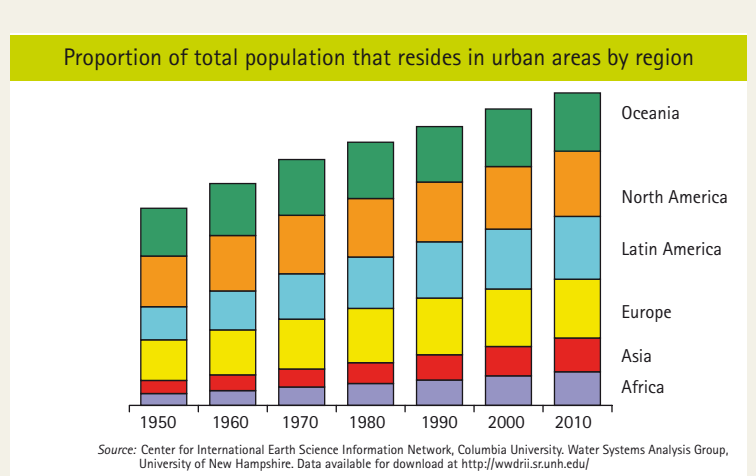
Between 1948-1999, there have been 1,831 international interactions recorded including 507 conflicts, 96 neutral or non-significant events and, most importantly, 1,228 instances of cooperation. Despite the potential problem, history has demonstrated that cooperation, rather than conflict, is likely in shared basins.



## HUMAN SETTLEMENTS

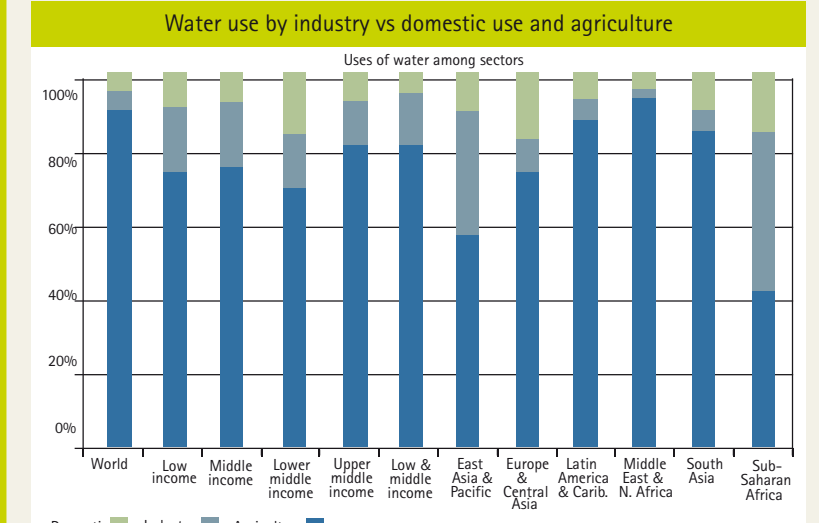
In 1950, the world's population was about 2.5 billion people. By 2000, global population had reached just over 6 billion. During this time, population growth in urban areas increased from 29 to 47%. By 2010, more than 50% of the global population will be urban dwellers.

This increase has numerous implications for water planning and management. Provision of water and sanitation services in urban areas has expanded much more slowly than the population growth in most low-income and many middle-income nations. Better water and sanitation services in urban and rural areas could improve the lives of hundreds of millions of people – and could serve to make rural areas more attractive.



## INDUSTRY

In many river basins, there is increasing competition for water among the various water use sectors. If we compare industry's water use to use by other sectors, namely agriculture and domestic use, it is clear that – globally – industry uses only a fraction of the amount of water used by agriculture. However, in East Asia and the Pacific, industrial water use has grown to a significant proportion of total use, in line with its significance to the economies of those countries. In sub-Saharan Africa, although overall water use is low, the water used by industry is a larger proportion of the total, because most agriculture in the region uses rainwater instead of irrigation.



