



# GLOBAL POPULATION AND WATER

ACCESS AND SUSTAINABILITY

POPULATION AND  
DEVELOPMENT  
STRATEGIES

NUMBER 6





United Nations  
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**NOTES:**

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## FOREWORD

**T**he escalating water crisis constitutes a major threat for global progress towards sustainable development in the new millennium. There is growing recognition that the urgent and deepening crisis in water stewardship worldwide is a particularly acute problem in countries of the developing world. There is need for a new convergence in thinking and practice to align the efforts of governments, development assistance organizations and the public to develop the synergies required to achieve the common goal of sustainability.

Water is essential for all aspects of life, yet one billion people worldwide are denied access to clean water supplies and half of the world's population lacks adequate water purification systems. The global consumption of water is doubling every twenty years, and it is estimated that in 2025, if present rates of water consumption are maintained, five billion out of the world's 7.9 billion people will be living in areas where it will be difficult or even impossible to meet basic water requirements for drinking, cooking and sanitation. The supply of safe drinking water is of vital importance because of the high risk of contracting life-threatening diseases from polluted or contaminated water sources and absence or improper use of sanitation facilities.

In the Plan of Implementation of the World Summit on Sustainable Development (WSSD) governments committed to achieving the internationally agreed development goals, including those contained in the United Nations Millennium Declaration. As a means to further support efforts to eradicate poverty they agreed to halve by the year 2015 the proportion of people who do not have access to basic sanitation, and further

endorsed the Millennium Declaration target of halving by 2015 the proportion of people who are unable to reach or to afford safe drinking water.

Stabilizing global population at a level that will permit the achievement of sustainable development will be attainable only if efforts to expand and improve the quality of reproductive health programmes are maintained, and only if these are combined with greater empowerment of women and increased investments in human capital, particularly in the education of girls.

Without the realization of the goals of the Programme of Action of the International Conference on Population and Development (ICPD), especially universal access to gender sensitive and quality reproductive health services, it will be difficult to achieve a more favourable balance between population and available resources. Efforts to slow population growth, to reduce poverty and hunger, to achieve economic progress, to improve environmental protection, and to reduce unsustainable consumption and production patterns are mutually reinforcing.

It has been argued that the current situation in terms of water demand and supply presents a problem of similar magnitude to the oil crisis of the early 1970s. Yet the crisis for water, all-pervasive as it has become, is not commonly perceived by authorities with similar levels of concern. Management of water resources is by no means a new problem and the control and use of water has been a matter of importance from time immemorial. Water access, rights and use for household, agricultural and industrial production purposes have long been prominent issues.

The provision of safe drinking water becomes a greater challenge as socio-economic development and population growth place increasing demands on limited water resources. Women and children, especially those living in rural areas, are disproportionately affected. Rural women spend hours every day collecting and carting water, either from communal taps or directly from streams and rivers. Long cartage distances pose particular difficulties for elderly people and those with disabilities. Poor communities are often unable to afford the costs of maintaining pumps and boreholes, or lack the skills to do so.

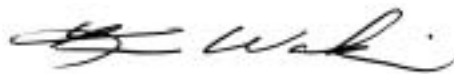
To date, the focus of most water management strategies has almost invariably been on the increase in supply of water without much atten-

tion to the management of demand. What is urgently required is an integrated approach to freshwater management to determine the best means of reconciling competing demands with limited supplies. This requires the development of a framework for systematic appraisal to provide the basis on which hard choices can be made and effective operational actions can be taken. Such a strategy is applicable to all countries irrespective of their stage of development.

There is general agreement among civil society groups that commodification and pricing of water would have a serious adverse impact on the poorest and most vulnerable communities that comprise a large proportion of the populations in many developing countries. Access to water, particularly safe drinking water, must remain an inalienable human right and no obstacles, however justifiable in conservation terms, should prevent universal access to this most essential of natural resources.

This report has been prepared as a contribution to the dialogue that will take place at the Third World Water Forum to be held in Kyoto, Japan between 16 and 23 March 2003. I would like to thank the Population and Development and the Reproductive Health Branches of the Technical Support Division, especially the small team listed on page vi, for the hard work and commitment in preparing this report. I would also like to sincerely thank my colleagues in the UNFPA Country Office in New Delhi, India, for supplying valuable source material. I sincerely hope that this report will prove to be useful in the context of the ongoing dialogue on population, water and sustainable development.

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## EXECUTIVE SUMMARY

Global population numbered 6.1 billion in 2000 and is currently growing by a net increment of some 77 million people per year. By 2025, the United Nations Population Division, in its 2000 Revision of the world's population prospects, estimates that total world population will be of the order of 7.9 billion. The impact of this growth will be focused mainly in less developed countries, where currently some 1.2 billion people, the majority of whom are women and children, are living in extreme poverty. The bulk of the population growth will accrue in the regions of the world least able to absorb large increments of people, increasing migration, threatening sustainable development and the quality of life.

The central role of water is evident in any systematic appraisal of life-sustaining requirements. Even at the most fundamental level of human survival and sustainable development, water not only has life sustaining qualities, but strongly influences economic activity (both production and consumption) and social roles. Fresh water is distributed unevenly, with nearly 500 million people suffering water stress or serious water scarcity. Under current trends, two-thirds of the world's population may be subject to moderate to high water stress in 2025. In the period to 2025, it is expected that the world will need 17 per cent more water to grow food for the increasing populations in developing countries, and that total water use will increase by some 40 per cent. Both the shortage and the uncontrolled excess of water can be life threatening, and the essential balance in-between must look to achieve appropriate priorities, equity and economy in the dispensing of this most vital resource.

At the Millennium Summit world leaders set a target of halving by 2015 the proportion of people without sustainable access to safe drinking water. And the 2002 World Summit on Sustainable Development coupled this with a similar target relating to sanitation. Although the number of people with access to water sanitation services increased in the 1990s, the proportions of global population lacking access to an improved water source (17 per cent), and sanitation services (40 per cent), remained practically the same due to the growth in population numbers. Halving the proportion of people without safe drinking water and sanitation will contribute to the achievement of each of the Millennium Development Goals (MDGs). Fewer children will die from water-borne diseases, more women will have time to engage in productive activities, reducing income poverty and enlarging their social and economic opportunities.

The most immediate impact of measures to protect water sources and increase access to clean water will be to reduce social and environmental vulnerability. By so doing, reductions in child and maternal mortality and improvements in child and maternal health are to be anticipated, as well as reductions in the incidence of malaria and other water-borne diseases. The availability of safe drinking water will also help in achieving the goal of gender equality and empowerment of women, as time spent on water collection can be devoted to more productive pursuits. In many localities this task is undertaken by school-age girls, so this measure should have a positive impact on girls' education.

Water is an essential resource for sustaining health, yet both the quantity and quality of available water supplies are declining in many parts of the world. In developing countries, lack of access to safe water, especially in rural areas and among poor communities, obliges women to spend hours every day collecting water for their families' daily needs, causing enormous drain on their energy, productive potential and health. Largely because of their role in collecting water, washing clothes, cleaning and cooking, and in rural areas, performing day-to-day agricultural tasks, women are constantly exposed to the risks of contracting water-related diseases that affect their reproductive health. Exposure to contaminated water sources is associated with pregnancy failures and with infant and childhood development difficulties, illness and mortality.

There is growing recognition that the urgent and deepening crisis in water stewardship is a particularly acute problem in developing countries, especially among the poorest communities. There is need for a new convergence in thinking and practice to align the efforts of governments, development assistance organizations and the public at all levels to develop the synergies required to achieve the common goal of sustainable development. While access to, and continuity of supply of, quality drinking water constitutes the most universal and most pressing of uses, rural and urban contexts alike require flows that are predictable in quality and reliable in quantity.

UNFPA fully supports multi-sectoral policies and population and development programmes designed to achieve the MDGs. Such policies and programmes need to take into account the linkages that exist between the different goals and the critical intervening role of population factors and reproductive health. Progressing towards the MDG targets, eradicating poverty and achieving sustainable development is dependent on making progress towards the International Conference on Population and Development (ICPD) goal of achieving universal access to reproductive health services. Population growth and dynamics are often associated with environmental degradation in terms of encroachment of fragile ecosystems, rapid and unplanned urbanization, as well as water and food insecurity. Population pressures tend to be highest in countries least able to absorb large increments of people, threatening sustainable development and resulting in deterioration in the quality of life.