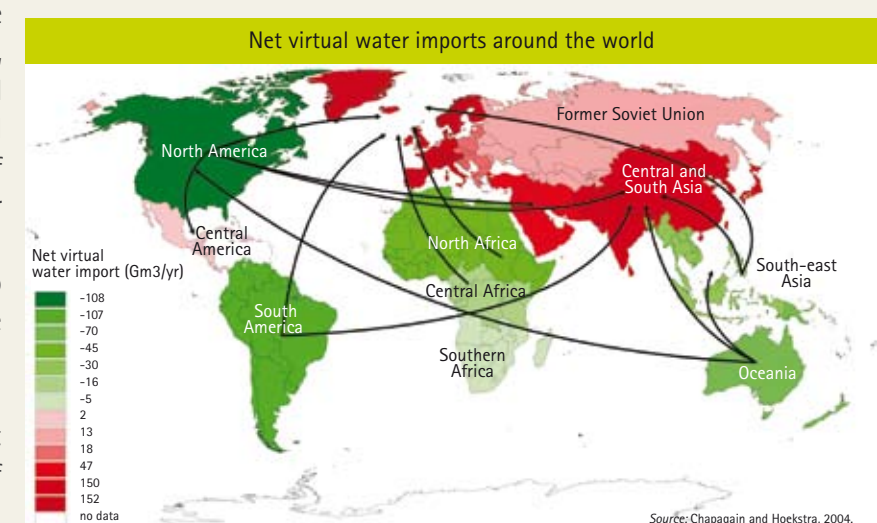
## ENERGY

We currently produce the vast majority of our energy from non-renewable sources like oil, natural gas and coal. If the current energy trends continue, the world's energy needs will be almost 60% higher in 2030 than they were in 2004. Fossil fuels will continue to be the dominant energy source in spite of the fact that they are a limited and non-renewable resource.

Hydro energy is one of the cleanest ways to generate electricity for different uses. Currently, hydroelectric power provides an estimated 19% of total electricity production. Canada is currently the largest producer of hydroelectricity followed by the US and Brazil. Hydropower will remain an important source of energy for the future, with two-thirds of its potential not yet utilized or underdeveloped, particularly in Latin America, Central Africa, India and China. It is important, however, that hydraulic work be implemented using the basic principles of sustainable development.

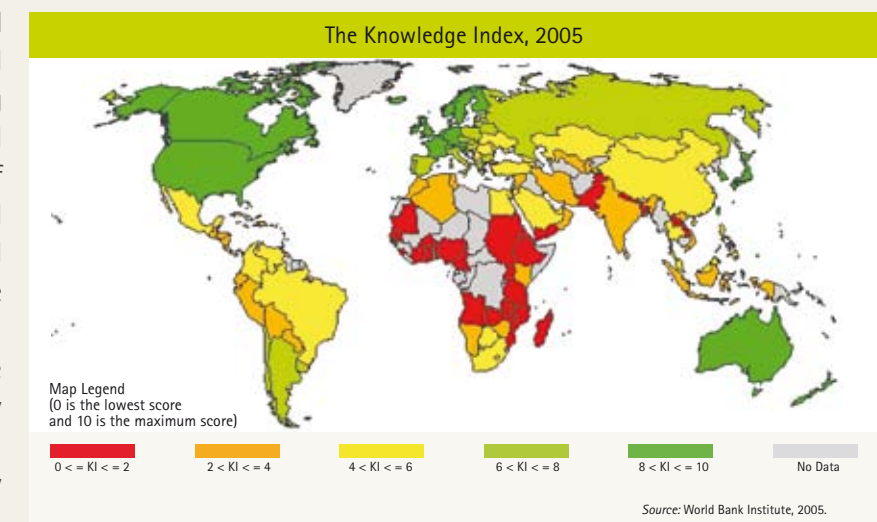
## VALUING WATER

Water incorporates social, cultural, environmental as well as economic values. All of these must be taken into consideration in appraising different policies and initiatives if the goals of Integrated Water Resources Management (IWRM) including social equity, environmental sustainability and economic efficiency are to be realized. Unfortunately, this is rarely the case in many developing countries where poor people often pay much more than the rich for the same water services (i.e. Sri Lanka, India, Columbia, Pakistan, Viet Nam and Laos PDR). The concept of virtual water recognizes the value of water embedded, directly or indirectly, in various products and services. This has come to influence production and trade policies especially in water-stressed areas in an attempt to make the most economic and efficient use of scarce water supplies.



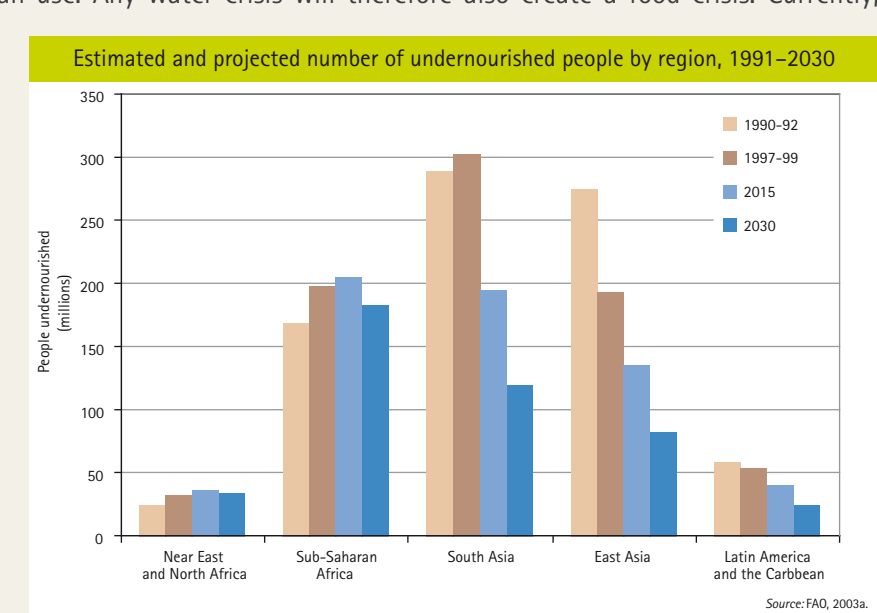
## KNOWLEDGE AND CAPACITY DEVELOPMENT

The lack of data and sound knowledge base systems, as well as equitable access to and sharing of scientific and local and indigenous knowledge, is one of the major obstacles to sound water management and development. This is especially the case in low-income and in-transition countries. Yet, we have the knowledge and capacity to solve many if not most pressing water-related problems – if they are properly governed.



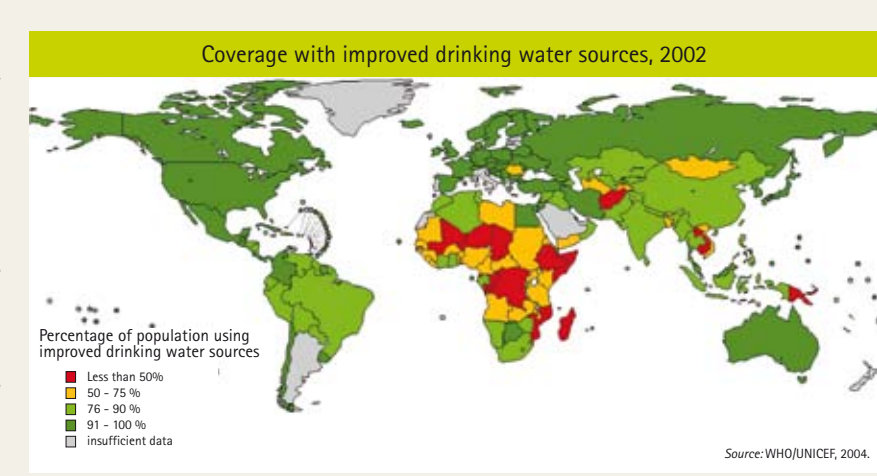
## FOOD, AGRICULTURE AND RURAL LIVELIHOODS

Agriculture is the largest water consumer in the world, with irrigation now claiming close to 70% of all freshwater appropriated for human use. Any water crisis will therefore also create a food crisis. Currently, approximately 777 million people in developing countries do not have access to enough food to live healthy and productive lives. About 13% of the world's population remains undernourished, most of whom live in rural areas of developing countries, which are likely to produce the bulk of the world's population growth. So while progress has been made in fighting hunger, the agriculture sector's water use will have to become more efficient in order to meet the food needs of everyone in the world.