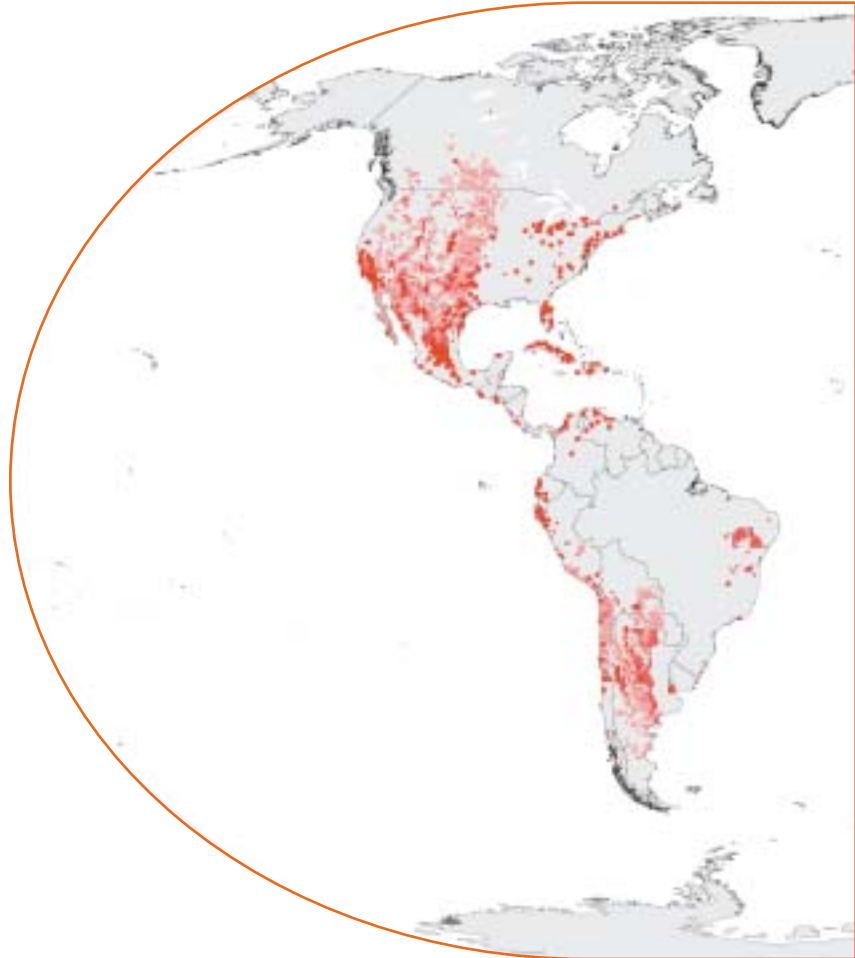
## CHAPTER 1 THE CHALLENGE

### Global Population

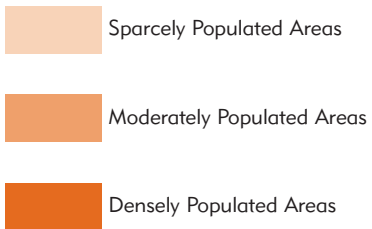
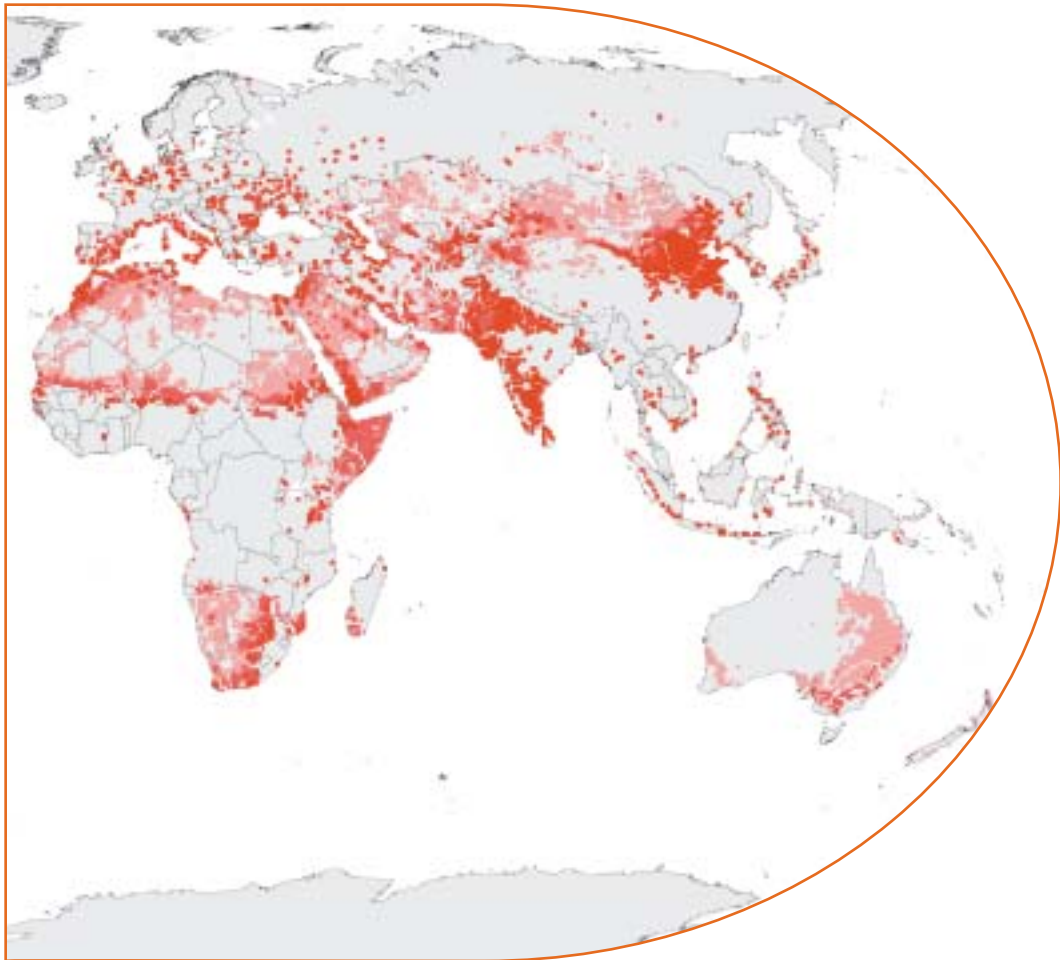
The world's population continues to grow by some 77 million annually. Over the next 15 years almost all of the projected 1.1 billion increase in global population, from 6.1 billion in 2000 to 7.2 billion in 2015 will be in developing countries, which now account for four-fifths of the global total (United Nations, 2001) (Figure 1.1). Taking a longer time span, the world's population is expected to reach 7.9 billion by 2025 and 9.3 billion in 2050. Population growth rates are particularly high in the least developed countries estimated at 2.4 per cent annually in the period 2000-2015, while in the developed countries this figure is estimated to be just 1.1 per cent. Of course, global figures conceal major differences in growth rates between regions and countries. Global population is also becoming more urban, with the proportion of the world's population living in urban areas projected to rise from 47 per cent in 2000 to 53 per cent in 2015; this trend being especially pronounced in the developing countries (United Nations 2002a).

Generalizations about the negative effects of global population growth on the natural environment and specifically water can be misleading and the benefits of new technologies need to be factored in. Even so, in many regions water scarcity and declining quality affect the poor the most. Nearly 75 per cent of the 1.2 billion people in extreme poverty, as defined by the \$1 a day measure, live in rural areas, where a significant proportion of the population lacks access to a quality water source and where rapidly growing populations are exerting heavy pressures on the natural environment (IFAD, 2001) (Map 1.1 and Figure 1.2).

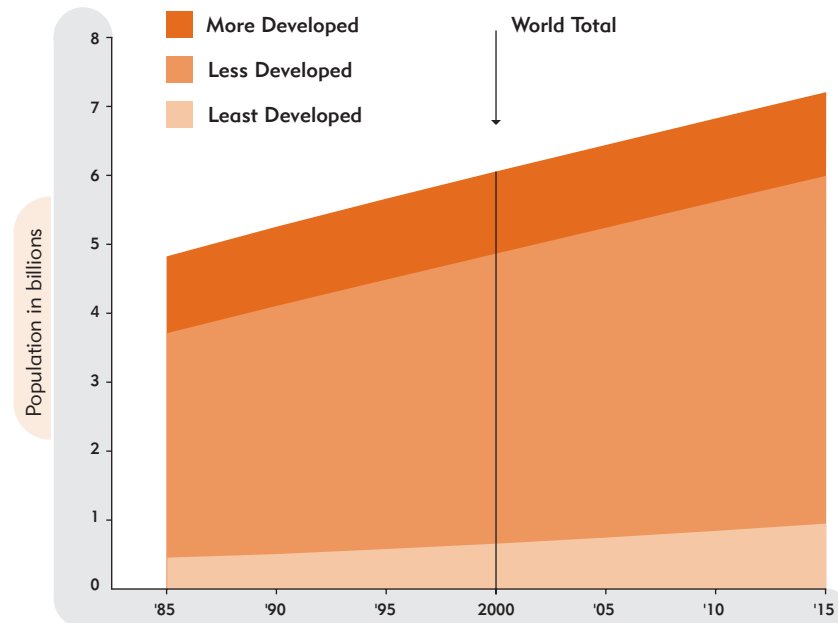
**MAP 1.1:** Population and Areas Suffering Severe Water Scarcity, circa 2000



**SOURCE:** World Bank, 2002c using data from Vorosmarty, C.J., Green, P., Salisbury, J., and Lammers, R.B. (2000)



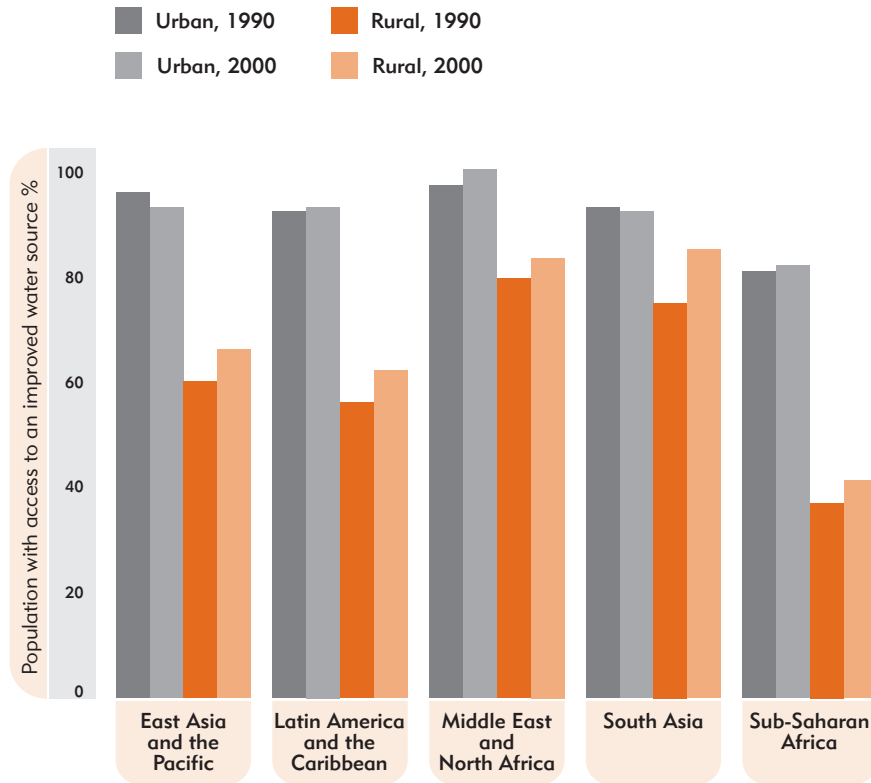
**FIGURE 1.1:** Estimated and Projected Population Size, 1985-2015, World, More Developed, Less Developed and Least Developed Countries



**SOURCE OF DATA:** United Nations, 2001

Declining supplies of quality water sources increase poverty through declining employment and income opportunities for the poor. The combination of rural poverty, population pressures and dwindling water supplies is a powerful force driving rural to urban migration, as well as cross border movements. Rapid urban growth often leads to people establishing slums where there are serious problems with, for example, water supply, sanitation and industrial waste. The rapid pace of urbanization further hinders the development of adequate infrastructure and regulatory mechanisms to cope with water pollution and the by-products of population and economic growth (Hunter, 2001). At the same time, increased consumption patterns in urban areas may divert water from rural areas. Thus, mobility and spatial distribution of populations are significant determinants of sustainability and in particular of water consumption patterns (Global Science Panel, 2002).

**FIGURE 1.2:** Urban and Rural Differences in Access to an Improved Water Source, Developing Countries, 1990 and 2000



**SOURCE OF DATA:** World Bank, 2002a

### Sustainable Development

The water crisis threatens global progress towards sustainable development in the new millennium. There is growing recognition that the urgent and deepening crisis in water stewardship worldwide is a particularly acute problem in countries of the developing world. There is need for a new convergence in thinking and practice to align the efforts of governments, development assistance organizations and the public at all levels, to develop the synergies required to achieve the common goals of sustainable development.

Box 1.1

### Population and Sustainable Development

The sustainable development agenda to improve human well-being and preserve the quality of the environment cannot succeed without a core focus on population. If we do not put the human population at the core of this agenda, our efforts to improve human well-being and preserve the quality of the environment will fail.

Demographic diversity presents different challenges requiring differentiated responses. The most urgent of these occur where rapid population growth, high levels of poverty, food and water insecurity, and environmental degradation coincide.

The core consideration of the population in the sustainable development debate is: how will humans be affected by environmental and socioeconomic change? To answer this question, we need to look at the kinds of changes that occur – in ecosystems and resource availability, population and demographic transitions, diseases and health care, economic activities and livelihoods. Environment systems are affected by multiple, interacting stresses.

The human population matters for sustainable development in two critical ways. First, it is an agent of change, including many of the environmental, economic, and social changes in the world that give rise to our concern about sustainability of our current development paths. Second, the human population and its living conditions are the ultimate objects of development, with long term human health, well-being, and survival, serving as criteria for judging whether development is sustainable or not. It is the human population and its individual members that ultimately will suffer the consequences of unsustainable paths of development.

For these reasons, the systematic integration of population in sustainable development is essential if we are to meet the needs of the present generation without sacrificing the livelihoods of future generations. At the core of this is a critical need for systematic integration of the interrelationships of population and society, environment and natural resources, and economic and governance institutions, at local, national and international levels.

SOURCE: Global Science Panel, 2002

World water shortages and rising demand are leading to escalating competition for access to clean water in both rural and urban areas. The impact on human health is severe, with millions of deaths each year from water-borne diseases, while water pollution and aquatic ecosystem destruction continues to rise.

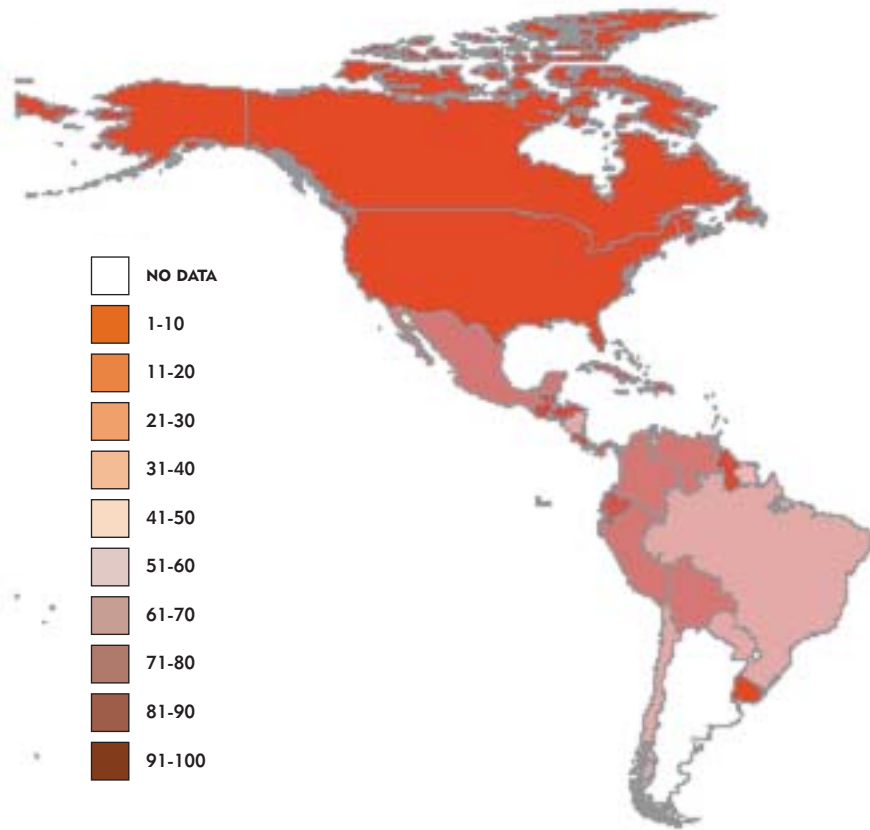
In developing countries there is frequently uncertain access to reliable supplies of potable water. Commonly both rural and urban populations lack reticulated systems and depend on accessing groundwater. In many localities, particularly in coastal areas, unregulated use of groundwater supplies has resulted in a falling water table that becomes progressively more contaminated by seawater or other pollutants. Water-borne sewage and processing of human waste is often absent or unreliable and waste disposal may also affect the groundwater flow on which people rely.

Among the factors contributing to the water crisis in developing countries are the incomplete understanding of requirements for sustainable water stewardship, the gaps in local capacities – scientific, educational, institutional, managerial and political – and the failure to put in place the full suite of enabling systems needed to achieve sustainability. The objectives of the combined efforts of local and international agencies must therefore be to improve awareness and understanding of water issues and solutions, to contribute to the resolution of the capacity deficit through capacity-building programmes, and to help establish sustainable systems and practices through directed technical and scientific assistance.

In recent decades, provision of water management infrastructure and services has commonly been provided by private sector specialists, frequently from more developed countries, with funding from international development organizations. Unfortunately, these services have often proved costly and ineffective in the long-term, driven by a supply-side, top-down approach, and led by outside experts unfamiliar with local needs and conditions. The outcome has often been a huge debt burden borne by the developing countries concerned without the realisation of most of the economic, social and human health benefits from the investment that were initially anticipated.

Increasingly there is an emerging recognition that a new approach is required. Such a strategy envisages more realistic planning, integrated action, community based, multi-stakeholder participation and greater equity in the developing-developed country relationship. Together this would contribute to develop the necessary momentum to provide continuous progress towards sustainable results on a more equal, partnership basis, an approach currently being advocated by the United Nations University's International Network on Water, Environment and Health (INWEH, 2001).

MAP 1.2: Percentage of Population with Access to Safe Water in Rural Areas, 1999

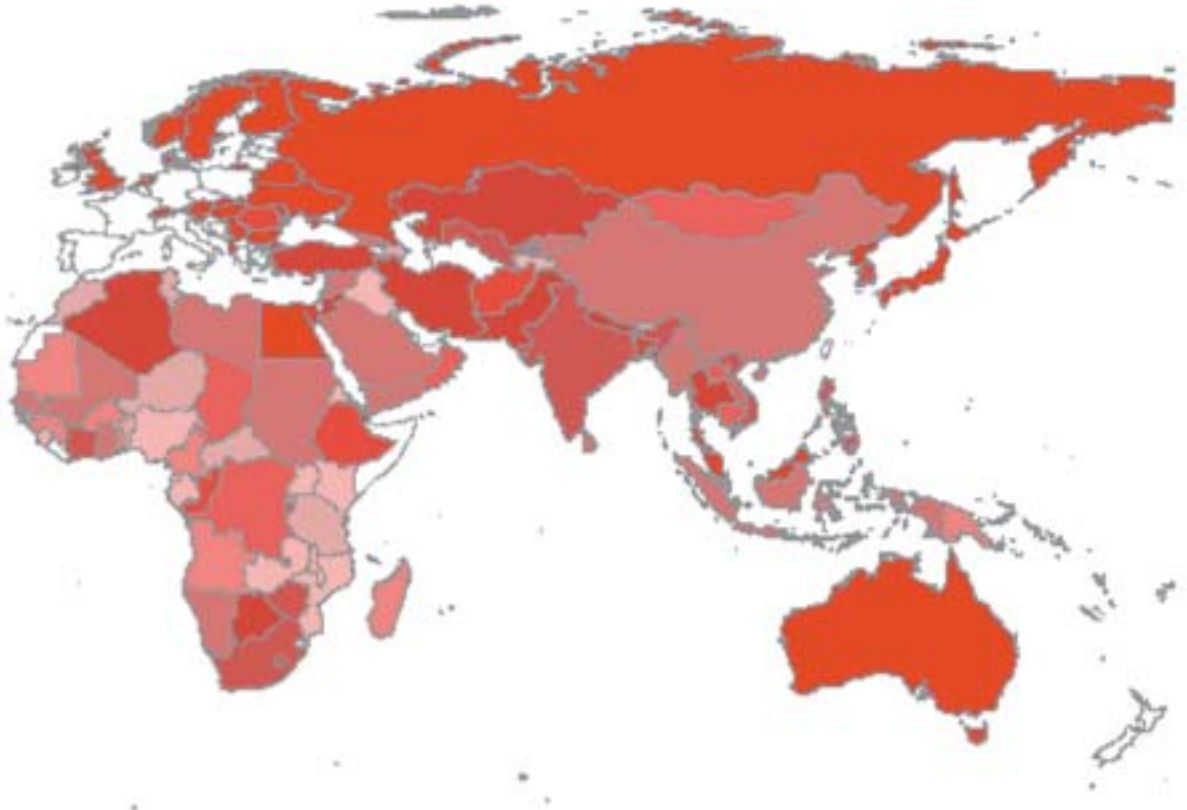


## Access to Water

### *Potable water*

Elementary infrastructural development in most rural and many urban environments in developing countries dictates that gaining access to drinking water is often time consuming and difficult. All possible sources are likely to be utilised – wells, streams, lakes and even canals. The poor are frequently excluded from basic services, such as piped water, sewerage and electricity and live under threat of, for example, flooding, fire and contagious disease. Commonly in squatter settlements, residents buy water from peddlers or fetch it from a public





SOURCE OF DATA: UNICEF, 2001

standpipe or well. Whatever the source, collection from far or near is commonly one of the onerous tasks designated as women's work. The continual lifting and carrying of endless containers of water is extremely burdensome and commonly damaging to health while the product conveyed, from whatever source is conveniently available, may be of highly dubious quality.

#### **Water shortages**

The ever-increasing demand for water, especially in cities, is caused by the increased demand by large populations in the expanding urban

Box 1.2

**Differential Vulnerability and MDGs: Focus on sub-Saharan Africa**

Many factors contribute to social, economic and environmental vulnerability, including rapid population growth, scale of poverty and hunger, poor health, low level of education, gender inequality, arable land lost to erosion, salinity and desertification, water shortages and pollution, disappearing forests and threats to biodiversity. Not all countries, sub-populations and households are affected in the same way. Consideration of vulnerability must therefore focus not only on countries but also the most vulnerable segments of the populations within countries (Fisher et al., 2002).

Two of the most important vulnerability issues relate to access to water and food, and at the global level, sub-Saharan Africa has the lowest level of access to safe water coverage of any region, with only 60 per cent of the populations served, and this region also has the highest percentage of undernourished – some 40 per cent of the total population – and there has been little progress in reducing hunger in the last three decades, in contrast to Asia where hunger has been halved from a level similar to sub-Saharan Africa in the late 1960s. Hence sub-Saharan Africa deserves the highest priority in national and international efforts to meet the MDG targets.

In sub-Saharan Africa, there are 10 countries, namely, Angola, Chad, Democratic Republic of Congo, Eritrea, Ethiopia, Guinea, Kenya, Madagascar, Rwanda, and Sierra Leone, that are most vulnerable in terms of access to safe water as well as hunger. In these countries less than half the population had access to safe water and over a third of the population is undernourished. The total population of this group of countries was 205 million in 2000, and is projected to increase to 306 million in 2015.

For another nine countries, including, Burundi, Cameroon, Central African Republic, Congo, Malawi, Mozambique, Niger, United Republic of Tanzania, and Zambia, between a third and a half of the populations do not have access to safe water and over a quarter are undernourished. In 2015 the total population of those countries will amount to 161 million, in comparison to 114 million in 2000.

Additionally for Benin, Burkina Faso, Gambia, Ghana, Mali, Nigeria, Togo and Uganda up to a third of the populations lack access to safe water and up to a quarter of the populations are undernourished. Here the year 2000 population of 191 is projected to increase to 284 million in 2015.

Many of the above sub-Saharan countries are also poor, with a significant proportion of the population living on less than a \$1 a day. The MDG targets for poverty, hunger and water are intertwined and one cannot be achieved without due attention to the others. And progressing towards these targets also requires consideration of population and reproductive health concerns, especially of the most vulnerable populations in the most vulnerable countries.

areas. Urban sprawl and residential development draw off increasing quantities of water, reducing water recharge. Where this occurs concurrently with the extraction of groundwater, subsidence and saltwater intrusion are commonly the result. This can accentuate flooding problems and, again, it is the poor living on flood-prone lands that are most vulnerable to these effects. The combination of rapid population growth, groundwater depletion, poor drainage and sea-level rise is a potent threat for many large urban populations in coastal areas.

Where water rights are traditional or unclear, water shortages could often be reduced by better regulation of well-drilling in urban areas; reforestation of denuded watersheds to increase infiltration of rainwater; the building of large dams or reservoirs in urban watersheds; and the development of pumping stations to deliver quality water to urban populations.

### **Irrigation**

Irrigation is commonly a major factor in increasing agricultural productivity, as it allows for multiple cropping and the use of high yielding modern crop varieties while reducing risk of drought. Moreover, development of new irrigation systems is very capital intensive and the tendency in recent years has been for international development assistance for this purpose to decline. This partly reflects the decline in international commodity prices for some irrigated crops and the rising per-hectare costs of new irrigation facilities and production inputs. As elsewhere in the water reticulation systems, long-established irrigation facilities are commonly confronted with problems of inefficient water use, siltation, and long-deferred maintenance.

Government participation in rural development, including the development of irrigation systems, is commonly aimed at improving elements of the physical infrastructure, raising agricultural productivity and increasing rural income levels and livelihood opportunities. Such investments contribute to social and institutional development, the improvement of the quality of rural life, poverty reduction, and more equitable distribution of resources.

## International Agreements

The case explicitly for rights to reliable access to water was made at the 1972 Stockholm United Nations Conference on the Human Environment and Development. The meeting endorsed the statement that 'all people have the right to have access to drinking water'. Some twenty years later the United Nations General Assembly declared the International

### Box 1.3

#### Population and Water – ICPD Programme of Action, ICPD+5, Millennium Summit and WSSD

##### **International Conference on Population and Development (ICPD) Programme of Action**

All countries should give priority to measures that improve the quality of life and health by ensuring a safe and sanitary living environment for all population groups through measures aimed at avoiding crowded housing conditions, reducing air pollution, ensuring access to clean water and sanitation, improving waste management...(para 8.10).

##### **ICPD+5**

Governments of developing countries...should continue to support declines in infant and child health programmes that emphasize improved prenatal care and nutrition, including breastfeeding, unless it is medically contraindicated, universal immunization, oral rehydration therapies, clean water sources, infectious disease prevention, reduction in exposure to toxic substances, and improvements in household sanitation...(para 18a).

##### **Millennium Summit**

We resolve...by the year 2015...to halve the proportion of people who are unable to reach or to afford safe drinking water (para 19).

To stop the unsustainable exploitation of water resources by developing water management strategies at the regional, national and local levels, which promote both equitable access and adequate supplies (para 23).

##### **World Summit on Sustainable Development (WSSD)**

Increase access to sanitation to improve human health and reduce infant mortality, prioritizing water and sanitation in national sustainable development strategies where they exist (para 6m).