## HEALTH

Over 1 billion people do not have access to safe drinking water. By adopting the Millennium Development Goals (MDGs), the world has pledged to halve this number. So far, the results have been better than those for meeting the sanitation goal. While much of the world is on track for the clean drinking water MDG target, however sub-Saharan Africa still has a long way to go.



## Coverage with improved sanitation, 2002

To halve the proportion of people without improved sanitation, global coverage needs to grow to 75% by 2015, from a starting point of 49% in 1990. However, if the 1990-2002 trend continues, the world will fall short of the sanitation target by more than half a billion people. In other words, close to 2.4 billion people will be without improved sanitation in 2015 – almost as many as there are today.



# WATER, A SHARED RESPONSIBILITY

## WORLD WATER ASSESSMENT PROGRAMME CASE STUDIES

One of the key objectives of the World Water Assessment Programme (WWAP) is to assist countries in reaching their commitments in key water-related challenge areas. Since its founding in 2000, WWAP has helped support the preparation of 17 CASE STUDIES IN 41 COUNTRIES, details of which can be found at [www.unesco.org/water/wwap](http://www.unesco.org/water/wwap). A glimpse of each case study is presented here in terms of a panorama of issues critical to the UNITED NATIONS WORLD WATER DEVELOPMENT REPORTS.

### 1 SUSTAINABLE URBAN WATER MANAGEMENT IN THE STATE OF MEXICO

Mexico comprises 31 States and the Federal District (The Capital). The State of Mexico, located in the centre of the nation of Mexico, suffers from severe water shortages due to a very dense population coupled with accelerated growth, especially in the Metropolitan Zone of the Valley of Mexico (which comprises the totality of the Federal District area and 18 municipalities located in the State of Mexico) with approximately 20 million inhabitants. Currently, water is transferred from local and external basins to meet the demands of the Metropolitan Zone. Increasing water demand has led to 100 percent or more overexploitation of groundwater resources. The effects are striking: groundwater level is declining. Consequently, in some cases the ground has been sinking up to 40 centimetres per year, aquifers have lost their hydrostatic pressure and some springs have dried up. Water and sewer infrastructure has also been damaged due to sinking ground.

The state government is constantly pursuing new mechanisms to slow down urban growth and to promote efficient water use. Federal and state policies are being implemented to promote an integrated approach towards the sustainable utilization of water, forest and land resources. The programmes and projects stemming from these policies strive to increase the participation of local stakeholders, improve infrastructure and enhance legal frameworks.

Photo: © Ron Gilling / Still Pictures

### 2 INNOVATIVE SOLUTIONS IN THE LAKE TITICACA BASIN

Climate variability and associated changes in ambient temperatures are affecting the tropical glaciers of Peru and Bolivia. Between 1991 and 2003, the Zongo and Chacaltaya glaciers suffered both areal and volumetric losses. In fact, the Chacaltaya glacier, a small glacier at medium altitude, lost 97 percent of its mass between 1980 and 2003 and it is expected to disappear completely by 2010. Since glaciers are the main source of water for urban centres along the Andes and for irrigation systems both in the Altiplano and in the desert Pacific coast in Peru, the receding trend will translate into drought for thousands of people.

To meet the water and sanitation needs of the poor at an affordable price, in 2001, a water transfer project from the neighbouring basin of Misicuni was initiated. In April 2005, the first phase of the project was concluded, providing 500 l/sec to the city of Cochabamba, Bolivia. The project will be developed in three stages and is expected to provide 20,000 l/sec at the end of the third phase. A complementary project also created a water consortium, which provides access to low-cost drinking water and sanitation in poor suburban areas.

Photo: © UNESCO - Zevaco

### 3 COMMUNITY INVOLVEMENT IN LA PLATA RIVER BASIN

La Plata River Basin is one of the largest river systems in the world, covering an extensive part of central and northern Argentina, southeast Bolivia, almost all the southern part of Brazil, the whole of Paraguay and a large part of Uruguay. In the growing slums of Brazil, wastewater pollution is rampant and water pricing is high, with residents often paying ten times the legal rate for water.