The provision of clean drinking water and adequate sanitation is necessary to protect human health and the environment...we agree to halve, by the year 2015, the proportion of people who are unable to reach or to afford safe drinking water and the proportion of people who do not have access to basic sanitation...(para 7).

Provide access to potable domestic water, hygiene education and waste management at the household level...that give priority to the needs of the poor...(para 60a).

Drinking Water and Sanitation Decade to achieve universal access to water supply and sanitation. In 2002, the United Nations Committee on Economic, Cultural and Social Rights, interpreting the provision of the International Covenant on Economic, Social and Cultural Rights, asserted, ‘...water is fundamental for life and health. The human right to water is indispensable for leading a healthy life in human dignity. It is a pre-requisite to the realisation of all other human rights’. The 145 countries that ratified the Covenant are now committed to ensuring that their people have access to safe and adequate drinking water and sanitation facilities – equitably and without discrimination. At the World Food Summit in 1996, leaders from 185 countries adopted the Rome Declaration in which it was agreed that ‘the right of everyone to have access to safe and nutritious food, consistent with the right to adequate food and fundamental right of everyone to be free from hunger’.

#### **Millennium Development Goals: Water, Food and Sustainable Development** —

At the Millennium Summit in September 2000, the 189 states of the United Nations reaffirmed their commitment to working towards a world in which sustainable development for present and future populations would be assured. At that Summit, political leaders from around the world took the unprecedented step of deciding to adopt eight mutually reinforcing goals, through a global development partnership aimed at substantially resolving the major issues of our time. The MDG targets include: reducing the incidence of poverty and hunger by half; ensuring universal access to primary education; eliminating gender disparity at all levels of education; reducing the under-five mortality rate by two-thirds and maternal mortality by three-quarters; reversing the spread of HIV/AIDS, malaria and other diseases; and concurrently promoting environmental sustainability; all in the context of a global partnership for development.

The central role of water (intrinsically linked with food as a basic human need but also essential as a resource with a major role in production as well as consumption) is evident in any systematic appraisal of life-sustaining requirements. Even at the most fundamental level of human survival and development, water not only has life sustaining qualities, but strongly influences economic activity and social roles, as reflected in its links to basic needs ( **Figure 1.3**).

**FIGURE 1.3:** MDG Basic Needs Targets and Critical Linkages to Water

Millennium Development Goal	MDG Target for 2015	Examples of critical linkages to water
<b>Eradicate extreme poverty</b>	<ul style="list-style-type: none"> <li>• <i>Reduce by half the proportion of people living on less than a dollar a day</i></li> <li>• <i>Reduce by half the proportion of people who suffer from hunger</i></li> </ul>	<ul style="list-style-type: none"> <li>• Rural livelihoods and incomes of the poor often depend on availability and access to water for agriculture.</li> <li>• Increased productivity of crop production, livestock and fisheries through efficient water use would contribute to lower food prices. Urban poor would benefit from reduced food expenditure.</li> <li>• Reduction of water-borne diseases through safe water supply would contribute to better health and increased human productivity for livelihood earning opportunities.</li> </ul>
<b>Achieve universal primary education</b>	<ul style="list-style-type: none"> <li>• <i>Ensure that all boys and girls complete a full course of primary schooling</i></li> </ul>	<ul style="list-style-type: none"> <li>• Increased school attendance would result from better health and nutrition as a result of safe water supplies.</li> </ul>
<b>Promote gender equality and empower women</b>	<ul style="list-style-type: none"> <li>• <i>Eliminate gender disparity in primary and secondary education preferably by 2005, and at all levels by 2015</i></li> </ul>	<ul style="list-style-type: none"> <li>• Reduced time and economic burden of fetching water for household needs, especially for women and female children. Within reach water supply provision would reduce health problems of carrying heavy loads of water. Time saved would enable access to education and income generating activities as well as for leisure and rest.</li> <li>• Women's empowerment would be facilitated through participation in water resource development and management of water supplies.</li> </ul>

SOURCE: Adapted from DfID et al., 2002

**Basic needs targets and critical linkages to water**

Pathways for the eradication of extreme poverty and hunger necessitate access to water not only for survival but also for almost any productive

purpose in the predominantly rural and agricultural environments where it occurs. For the most part, expanded and effective access must go beyond the natural occurrence of water sources, already utilized as efficiently as consumers can contrive, to institutional intervention to achieve wider and more adequate distribution through reticulation and improved forms of delivery on an equitable basis.

Equally, without informed and consistent intervention, the quality of water and the environment from which it is drawn becomes progressively worse, introducing further hazards to the health of women and children and those who are the most vulnerable. Chronic and debilitating disease compromises the productivity as sufferers curtail their participation in their normal production processes. Such intervention is even more essential in the rapidly expanding urban contexts of developing countries where rapid population growth (both natural increase and rural to urban migration) is putting housing and access to basic services, such as water, sanitation and health, under extreme stress.

In most developing societies, the prevailing methods of distributing water for most purposes are far below levels that are efficient or even adequate, let alone technologically feasible. For many purposes, and most commonly for obtaining water to satisfy the range of household needs, women and children carry water in immense quantities over long distances. Establishing alternative means of distribution again requires informed intervention that would free up women and girls for alternative activities which can be both productive and personally enhancing in terms of education and the development of new skills.

Modification of gender disparities in the allocation of tasks represents a major and seemingly intractable issue. Cultural practices and perception of acceptable behaviour are firmly entrenched in many societies so that, in the context of utilisation of water, women need empowerment to participate in the crucial decisions about alternative forms of delivery and overall management of the resource.

#### ***Health targets and critical linkages to water***

The high cost of water and lack of water quality for the poor are responsible for a low level of personal hygiene and associated spread of communicable diseases, and high prevalence of water-related diseases (Ahmed, 2002) (Figure 1.4). Some 60 per cent of all infant mortality is linked to infectious and parasitic diseases, many of them water-related.

FIGURE 1.4: MDG Health Targets and Critical Linkages to Water

Millennium Development Goal	MDG Target for 2015	Examples of critical linkages to water
Reduce child mortality	<ul style="list-style-type: none"> <li>• Reduce by two-thirds the mortality rate among children under five</li> </ul>	<ul style="list-style-type: none"> <li>• Some 60 per cent of all infant mortality is linked to infectious and parasitic diseases, most of them water-related (e.g. diarrhoea, cholera) that kill 10,000 to 20,000 children each day.</li> <li>• With better survival of children, increased scope of reduction in family size.</li> </ul>
Improve maternal health	<ul style="list-style-type: none"> <li>• Reduce by three quarters the maternal mortality ratio</li> </ul>	<ul style="list-style-type: none"> <li>• Water-related diseases weaken the mother and unborn child; reduced incidence of water-borne diseases and risk of mortality through safe water supplies.</li> </ul>
Combat HIV/AIDS, malaria and other diseases	<ul style="list-style-type: none"> <li>• Halt and begin to reverse the spread of HIV/AIDS</li> <li>• Halt and begin to reverse the incidence of malaria and other major diseases</li> </ul>	<ul style="list-style-type: none"> <li>• Access to safe water is essential for health. Stagnant water supports mosquito population, and increase in temperature associated with climate change expands the area affected by malaria.</li> <li>• Polluted water shortages, unsanitary living conditions kill 12 million people a year.</li> <li>• With adequate supplies of safe drinking water and sanitation, the incidence of some illnesses and death could drop by as much as 75 per cent.</li> </ul>

SOURCE: Adapted from DfID et al., 2002

With adequate supplies of safe drinking water and sanitation, the incidence of some illnesses and deaths could be reduced by as much as 75 per cent (United Nations, 2002b).

Water-related diseases constitute a major obstacle to the achievement of a healthy population in most developing countries. While the quality of water itself is of prime concern to reduce and eventually eliminate



the risks associated with microbial infection, water as the medium of vector support is also a crucial consideration. Infants and young children are particularly vulnerable to this cluster of diseases, and infant and child mortality rates from these causes in many low income countries are unacceptably high. The same set of diseases has a wide impact on mothers and new-born children and account for a large proportion of maternal deaths.

Despite a long history of attempts at controlling the malarial mosquito, ineffectual implementation of drainage and spraying measures and favourable natural environmental conditions for breeding maintain high incidence rates for the disease, resulting in malaria still being a major cause of death and debilitation. Indications are that, in some areas of the developing world, climate change may enhance conditions for such vectors and exacerbate the risks.

***Institutional targets and critical linkages to water***

Initiatives beyond the capabilities of local communities and even whole societies are required if the fundamental and far-reaching improvements in living conditions and the delivery of basic resource and health needs is to be achieved. This is not to undervalue the participation of local communities in making decisions and managing change, but they rarely have the skills or the resources required to achieve the scale of modification required. There is a major role for governments, national and international agencies in promoting and facilitating the protection of the environment and where necessary its rehabilitation (Figure 1.5).

Spontaneous actions by the populace at large may run counter to official policies and efforts for conservation and preservation of their environments. Where attitudes and actions appear to be inimical to improved practice there is likely to be a need for informed advice and educative measures to achieve positive change.

Pursuing policies of sustainability in the environment provides an assured basis for the safe implementation of a large range of developmental activities that span utilisation of water for most purposes and from most sources. While sustainable access to safe drinking water must generally take priority, Figure 1.5 lists a wide variety of producer and consumer issues requiring consideration.

FIGURE 1.5: MDG Institutional Targets and Critical Linkages to Water

Millennium Development Goal	MDG Target for 2015	Examples of critical linkages to water
<p><b>Ensure environmental sustainability</b></p>	<ul style="list-style-type: none"> <li>• <i>Integrate the principles of sustainable development into country policies and programmes; reverse loss of environmental resources</i></li> <li>• <i>Reduce by half the proportion of people without sustainable access to safe drinking water</i></li> <li>• <i>Achieve significant improvement in lives of at least 100 million slum dwellers, by 2025</i></li> </ul>	<ul style="list-style-type: none"> <li>• Sustainable and efficient groundwater, river basin resource use, protection of ecologically important wetlands, productive agriculture, clean local hydropower development where feasible, especially to meet energy needs of the urban and peri-urban poor, reduction in solid fuels, reduced land degradation from water erosion, reduced incidence of water-borne diseases, would all contribute to environmental sustainability and reduction of poverty.</li> </ul>
<p><b>Develop a global partnership for development</b></p>	<ul style="list-style-type: none"> <li>• <i>Good governance, development and poverty reduction, and fair-trading and effective financial systems</i></li> <li>• <i>Special needs of least developed and land locked countries and small island states</i></li> <li>• <i>National and international measures for debt sustainability</i></li> <li>• <i>Productive and decent youth development</i></li> <li>• <i>Access to affordable essential drugs</i></li> <li>• <i>Access to technological innovations, particularly the private sector information and communication technologies</i></li> </ul>	<ul style="list-style-type: none"> <li>• Resolution of local and international water conflicts.</li> <li>• Availability and access to safe water resources would result in improved productivity, and higher incomes.</li> <li>• International cooperation and development aid and investments for urban water supplies (including role of private sector), hydropower for clean energy, agricultural development and livelihoods of the rural poor, etc would result in reduction in global poverty and income disparities.</li> <li>• Access to knowledge and world-wide experiences, both scientific and traditional, of water resource management technologies for development and environmental sustainability.</li> </ul>

SOURCE: Adapted from DfID et al., 2002

While access to knowledge and worldwide experience of water resource conservation and management technologies is likely to contribute significantly to development and environmental sustainability, few communities or even developing nation states are capable of proceeding totally independently. Of necessity, most will look for partnership opportunities with other countries and international agencies, not only for financial support but also for the specialist knowledge and skills that are their best assurance of successful intervention.

Each individual MDG is important in itself, but for the effective achievement of the MDG targets, each MDG must be viewed as interlinked and mutually reinforcing. Poverty cannot be eliminated, or even ameliorated, without eradicating hunger and vice versa. More universal access to, and participation in, all levels of education leads to better health and improved human productivity. And the achievement of all of the MDGs is critically dependent on progressing towards the ICPD goal of ensuring universal access to quality reproductive health services.

Improving human well-being and sustaining the environment enhance the potential for peace and security. The challenge ahead is formidable given the wide disparities in access to the basic necessities of life, the differentials in the resources available, the scale of destitution resulting in huge numbers living in poverty and hunger, with little access to health care and education, and often located in deteriorating human and physical environments. Additionally, the poor and the vulnerable seldom have a voice that is heard, they are often not even acknowledged, or are deemed politically and socially insignificant and are frequent targets of discrimination.



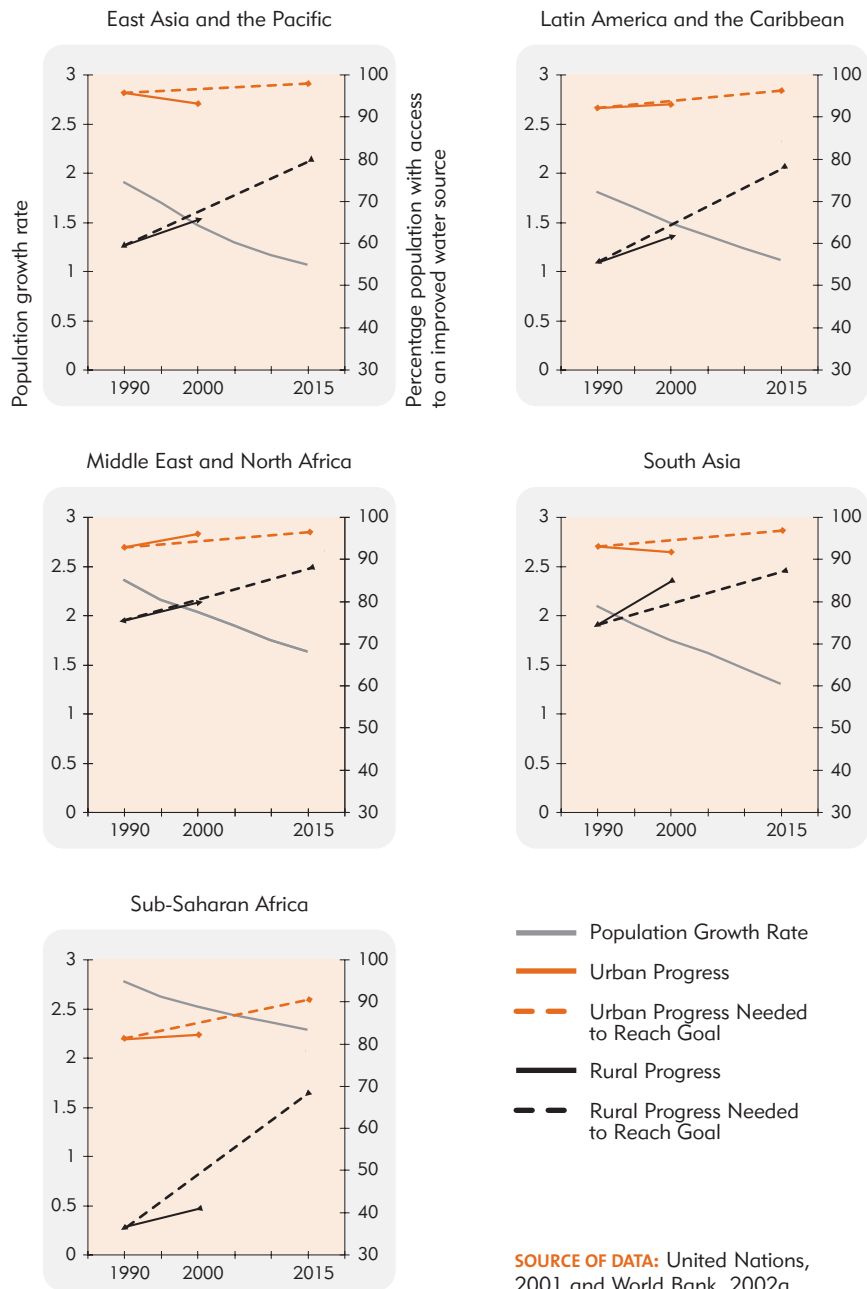
## CHAPTER 2 THE CONSTITUENCY AND THE DEMANDS

### Human Needs

To achieve the MDG and WSSD targets of halving the number of people without access to an improved water source and sanitation by 2015, and taking account of the growing global population, an additional 1.6 billion people will need access to safe drinking water and 2.2 billion people will need improved sanitation systems (United Nations, 2002b)(Figure 2.1). Fresh water is distributed unevenly, with nearly 500 million people suffering water stress or serious water scarcity. Under current trends, two-thirds of the world's population may be subject to moderate and high water stress in 2025. Over this period, it is expected that the world will need 17 per cent more water to grow food for the increasing populations in developing countries, and that total water use will increase by 40 per cent (United Nations, 2002b).

Along with a multitude of other factors, the growing population, especially in the lower-income countries, contributes to pressures on scarce water resources and the quality of life, especially among the poorest communities (Box 2.1).

**FIGURE 2.1: Population Growth Rates and Percentage of Population with Access to an Improved Water Source, 1990-2015 ~ Progress to MDG 7**  
"Halve, by 2015, the proportion of people without sustainable access to safe drinking water"



## Box 2.1

## Impact of Population on Water and Quality of Life in India

Agriculture in India relies on a comprehensive system of irrigation. However, water tables are falling as groundwater is currently being extracted at twice the recharge rate. Eventually the shortfall will adversely impact harvests. Because the general scarcity of water is particularly acute in many parts of the country, UNFPA supported a two-year policy research project that started in 2000, and carried out by the Tata Environmental Research Institute in New Delhi, on the relationship between population growth and distribution, and water availability. At the macro level, an assessment was made of the impact of population growth on water resources to identify critical states and districts. At the village level, a micro assessment was made of water availability and water quality on the quality of life of people, particularly women and children. The project was undertaken in eight villages and four districts in the states of Rajasthan, Karnataka, Himachal Pradesh and Kerala (UNFPA, 2001b).

**Project findings:**

- In all villages, concerns were voiced about water shortages. This was perceived differently in different regions. In some areas water scarcity was particularly acute even for drinking purposes, while availability for irrigation was a major concern in another district. In the coastal villages of South India, there is a problem of salt-water incursion in the wells.
- Water quality was examined on chemical and bacteriological parameters. Out of twenty tested only three met the ISI standards for drinking water.
- Considerable effort goes in water collection for drinking and other household uses. In all of the villages the burden of water collection is on women and children (mostly girls), who spend several hours a day on this activity. Most women respondents complained of frequent backaches and related this to carrying heavy pots of water (as well as fuel wood). In one district, villagers described that they are unable to send their children to school, as they are needed for household chores such as water collection.
- In some villages, a few relatively better-off households and several belonging to a community in which women are not allowed to go out, spend as much as one-fourth of their income to hire carts to carry water. These households also invest close to half-a year's earnings in storage facilities.
- Acute diarrhea is reported as a widespread problem in all but one village. These findings are in conformity with results of water examination on bacteriological parameters as most samples reported coliform organisms. In one district, mottling of teeth and stiffness of joints was reported, which can be attributed to high fluoride content.

**Factors contributing to water stress:**

Water related stress is aggravated by a multitude of interrelated factors: natural, demographic, socio-economic and infrastructural.

**Natural factors:** Water related concerns are most acute in arid and semi arid areas. Proximity to coast and hilly regions also compound water stress.

**Demographic factors:** The direct role of the population growth in aggravating water scarcity is evident in all villages surveyed. Population density is found to impact water quality and quantity.

*continued on next page*

Box 2.1 *continued*

**Socio-Economic factors:** The poor are most vulnerable to water related stress; higher income households have significantly less water related stress. In some villages caste is an additional factor affecting access to water.

**Infrastructural Factors:** Water availability is restricted in some districts due to erratic power supply. Water supply schemes are also marred by poor maintenance of the public water distribution systems i.e. leaking pipes, broken taps and unclean storage reservoirs. Furthermore, health problems are aggravated in the absence of a dependable health care facility in most villages surveyed.

**SOURCE:** UNFPA Country Office, New Delhi, India.

## Gender and Women's Empowerment

Women play a central role as producers of food, managers of natural resources and as income earners and caretakers of household food, water and nutrition security. Women and children, especially those living in rural areas, play a particularly significant role in taking care of household water needs.

Gender differences in property rights and access to natural resources, such as water, hinder sustainable development (Quisumbing et al., 1999). A review of 271 World Bank projects by IFPRI shows that when the needs of both men and women are addressed, sustainability of projects increased by 16 per cent (IFPRI, 2000). Increased women's participation in the management of domestic and commercial water resources helps empower women and improve project efficiency and effectiveness (Cleaver, 1997). A literature review attributes the following aspects of women's participation in water projects as promoting their empowerment and project efficiency: (i) their skilled role in project implementation and management; (ii) their representation in community decision-making; (iii) their increased awareness of health and hygiene in water management and (iv) their enlarged income generating capacity through time saved in fetching water (Joshi and Fawcett, 2001). Others contend that project efficiency has come at a high cost in terms of opportunity cost in women's time and has done little to empower women (Jackson, 1997) and has needlessly isolated and separated women in terms of their social relations (Baden and Goetz, 1998).



Participation does not necessarily mean sharing power and often it entails involvement in externally conceived projects through contributions and benefits (Wallace, 2000). Empowerment is more deep-rooted and can be defined as the expansion of assets and capabilities of poor people, particularly women, to participate in, negotiate with, influence, control and hold accountable institutions that affects their lives (World Bank, 2002b). The entry of women into the male domain of technological inputs for water management has been seen as an achievement and in certain instances has been beneficial for the women included. However, women's involvement is often a one-time event, and it is frequently simply for project efficiency goals. Their irregular inputs may actually redefine their position instead of promoting their empowerment. At the same time, the concentration of hygiene education on women can prolong gender inequality for women as caretakers (Joshi and Fawcett, 2001). In brief, women's participation in water projects is a necessary but insufficient condition for their empowerment.

### Water Consumption and Sustainability

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Water is essential for achieving sustainable development, and it is this resource that will play a large role in determining whether or not the MDGs are achieved. The core concern is how to achieve equitable access and adequate water supplies, while at the same time protecting and preserving supplies and maintaining environmental security. Water is the key resource for food security, for good health, for providing clean hydroelectric energy, for protecting ecosystems and aquatic biodiversity, and for industrial development. Together these make for a complex set of relationships reflecting water demand and water supply relative to size of population and the multiplicity of end uses (Figure 2.2).

While the world population increased threefold during the twentieth century, water withdrawals increased sixfold. Current water withdrawal at the global level accounts for about 10 per cent of the world's total renewable water resources and of this withdrawal about half is consumed. In the next two decades, water consumption is projected to double but still remaining well below the critical ratio of water consumption to supply generally set at 40 per cent.

If water consumption per capita at the global scale reaches the current level in developed countries, over 90 per cent of the available water resources would be utilized by 2025. Such projections, assuming no

change in the efficiency of water use, could result in a doubling of agricultural productivity per unit of water utilised (FAO, 2000a).