From 1992 to 1995, efforts to improve the water and sanitation infrastructure of the slums of Brazil were carried out through PROSANEAR, a pilot programme based on cost-effective, appropriate technologies and community participation. Rather than implementing a pre-designed project, PROSANEAR teams directly involved communities in order to adapt efforts to their needs and enlist their support. This new approach to delivering water and sanitation services to the urban poor demonstrates that the poor will pay for water and sanitation services, as long as they understand what they are paying for and receive adequate services for their payments.

Photo: © UNESCO - Robinson

### 6 FLOOD PREVENTION IN THE AUTONOMOUS COMMUNITY OF THE BASQUE COUNTRY

The Autonomous Community of the Basque Country (ACB) is 1 of 17 autonomous bodies of Spain. The region's rugged surface conditions and high rainfall have, in the past, prompted serious flooding and a number of droughts. The last major flood, in 1983, registered over half a metre (500 mm/m<sup>2</sup>) of rainfall in 24 hours, leaving 34 people dead and more than 1,200 millions euros in damage.

As a response to these extreme events, in 1992, ACB implemented an Integral Plan of Flood Prevention and the region has also established an extremely dense hydrometeorological monitoring network, with over 330 control stations currently in operation. Furthermore, a network with 360 sampling points has been set up in order to survey the environmental status of all aquatic ecosystems and regional water bodies.

Photo: © José María Sanz de Galdano Euziza

### 7 THE BASIN APPROACH IN FRANCE

France's 6 major river basins have different climatic, hydrological and socio-economic characteristics. As challenges in each basin are different, each is managed by a separate basin agency and the regional, departmental and local administration, using an integrated water resource management approach. Most of these challenges are being addressed by updated laws and regulations, better management practices and utilization of the latest technology.

The Adour Garonne Basin is an agricultural area, where irrigated surfaces have doubled over twenty years. Decades of unsustainable use associated with heavy industry greatly deteriorated the Adour's natural water resources. In the Loire Brittany Basin, intensive breeding of livestock and the development of cereal have had major impacts. The Rhine Meuse Basin is shared between 9 riparian countries. Pollution control, protection of ecosystems, prevention and early warning of industrial accidents are the current challenges. 64 percent of the national hydroelectric production is produced in the Rhone Mediterranean Basin, however dams have modified river flow and thermal characteristics causing an impoverishment of invertebrate fauna and riverside forests. 30 percent of the population of France lives in the Seine Normandy Basin alone, 80 percent of which live in urban areas.

Photo: © Agence de l'eau Loire-Bretagne

### 8 SHARING WATER IN THE DANUBE RIVER BASIN

The Danube River Basin (DRB) covers parts of all of 18 states comprising Albania, Austria, Bosnia-Herzegovina, Bulgaria, Croatia, the Czech Republic, Germany, Hungary, Italy, the Former Yugoslav Republic of Macedonia, Moldova, Poland, Romania, Serbia and Montenegro, the Slovak Republic, Slovenia, Switzerland and Ukraine. There are marked differences between these countries in terms of economy, sociology and topography that make managing water a complicated matter.

The International Commission for the Protection of the Danube River (ICPDR), with 13 cooperating states and the European Union, was established in 1998 to promote and coordinate sustainable and equitable water management practices. The ICPDR makes recommendations for improving water quality, developing mechanisms for flood and industrial accident control, agreeing on standards for emissions and ensuring that these measures are reflected in the cooperating states' national legislations and applied in their policies.

Photo: © UNESCO

### 10 REVERSING ENVIRONMENTAL DAMAGE IN LAKE PEIPI/CHUDSKOE-PSKOVSKOE

Lake Peipsi is located on the border of the Republic of Estonia and the Russian Federation. Pollution and eutrophication are two of the most critical problems facing the region. The fishing industry, which has been the major economic activity around the lake, has suffered from environmental damages inflicted by pollution and over-fishing.

Over the past few years, both countries have implemented projects, such as the Tartu city wastewater treatment plant in Estonia, intended to improve water quality, reduce pollution and preserve the lake's biodiversity and protected areas. Furthermore, the Joint Lake Peipsi Management Programme, an integrated water resource management tool, is being developed by both countries to help coordinate their efforts.

Photo: © Agri Jaani

### 15 WATER PRICING IN MONGOLIA

In 2004, 40 percent of the population of Mongolia lacked access to safe water resources and only 25 percent of the population had adequate access to sanitation facilities, mainly because of poverty. Almost half of the poor live in urban areas and one-quarter of the urban poor is located in the capital city Ulan Bator.