**FIGURE 2.2:** Relationship Between Population and Water Use



**SOURCE:** Adapted from Population Reference Bureau et al., 1997

A significant problem arises in that, although there is enough water at the global level, availability does not coincide with the regional distribution of the world's population. In many tropical regions, annual rainfall occurs during a short rainy season, and most of it is lost in runoff

## Box 2.2

**Burden of Water Collection on Women and Children**

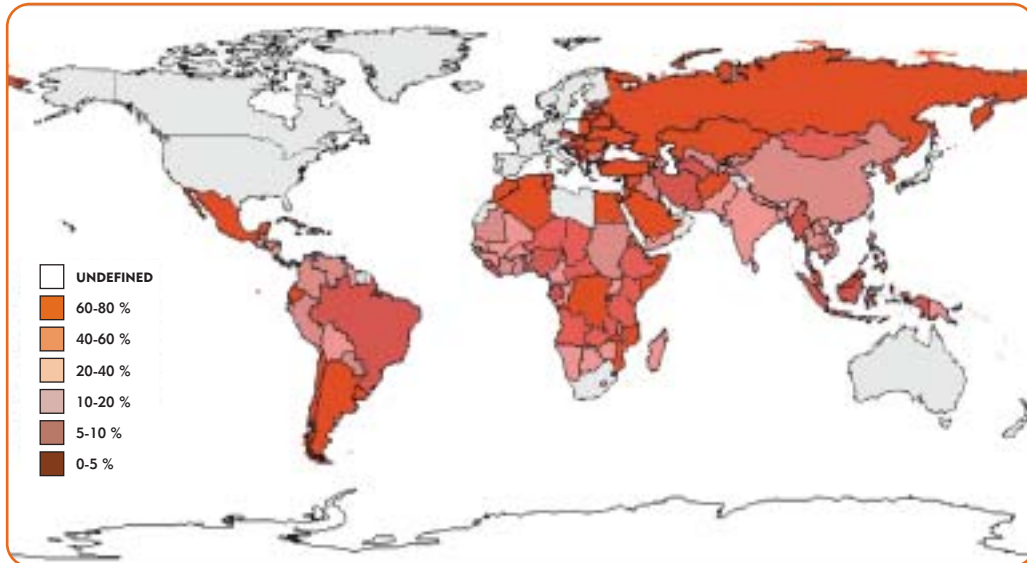
A recent water study in Kenya, Uganda and Tanzania went back to the same 34 sites that were studied in 1972. Water is still primarily collected by women and children and carried on the head, leading to headaches, general fatigue, and pains in the chest, neck and waist. The distance walked to collect water was about 580m in rural areas (although for some it can reach over 4 km) and 300 m in urban areas. This is a slight improvement since 1972 due to more standpipes, wells and private vendors, including in rural areas. Due to population increase, however, time spent queuing has increased significantly, especially in urban areas. A return journey to collect water takes on average 25 minutes (double the time since 1972), and 3.9 trips per day are made by each household. Thus, an average household spends 1 hour and 40 minutes each day collecting water. This reduces time for cooking and can affect the amount of time children spend at school.

**SOURCE:** DfID et al., 2002

and rivers flowing into the oceans, unless it can be stored. Distribution of large quantities of water over long distances for agriculture or industrial uses is not economically feasible. The construction of large dams has slowed in view of experiences of environmental disruption, displacement of populations, loss of agricultural lands, silting and impacts of downstream areas.

The world's land and water resources are critical for human survival. They provide food and other agricultural products and other essential services such as purification of air and water, maintenance of biological diversity, and decomposition and recycling of nutrients. While world food production is currently sufficient to meet global food needs, under-nourishment is still pervasive in many developing countries with an estimated 800 million persons being under-nourished (**Map 2.1**). Long-term forecasts indicate persistent and possibly worsening food security in many countries, especially in sub-Saharan Africa. This raises issues of viability and sustainability of agriculture and an assurance that access can be maintained or improved to preferred foods at affordable prices in order to achieve lives that are as healthy, productive and satisfying as possible (**Box 2.3**).

**MAP 2.1:** Percentage of the Population Undernourished, 1998



SOURCE: FAO, 2002a

### Box 2.3

#### Challenges of Achieving Water Security

Meeting basic needs of safe and sufficient water and sanitation, essential for human health, empowering people through participatory water management.

Securing food supply for food security through efficient and equitable allocation of water.

Protecting integrity of ecosystems.

Sharing water resources for different uses at all levels, including trans-boundary water resources.

Managing risks of security from floods, droughts, pollution and other water-related hazards.

Valuing water and related services, taking into account economic, social, environmental and cultural values, with equity and basic needs considerations of the poor and most vulnerable populations.

Involving all stakeholders in ensuring good governance and management of water resources.

## Managing Water Use

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### **Water and food security**

The goal of achieving food security, in an environment of growing population and limited land and water resources, cannot be achieved without ensuring the sustainability of agricultural development. Agriculture is the major user of water in most developing countries, while industry is the greatest user in developed countries. Water loss and contamination in agricultural irrigation leads to inefficiencies of water use, often reflecting poor management practices, ill-maintained reservoirs and waterways, and lack of viability in terms of costs and incentives. In practice, it is commonly the poorest farmers that have the least access and opportunity to use water to meet food production objectives.

Irrigation efficiency, measured as the ratio of water consumed to water applied, is estimated at about 40 per cent at the global level, with regional variations ranging from about 25 per cent in Latin America to some 50 per cent in South Asia, (FAO, 2000b). The green revolution had a major impact on the world's demand for water through the development of high yielding crop varieties, which contributed to a doubling of world food production. The current scientific advances in molecular biology and biotechnology offer potential for developing drought-resistant and water-saving crop varieties. For example, such varieties of maize and rice could make an important contribution to food security in Africa and Asia.

About 10 per cent of all irrigated cropland suffers from waterlogging and salinization due to drainage problems, thereby resulting in reduced crop yields. The inefficient use of fertilisers and pesticides is also a major cause of pollution of both surface and ground waters (FAO, 2000b).

### **Water and biodiversity**

The pollution and depletion of aquatic ecosystems has serious consequences for biodiversity and human health. During the last fifty years, half the world's wetlands have been lost and pollution impacts in coastal areas have resulted in declining fisheries and destruction of biodiversity habitats. Aquatic ecosystems, both freshwater and marine, are sensitive to pollution from industry, agriculture and human waste.

Freshwater ecosystems are rich in biodiversity, with some 300 new fresh water species being identified each year. Currently about 12 per cent of

all animal species, including over 40 per cent of all recognized fish species, live in fresh water environments. However, at least one-fifth of all freshwater fish species so far identified are endangered, vulnerable or now extinct (National Wildlife Federation, 2002).

Freshwater species are susceptible to all human induced changes to the hydrological cycle as well as to other threats, such as accidental or intentional introduction of non-native species. In a study of 50 countries, it was found that the loss of natural habitat was greatest in areas of high population density (reported in UNFPA, 2001a). In ten countries that had lost the most habitats (averaging 85 per cent), the average population density was about 200 people per square kilometre, in comparison to another ten countries that had lost the least habitat (averaging 40 per cent) with an average population density of some 30 people per square kilometre. A significant proportion of the total fresh water available is needed to maintain aquatic ecosystems and the millions of species that biodiversity represents.

#### ***Water scarcity and management***

Freshwater resources are very unevenly distributed. The arid and the semi-arid zones of the world, which constitute 40 per cent of the land-mass, receive only two per cent of global run-off. The proximate causes of groundwater depletion and pollution are rooted in population growth, economic expansion, the distorting impacts of subsidies and financial incentives, and the spread of energised pumping technologies.

Water scarcity occurs when demographically induced demand for water exceeds the prevailing level of local supply (Turton and Warner, 2002). When discussing water-scarcity, Sexton (1992) has differentiated between absolute and economic scarcity. Absolute scarcity is created when the unavailability of appropriate technology limits the supply of water. Economic scarcity refers to economic choices in the provision of water, in which a broad participation is required to engage all levels of society in the process of collection and distribution (Johnson-Welch, 2000). Participation is a means of generating appropriate and acceptable solutions to water management, promoting ownership of the solutions and encouraging long-term sustainability.

## Competing Demands

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Development makes a multiplicity of demands on natural resources and the demand for water comes from every segment of the economy and society. While access to and continuity of supply of quality drinking water constitutes the most universal and most pressing of uses, rural and urban contexts alike require flows that are predictable in quality, and reliable in quantity. Both the shortage and the uncontrolled excess of water can be life threatening, and the essential balance in-between must look to achieve appropriate priorities, equity and economy in the dispensing of this most vital resource.

The priorities to be determined must trade off the relative merits of drinking water, maintenance of waterways for irrigation, fishing and navigation; damming of waterways for irrigation and hydro-electricity; allocation of the resource between contiguous countries and conservation of aquifers and groundwater. Furthermore, there can often be repercussions over unilateral decisions to develop or utilise water resources, as in the case of cultural sensitivities over the loss of productive hill country farm and ancestral land to the water and power needs of urban and lowland users for 'the greater economic good'. All this, while considering the direct and indirect environmental impacts of these allocative decisions.

On a global scale, about 67 per cent of all water accessed for human use is absorbed by agriculture, mostly in the form of irrigation. Industry accounts for 19 per cent of the water utilised, and domestic use accounts for a mere 9 per cent (WRI, 2000) (Table 2.1). But, largely because of their patterns of economic activity and level of industrial development, there are major contrasts between developed and developing societies in their patterns of water consumption.

The global consumption averages cited vary immensely between world regions. For example, in Africa, agriculture consumes 63 per cent of all water withdrawn for human use, while the proportion used for domestic purposes is eight per cent and for industry just four per cent. By contrast, in Europe, the bulk of the water accessed for human use, 45 per cent, is supplied to industry. Agriculture's share is 39 per cent and domestic consumption is 14 per cent. The impact of these major sectors on the environment as a consequence of their use of water and their methods of retuning used or surplus water into the system are significantly different.

**TABLE 2.1: Freshwater Resources and Withdrawals, Globally and by Region, 1995**

Region	Average annual internal renewable water resources		Annual withdrawals			Sector		
	Total (km <sup>3</sup> )	Per capita (m <sup>3</sup> ) 2000	Total (km <sup>3</sup> )	Percentage of internal water resources	Per capita (m <sup>3</sup> )	Sectoral withdrawals (per cent)		
						Domestic	Industry	Agriculture
World	42,655	7,045	3,760	9	664	9	19	67
Europe	2,900	3,981	512	18	704	14	45	39
North America	6,680	21,583	566	8	1,907	10	39	46
Central America and Caribbean	1,090	6,290	114	10	716	x	x	x
South America	12,030	34,791	166	1	518	20	11	60
Oceania	2,400	78,886	34	1	1,178	x	x	x
Africa	4,047	5,159	214	5	307	8	4	63
Asia	13,508	3,668	2,156	16	627	7	9	81

SOURCE OF DATA: WRI, 2000

**Agriculture and food production**

Enormous quantities of surface and ground water resources are used for crop production. Poor drainage and irrigation practices have led to waterlogging and salinization of approximately ten per cent of the world's irrigated land and millions more hectares are under threat and already experiencing symptoms of those problems.

Agriculture is also responsible for most of the depletion of groundwater and up to 70 per cent of water pollution, and both are accelerating. Grain lands in particular are consuming groundwater at unsustainable rates. Collectively, annual ground water depletion in India, China, the United States, North Africa and the Arabian Peninsula, totals 160 billion cubic metres a year – an amount roughly double the total annual flow of the River Nile.



## Box 2.4

**Effects of Water Expropriation on Eco-Systems**

Access to water of acceptable quality is fundamental for all human, animal and plant life. Overexploitation of natural resources and high population growth pose serious challenges to finite freshwater resources and fragile ecosystems. Effective management of these resources on a sustainable basis is vital if we want ensure sustainable development. Globally there is enough water available. But meeting the demand requires that water be supplied when and where it is needed. The spatial, temporal and qualitative characteristics are the most important challenges to meeting the rising demand for water in all sectors (Meinzen-Dick and Rosegrant, 2001).

Currently people expropriate about 54 per cent of all available freshwater from rivers, lakes, streams and shallow aquifers (Hinrichsen, 2003). Population growth in the next 25 years is expected to increase this figure to around 70 per cent. A deepening fresh water crisis, affecting some 2.3 billion people, has pitted rural against urban needs, industry versus agriculture, water-rich versus water-poor countries and is taking an increasing toll on the aquatic ecosystems and the animal and plant life that they support. Increasing competition for fresh water resources is undermining development prospects in many parts of the world. Rapid industrialization and urbanisation, construction of thousands of dams, and pollution of many fresh water sources have profoundly affected freshwater ecosystems. Globally the world has already lost 50 per cent of its wetlands. The losses of these ecosystems has adverse environmental effects on the loss of capacity for storing water and nutrients and the ability to soak up and dilute pollutants from agricultural run-off, sewage from industry.

Competition between people and wildlife for water is intensifying in many regions of the world. For example, China's fresh water supplies are insufficient for its population. As a result it resorts to draining its rivers and mining ancient aquifers that take thousands of years to refill. In the water-rich Yangtze River Basin, water demands from farms, industry and growing populations have polluted and degraded freshwater ecosystems. The effects of China's intense water demands predominately for agricultural needs can be seen by the dry lake beds of the Gianghan Plain (Hinrichsen, 2003).

In Africa, Lake Chad has shrunk to one-tenth of its size in 1960 because of massive water withdrawals for irrigation purposes. Population growth rates in the surrounding countries average around 3 per cent a year, but in the regions around the borders of the lake this figure is much higher because of migration from other more dry and increasingly desertified regions (Hinrichsen, 2003). As a result of population pressures and overexploitation, the lake's fisheries have virtually collapsed.

About 40 per cent of the world's arable land is degraded to some degree. Many of the most degraded soils are found in the world's poorest countries, in densely populated, rain-fed farming areas, where overgrazing, deforestation, and inappropriate use also compound problems. When soils become infertile, traditional farmers either let the land lie fallow until it recovers or simply abandon unproductive lands and move on, clearing forests and other fragile land areas as available.

Two-thirds of the world's population lives in areas receiving a quarter of the world's annual rainfall, while such sparsely populated areas as the Amazon Basin receive a disproportionate share. About 70 per cent of the world's fresh water goes to agriculture, a figure that approaches 90 per cent in countries that rely on extensive irrigation. Already some 30 developing countries are facing water shortages, and by 2050 this number may increase to over 50 countries, the majority in the developing world. This water scarcity together with degradation of arable land could become the most serious obstacle to increasing food production to meet the goals of food security.

The problems of water, food and poverty are closely linked and need to be addressed simultaneously to be effective. Over 75 per cent of the poor live in rural areas and are dependent for their livelihoods, primarily on agriculture. Whereas less than three per cent of the population in developed countries gain their livelihoods directly from agriculture, in many developing countries as much as two-thirds of the population derives a livelihood directly or indirectly from agriculture, but their voices are seldom heard and communities in the agricultural and rural sectors of society are generally unable to mount effective political lobbies.

### **Industry**

Although the proportion of water drawn off for industrial purposes is estimated at about 20 per cent, the contrast between developed and developing countries collectively is extreme. In high-income countries, about 59 per cent of the water use is dedicated to industrial uses, whereas only eight per cent of total consumption is used by industry in low-income countries ( UNESCO, 2001). By 2025, the collective industrial component is expected to have increased to 24 per cent of total fresh-water withdrawal.

Disposal of industrial waste constitutes a major threat to the environment. Some 300-500 million tons of heavy metals, solvents, toxic sludge and other wastes accumulate each year from industry. Industries based on organic raw materials are the most significant contributors to the organic pollutant load with the food sector being the greatest polluter. More than 80 per cent of the world's hazardous waste is produced in developed countries, especially the United States. It is estimated that, in developing countries, 70 per cent of industrial waste is dumped untreated into water where they pollute the usable water supply.

## Water Regulation

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### ***Hydro-electric power / storage dams***

Energy production is a major element in development plans and an essential accompaniment of industrialisation and modernisation. Among the options for generating energy (many of which are potentially serious environmental polluters) hydro-electricity offers a relatively clean, efficient and sustainable method of power production. However, creation of the requisite head in storage dams, assuring a large continuous flow, can impact on local primary production, inundate large areas displacing the resident population, compete for priority with other users such as irrigation and transportation, and largely determine the scale and frequency of water release for other uses such as irrigation (often working to a different seasonal demand) below the dam.

Since hydro-electric power potential is largely confined to steeper, dissected landscapes, and is being promoted mainly in the interests of urban and industrial development in relatively distant locations, there is immense potential for highland-lowland conflict. Hill country peoples reluctantly witness their ancestral and productive valley and terrace landscapes submerged and lost to them for purposes in which they have little interest and from which they gain little direct benefit. Since priority of access and allocation of water rights are often arbitrary, informal or non-existent, there are major grounds for dissent and conflict.

### ***International competition***

While the resolution of the diverse issues of water supply and access are demanding enough for national and local governments, supply authorities and consumers, the problems can be seriously compounded by the competing requirements of contiguous nation states. While this is most obvious in circumstances where major rivers (such as the Mekong in

mainland Southeast Asia) and other waterways flow through several countries or constitute the official boundary between countries, it can also impact on other water sources, such as aquifers and groundwater generally.

Agreements between countries on maintenance of flows and draw-off rights for predetermined levels of water are essential, but difficult to arrive at. However unilateral action, especially by upstream users (such as China in the case of the Mekong River) can have extremely severe repercussions for countries dependent on a reliable supply downstream. In the case of groundwater, excessive use can induce serious problems of saltwater intrusion, and where this results from lack of adequate monitoring or flow regulation, outcomes can be extremely inequitable.

#### **Pollution**

Contamination of water especially in urban environments, is a chronic problem in most developing societies. Pollution of surface water by upstream industries, leaking septic tanks and the dumping of solid wastes by residential communities pose serious risks. Rivers and canals in large cities are often biologically dead and are a potentially dangerous source of bacteria and poisons. Environmental pollution is associated with the two main causes of infant mortality – diarrhoea and respiratory diseases – and the children of the poor, due to their residential location and lack of access to health care, are particularly vulnerable.

**Water Access and Hazards to Health**

Water is an essential resource for sustaining health, yet both the quantity and quality of available water supplies are declining in many parts of the world. About half the world's rivers are seriously depleted and polluted, and some 80 countries with 40 per cent of the earth's population are suffering from water shortages (UNEP, 2002). This trend has contributed to the entrenchment of poverty in whole countries, and marginalised large sectors of populations in others. These people in particular are vulnerable to water-related illnesses, including those resulting from poor sanitation and hygiene.

Women are constantly exposed to the risks of contraction of water-related diseases largely because of their role in collecting water, washing clothes, cleaning and cooking, and in rural areas, performing day-to-day agricultural tasks. Carrying heavy water jars over long distances puts women's health at risk, particularly during pregnancy. Bearing heavy loads can result in premature birth, a prolapsed uterus, or back injuries. Lack of sufficient quantities of clean, fresh water enabling the regular practice of proper hygiene plays a role in common lower reproductive tract infections in women.

Appropriate hygiene and sanitation practices are both dependent for their effectiveness on access to clean water. Most water-related infections are acquired through the faecal-oral route; hence, adequate latrines, cleanliness to keep human and animal faecal material out of living quarters, and washing hands after defecation, are necessary

Box 3.1

**Impact of Hygiene Education in Indonesia**

In Indonesia, researchers demonstrated an 89 per cent reduction in child diarrhoeal episodes as a result of providing mothers with hand soap, explaining to them the faecal-oral route of diarrhoea transmission and suggesting specific hand washing times and techniques to prevent child diarrhoea, compared to a control period before the intervention. The intervention included ten follow-up visits with health educators over a 20-week period, once the soap and educational messages had been provided.

SOURCE: USAID, 1999

measures to avoid infection. It is difficult to practice even elementary hygiene without sufficient quantities of water free of these contaminants. In addition, it is necessary to protect the water sources themselves from faecal contamination and agricultural and industrial pollutants. In developing countries, 90 to 95 per cent of all sewage and 70 per cent of all industrial wastes are dumped untreated into surface water (UNFPA, 2001a).

Urban populations tend to be better served than rural, but where there is piped water from municipal supplies, this may still be contaminated by disease-bearing organisms. Even when clean water is plentiful, it may not be accessible to all: the poor have to ration their water carefully because of the effort required to collect it, or the high price they have to pay for purchasing it. Time and again, poor people everywhere cite the lack of safe, affordable water for drinking and hygiene as one of their most pressing concerns (WHO, 2001).

Making adequate water supplies available and accessible to the poor, providing hygiene education in schools, and protecting water sources from contamination, play critical roles in breaking the faecal-oral transmission cycle. Studies show that improving water and sanitation can reduce the number of diarrhoeal episodes by between 20 per cent and 26 per cent, and better hygiene practices, such as washing hands regularly, can reduce the number of diarrhoea cases by up to 35 per cent (Begin, 2002).

**Box 3.2****Poor People Pay Much More than the Rich for Water**

In Bamako, the capital of Mali, poor people pay as much as 45 times more per unit of water than do the rich, who get water piped into their homes, often at subsidised prices. In 1988, 25 per cent of the population living in cities in developing countries bought water from vendors, typically spending 10-20 per cent of household income on their water needs.

**SOURCE:** WHO, 2001

**Water-Related Diseases and their Effect on Reproductive Health**

The ingestion of water contaminated by faecal material infects people with viruses such as hepatitis, bacteria such as cholera, typhoid and dysentery, and parasites such as amoeba. In communities where such contamination is low, and where generations have used the same water source and have become immune to a low level of pathogens, the water may not carry life-threatening risks. However, children, pregnant women and those whose immunity is compromised by HIV/AIDS and other diseases, are at significant risk.

Water-related diseases, such as diarrhoea and cholera, kill an estimated three million people a year in developing countries, the majority of whom are children under the age of five. Other diseases, such as malaria, which are carried by insects and other water-based vectors, account for up to 2.5 million deaths a year (DfID et al., 2002). In India alone, nearly one million people die annually from water-borne diseases (World Bank, 2001).

Over two million people, most of them children under five years of age, die each year of diarrhoeal disease linked to inadequate water supply and poor hygiene. Another million die of malaria. In China alone, 1.5 million people are infected with hepatitis A (WHO, 2001). Intestinal worms, which can lead to malnutrition, anaemia and retarded growth, infect about 10 per cent of the population of the developing world. An estimated 200 million people are infected with schistosomiasis, of which 20 million suffer severe physical debilitation. The disease, which is found in 74 countries of the world, is caused by one of the five species of the parasite Schistosomiasis that attacks the liver, bladder, lungs or central nervous system (WHO et al., 2000).

**TABLE 3.1: DALYs\*\* Associated with Selected Diseases from Environmental Exposures, World, 1990**

	Acute respiratory infections	Diarrhoeal diseases	Vaccine-preventable infections	Tuberculosis	Malaria
DALYs lost (thousands)	70,017	89,670	7,117	3,843	28,535
Per cent of global DALYs lost	5	6.5	0.5	0.3	2.1

\*\* DALYs: Disability adjusted life years are losses from premature death and loss of healthy life resulting from disability or illness.

SOURCE : WHO, 1997

All of these diseases affect pregnancy outcomes: the health of the mother as well as the developing foetus and the newborn. Infectious hepatitis is usually fatal in pregnancy. Malaria may cause abortion and retard foetal growth. Hookworm and schistosomiasis cause anaemia, chronic fatigue and haemorrhage in childbirth. Hookworm alone affects some 20 per cent of the world's population, and because it causes chronic faecal blood loss, it has the most detrimental effect on maternal anaemia (Begin, 2000).

### Malaria During Pregnancy

Pregnant women are the main adult risk group for malaria (WHO, 2002a), which is particularly dangerous during pregnancy. It causes severe anemia, and is a major factor contributing to maternal deaths in endemic areas (Versteegh, 2000). Sub-Saharan Africa bears 90 per cent of the global malaria burden. Every year at least 24 million pregnancies occur among women in malarial areas of Africa, but less than five per cent of them have access to effective interventions (WHO, 2002a).

Malaria during pregnancy increases the chance of abortion, premature birth, stillbirth, intrauterine growth retardation, and low infant birth weight, which is the greatest single risk factor for death in the first month of life (WHO, 2002a). Insecticide-treated bed nets (ITNs) decrease both the number of malaria cases and malaria death rates in pregnant women and their children. A study in an area of high malaria transmission in Kenya has shown that women protected by ITNs give birth to 25 per cent fewer underweight or premature babies (WHO, 2002a).



**Box 3.4****Intermittent Preventative Treatment Effective in Reducing Number of Low Birth Weight Babies**

Intermittent preventative treatment (IPT) involves providing all pregnant women with at least two preventative treatments of an effective anti-malarial drug. One study in Malawi evaluating IPT showed a decline in placental infection (32 per cent to 23 per cent) and in the number of low birth weight babies (23 per cent to 10 per cent). It also found that 75 per cent of all pregnant women took advantage of IPT when offered.