Although the Mongolian Government gives priority to the interests and water needs of the poor, weak regulations have led to a pro-industry and pro-wealthy pricing scheme. The charges applied to rural consumers for 1,000 litres are 84 times higher than what industries and mining companies pay. As a result, those with the lowest income pay the most and consume the least: the decentralization of water tariffs has promoted economic growth by providing low-cost water to business and industry but disregarded the needs of the poor. The government of Mongolia is committed to implementing reforms in management of water resources and protection of environment.

Photo: © UNESCO - Michel Setbon

### 16 WATER FOR AGRICULTURE IN THAILAND

Its fertile and well-watered central plains have helped Thailand a major international exporter of rice and other agricultural crops, and processed agricultural products. Agricultural production, although it comprises only 10 percent of the national GDP, is the major source of income for the rural poor. Thailand allocates 10 percent of its national budget to irrigated agriculture and its water policy calls for the nation-wide distribution of water for subsistence irrigation. However, intensive agriculture has also caused significant deforestation and irrigation has led to the degradation of watersheds and aquifers.

Of late, industry has become Thailand's main source of GDP. Though this has, in part, helped to decrease rural agricultural production and its related deforestation pressure, industrial areas have polluted wetlands with toxic chemicals. In an effort to lessen these negative trends, environmental concerns have been included in national socio-economic development plans.

Photo: © Kanika Senanusukul / JUNE / Still Pictures

### 17 ENSURING THE KNOWLEDGE BASE IN JAPAN

In Japan, there are several high-level research institutes and centres that focus on water resources issues, environmental protection and disaster prevention. These bodies develop scientific research and also make policy recommendations for better management.

The Law for Enhancing Motivation on Environmental Conservation and Promoting of Environmental Education was established in Japan in July 2003 to promote environmental education in schools and in the community, and enhance public awareness and education on issues related to environmental protection and conservation of natural water bodies. Complimentary initiatives have triggered the creation of National Water Day on August 1, the Annual Forum on Water Environment and the Disaster Prevention Poster Competition among other local and school activities.

Photo: © UNESCO - A. McKenzie

### 14 SRI LANKA: REBUILDING LIFE AFTER THE TSUNAMI

The tsunami that occurred on 26 December 2004 was the biggest natural disaster to strike Sri Lanka, resulting in 38,900 deaths and 443,000 displaced people. It is also estimated to have orphaned hundreds of children. The disaster also severely damaged the local fishing industry and hurt agricultural productivity, infiltrating 10,000 ha with seawater. Groundwater has become highly saline and wells have filled with saline water. Infrastructure, such as roads, bridges, schools, water supplies and dwellings, have also been destroyed.

Ongoing research reveals that environmental damage to coastal ecosystems such as coral reefs and mangroves reduced the capacity of the natural barriers to mitigate the tsunami force and thus intensified the destruction. It was observed that in the regions where coral mining was rampant, the damage to the coast was severe. It was also observed that vegetated coastal sand dunes completely obliterated the tsunami waves in Yala and Bundala National Parks, and the damage occurred only at places where the dune line was broken by river outlets. Therefore, government and NGOs are in the early stages of planning to restore these barriers where possible with community participation.

Photo: © UNESCO - E. Schneider

### 13 ALLEVIATING POVERTY IN KENYA

In order to alleviate poverty in Kenya, where water scarcity is already a seriously limiting factor for development, the Kenyan Government has proposed the Economic Recovery Strategy for Wealth and Employment Creation (ERS, 2003-2007). The ERS promotes the implementation of initiatives to facilitate the achievement of the Millennium Development Goals. The Strategy recognizes water as a pivotal element in poverty reduction and proposes adopting an approach that has a strong emphasis on providing services to the poor while ensuring adequate water for the various competing demands.

ERS builds on the poverty reduction strategy programme of Kenya (initiated in 2000) which is committed to providing water and sanitation services to the majority of the poor at a 'reasonable distance': less than 2 km. The proposed strategy is to involve communities and local authorities more actively in the management of water and sewerage systems and services.