**SOURCE:** WHO, 2002a

**Anaemia During Pregnancy**

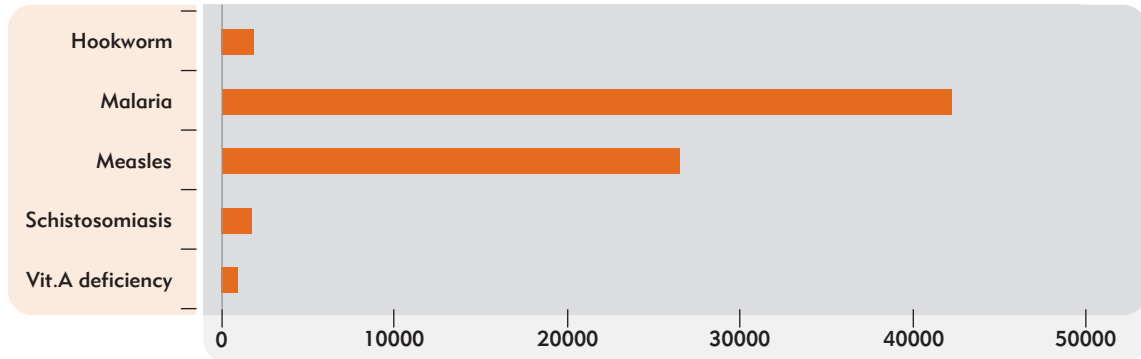
In addition to protein energy malnutrition, anaemia is caused by persistent bouts of diarrhoea and intestinal worms and can have a severe impact on the growth and development of the foetus. Estimates suggest that eliminating malnutrition among pregnant women would reduce disabilities among infants by almost one-third (UNEP et al., 2002). Hookworm infections, related to environmental factors such as wastewater disposal, affect nearly 44 million pregnant women in developing countries each year.

Estimates attribute 20 per cent of maternal deaths in Africa and 23 per cent of those in Asia to anaemia during pregnancy. Anaemia is third among the causes of DALYs lost among women of reproductive age (Murray and Lopez, 1996). It is also associated with poor birth outcomes, such as premature birth and low birth weight. Because of the association of anaemia with water-borne parasitic infections, studies found that in areas where anaemia rates are high, the condition cannot simply be corrected with daily iron supplements (Begin, 2000).

**Chemical Contaminants and Reproductive Health**

Scientists now regard certain chemicals such as PCBs, DDT, dioxins and at least 80 pesticides as 'endocrine disrupters' which may interfere with normal hormone function, undermining disease resistance and reproduction. There is also growing concern about their role in certain reproductive cancers in women. Furthermore, some of them may cause declining sperm counts in men, infertility among women, miscarriages, and early puberty in girls (UNFPA, 2001a).

**FIGURE 3.1:** DALYs Lost Annually (in thousands) to Hookworm Infection in Comparison to Other Causes, World, 2001



SOURCE: WHO, 2002c

Many countries are now experiencing problems with elevated levels of nitrate in groundwater as a result of large-scale use of organic and inorganic fertilisers. Excess nitrate in drinking water has been linked to methaemoglobin anaemia in infants, the so-called 'blue-baby' syndrome. Nitrate leads to the oxidation of normal haemoglobin to methaemoglobin, which is unable to carry oxygen to the tissues. This may result in cyanosis (a dark blue colouration) and in some cases, asphyxiation and death (WHO, 2002b).

Arsenic in drinking water is a major public health threat. Of 25,000 wells tested in Bangladesh, 20 per cent were found to have high levels of arsenic (above 0.05 mg/l) (WHO et al., 2000). Arsenic in groundwater is also a major problem in parts of India, as well as a large number of other countries. Arsenic may occur naturally in groundwater, but it may also be discharged from a variety of industrial processes. A number of studies have attempted to establish a possible connection with reproductive disorders and the results suggest arsenic does increase foetal and neonatal mortalities and low birth weights, spontaneous abortions, stillbirths and pre-eclampsia (WHO, 2002b).

Pregnancy and perinatal health (in the first days after a child is born) are seriously undermined by chemical contaminants ingested by the mother. They contribute to the 2.4-3.2 million perinatal deaths each year, of

**Box 3.4****High Nitrate Levels Results in Higher Likelihood of Chronic Effects and Gastric Cancer**

In some countries, notably in Central and Eastern Europe, such as Moldova and Romania, levels of nitrate found in shallow groundwater are up to 1000 mg/l (the Guideline Value (GV) being 50mg/l), while in India anecdotal evidence suggests levels of up to 1500mg/l can occur. At these levels, more widespread chronic effects are to be noted, including a possibly greater likelihood of gastric cancer.

**SOURCE:** WHO, 2002b

which one million are due to low birth weight. Chemical contaminants are also a significant factor in congenital anomalies, which account for 589,000 deaths annually. Genetic damage has possibly the most adverse basic effect on reproduction since it may interfere with cell division and early development of the embryo and foetus (WHO, 1997).



## CHAPTER 4 CONCLUSION

The WSSD reinforced and gave momentum to the MDGs, and in particular to the targets of halving the proportion of people without access to water and sanitation by 2015 as important elements contributing to the eradication of poverty. Although about 80 per cent of the people in developing countries have access to improved water sources, around one billion people are still denied such access and 2.4 billion people lack access to basic sanitation.

Growing population pressure, abusive land practices such as over-cropping and deforestation, and the increasing demands of water-intensive agriculture and industries are hastening water depletion and contamination at more rapid rates than can be replenished or recovered. As population growth and economic development increase demands on limited water resources, water management and the provision of safe drinking water and sanitation facilities will increasingly become priorities in the sustainable development agenda.

Many countries could help avoid water crises if they combined steps to conserve and manage supply and demand better, with programmes to slow population growth by, *inter alia*, providing families and individuals with information and services to make informed choices about reproductive health. When reproductive health information and services are widely available and accessible, couples are better able to implement their fertility desires.

## Box 4.1

**Water and Sanitation in Poverty Reduction Strategy Papers (PRSPs)**

Access to water and sanitation are among the top priorities of the poor and directly contribute to poverty reduction and sustainable development. Poverty Reduction Strategy Papers (PRSPs), completed in 21 countries at the end of 2002, provide a country-owned framework to strengthen the impact of public action on poverty reduction. They are based on a participatory analysis of the multiple causes of poverty and target integrated strategies on addressing these causes. The PRSP process provides an opportunity for those working on population and water linkages to make a case for the importance of adequate water supply and sanitation as a vital component in poverty reduction and sustainable development.

Yemen, situated in a dry and semi-arid area, is currently facing severe water stress that is likely to get worse as the population is expected to double by 2026. The PRSP in this country clearly links population pressures on natural resources, particularly water, as being incompatible with poverty reduction and sustainable development. It further recognizes that inadequate sanitation contributes to ill health and poverty. The PRSP sets out to raise water coverage to 69 per cent in urban areas and to 65 per cent in rural areas as well as increasing sanitation coverage to 7.4 per cent of the population by 2005.

In Bolivia the PRSP notes that the rural poor are at high risk of disease and ill health due to a scarcity of water and poor sanitation. Some 78 per cent of those in rural areas lack drinkable water and 72 per cent lack sanitation. The water shortage in these areas further poses restrictions on production gains in agriculture. The PRSP gives high priority to improving water and sanitation infrastructure and increasing access for rural households.

Zambia's PRSP aims to ensure that the country's water resources are effectively developed and managed to contribute to poverty reduction through increased access to safe water and sanitation for low income rural and urban Zambians.

The PRSP in Rwanda links water to poverty and quality of life and identifies adequate supply and sanitation to positive impacts on maternal and child health, improvements in educational enrolment for girls, reduced cost of health services, and reduced daily drudgery for women fetching water. It sets as a main objective for sanitation to improve from a current coverage of about 10 per cent to 50 per cent of the population through sensitization of the rural population, promotion of improved latrines and hygiene education.

While most PRSPs recognize that water and sanitation impact on poverty in many ways and are key determinants of levels of poverty and the sustainability of livelihoods, few have prioritized water and sanitation interventions. A key factor is the weak poverty diagnostic within the sector, reflecting the weak base of sector information that tends to focus largely on physical facilities. A further reason is the lack of clear links between central ministries and local authorities in planning and priority setting, the sector's institutional complexity and the fragmented nature of its financing agreements.

In working towards improvements in the quality of life and the achievements of the MDGs, water is a key issue around which much revolves. Availability of adequate supplies of water and ready access to them are essential prerequisites for food sufficiency and hunger eradication and the agricultural systems from which they derive. Increasing access to water is an essential element in the global fight against poverty (Box 4.1).

As high-quality water supplies have diminished, competition for them has been increased. This competition is most acute between rapidly expanding urban areas and cultivated rural areas that often regard reticulation of water to the cities as the diversion of a natural resource to which they, as farmers and fishers, have a prior right. A case might well be made for differentiating between varying qualities of water and, where feasible, directing these to the appropriate users. While potable water must take priority for meeting basic human needs, there is no need for the huge quantities required for subsistence or commercial production to be of this quality, and further differentiation might be made between agricultural demand (for non-toxic supplies) and industrial demand that is tolerant of a lower-quality supply.

Intensified efforts are required to promote and operationalize institutional and management approaches and techniques that are supportive of sustainability objectives for water supply and sanitation services. Even where they have been promoted in the past, in recent years the sustainability aspects of water supply and sanitation systems have been seriously neglected in many developing countries. Maintenance of water supply and sanitation facilities are commonly accorded minimal attention, whereas construction of new facilities is more likely to gain political support and attract funding. The outcome of such neglect is extensive wastage, systemic inefficiency and a range of unintended and undesirable side effects.

Consistent with this approach, the focus of water management strategies in most countries with any significant form of regulation or control has generally been on increasing the supply of water without comparable attention to the management of demand. An integrated approach to freshwater management is required in order to reconcile expanding demands with finite supplies. Such a strategy requires the development of a comprehensive framework for undertaking a systematic appraisal of the water resources available and an objective and realistic assess-

ment of present and future demand. This information provides the basis for making difficult choices between competing uses, and permits the planning and implementation of effective operational measures.

In the longer term, the impending water crisis in many regions can only be addressed through hard policy decisions that allocate available water supplies on the basis of agreed social and economic priorities. Greater emphasis on water-efficient technologies and pollution control needs to be an integral part of collection and distribution strategies and could also address more forward-looking alternatives such as desalination. Account must also be taken of the escalation in costs of accessing new supplies, since most of the readily accessible low-cost reserves have largely been exploited already.

In spite of widespread evidence of the negative effects of unsustainable water extraction and related environmentally destructive practices, some national and transnational companies operating for profit persist with practices deleterious to the public interest. Where these types of action are being perpetrated, sometimes even with the connivance of local officials, closer monitoring and regulation must be implemented, with effective support from the appropriate authorities.

In many developing countries, attempting to regulate water use through pricing could have a serious adverse impact on the poorest and most vulnerable communities. Access to a sufficient supply of water for household needs, particularly drinking water, must remain an inalienable human right and no obstacles, however justifiable in conservation terms, should prevent universal access to this most essential of natural resources.

Although the core issues of domestic water and sanitation tend to be the everyday responsibilities of women throughout much of the developing world, it is men that commonly make the major decisions in the community. The same gender demarcation frequently applies, though to a lesser extent, to water for agriculture. Well-planned water and sanitation programmes offer a real opportunity for women to exercise leadership and authority within a community, and to extend their influence beyond the community level to address the strategic needs of women in this essential area.



The benefits of providing greater access to good quality water go far beyond the reduction of water-related morbidity and mortality. The most immediate impact of measures to protect water sources and increase access to clean water will be to ensure environmental sustainability. By so doing, reductions in child mortality and improvements in maternal health are to be anticipated, as well as reductions in the incidence of malaria and other diseases. The availability of safe drinking water will also help in achieving the goal of gender equality and empowerment of women, as time spent on water collection can be devoted to more productive pursuits. In many localities this task is undertaken by school-age girls, so this measure should have a positive impact on girls' education. Finally, all of these measures will have a positive impact on realising the goal of eradicating extreme poverty and hunger.

A key challenge, therefore, is to encourage a participatory management approach that is capable of prioritising among competing demands, utilising appropriate technologies, regulating and expending the available supply to meet justified demand, within the context of sustainability of the delivery system and a benign relationship with the environment. Significant progress towards the MDG/WSSD targets on water and sanitation will make a major contribution to the achievement of the other MDG targets as well as to sustainable development.



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