Photo: © Ministry of Water and Irrigation of Kenya

### 12 GENDER AND PRIMARY EDUCATION IN ETHIOPIA

As one of the poorest countries in the world, Ethiopia's ability to develop water and land resources for the promotion of socio-economic development is greatly limited by the fact that only 1 child out of 3 goes to school and about only 37 percent of those children are girls. Often, women and girls are responsible for carrying water from considerable distances away, and during dry periods, they walk longer distances for even smaller quantities of water of lower quality. Although women bear the responsibility of providing water in many communities, they are excluded from important planning and decision-making in water management.

The incidence of disease-related to unsafe water supply and inadequate sanitation, to which children are especially susceptible, is very high. High population growth rates, low-education levels and high rates of illiteracy have also contributed to the burden of ill-health.

Photo: © FAO/1706/J.M. Marzot

### 11 ASSESSING THE IMPACTS OF CLIMATE CHANGE IN UGANDA

The continent of Africa warmed up by 0.5°C in the past century. The five warmest years in Africa's recorded history all occurred after 1988. Recent studies have shown that the glaciers and ice fields on Rwenzori, one of a few of permanently ice-capped mountains in Africa, have decreased markedly both in number and size and that the rate of shrinkage has been greatest after 1990. Malaria has for long been the leading cause of illness in Uganda, and incidences in the highlands are thirty times higher today than at the beginning of the twentieth century. Rising temperatures, in addition to heavy El Niño rains, local climate changes arising from wetland drainage, population growth and human migrations are thought to be some of the most important factors contributing to the increased incidence of malaria.

Rising temperatures also have a negative effect on the agriculture sector of Uganda. Modernizing agriculture to mitigate effects of climatic variations on rain-fed agriculture and involving stakeholders in the planning and implementation of water projects are among the water sector's key objectives in Uganda.

Photo: © UNESCO

### 9 WATER AND ENERGY IN SOUTH AFRICA

In South Africa, the energy sector contributes to the national GDP as much as agriculture. Its coal-fired power stations, however, emit millions of tons of carbon dioxide. Adopting viable pollution control schemes that will not preclude development throughout the country is now the prevailing challenge.

Hydropower plants currently contribute only 0.4 percent to current electricity generation because of limiting factors such as the quantity and variability of surface water. However, South Africa has prioritized hydropower development to manage electricity demand peaks within the South Africa Development Community (SADC) context. The SADC is a regional economic community that aims to combat poverty, ensure food security, and promote industrial development through the integration of the regional economies.

Photo: © UNESCO - J. Sjöova

### 4 ENSURING WATER THROUGH DAMS IN THE SENEGAL RIVER BASIN

The Organization for the Development of the Senegal River (OMVS) was created in 1972 with a mandate to ensure food security and harmony among all riparian users, namely Guinea, Mali, Mauritania and Senegal. The area is gradually developing thanks to the construction of two main dams (Diama and Manantali) providing energy, irrigated agriculture and year-round navigation and to an original management approach based on a concept of 'optimal' distribution among users rather than volumetric water withdrawals. The Manantali dam, although located in Mali, belongs to all the members of the OMVS authority.

As a result of these dams, freshwater is available year-round in sufficient quantities and the member states have access to cheaper electricity. However, water-borne diseases and water pollution have significantly increased due to the development of irrigated agriculture and agro industry.

Photo: © UNESCO - A. N. Vorontzoff

### 5 WATER AND HEALTH IN MALI

An effort has been made to provide drinking water to Malian cities with populations of over 10,000 inhabitants, but the development of disorderly housing settlements and increasing pollution affect the quantity and quality of water available to residents, which has a dramatic impact on health. In fact, water-related diseases such as cholera, diarrhoea and the guinea worm represent more than 80 percent of all illnesses in Mali.

Since the early 1990s, over 700 communal councils have been created to share the responsibility of water management and to maintain the infrastructure. However, though access to water is, on the whole, increasing, access to adequate quantities of clean water is still a problem in both rural and urban areas.

Photo: © FAO/13702/J. Isaac

Local-level actions are the starting point of the global strategy to improve the overall quality of the world's water resources. Lessons learned — successes and failures — are invaluable sources of information and, if properly shared, will help us to solve some of the world's most pressing freshwater-related problems.