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coping with water scarcity

challenge of the twenty-first century

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Introduction

22 March is World Water Day, a day for reflection and for action to address the pressing issues related to the world's water resources. Coordinated by the Food and Agriculture Organization on behalf of the 24 Agencies and Programme Members of UN-Water, World Water Day 2007 will be marked in many countries in diverse ways. The theme of World Water Day 2007 is "Coping with Water Scarcity".

Water scarcity affects all social and economic sectors and threatens the sustainability of the natural resources base. Addressing water scarcity requires an intersectoral and multidisciplinary approach to managing water resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. Integration across sectors is needed. This integration needs to take into account development, supply, use and demand, and to place the emphasis on people, their livelihood and the ecosystems that sustain them. On the demand side, enhancing water productivity (the volume of production per unit of water) in all sectors is paramount to successful programmes of water scarcity alleviation. Furthermore, protecting and restoring the ecosystems that naturally capture, filter, store and release water, such as rivers, wetlands, forests and soils, is crucial to increasing the availability of water of good quality.

Experts are divided on whether the world is facing a water crisis today. Those who believe so can point with justification to the accumulation of reports throughout the world. For example, in just one week in mid-November 2006, national media sources reported local but high-profile shortages in parts of Australia, Botswana, Canada, China, Fiji, Kuwait, Liberia, Malawi, Pakistan, Philippines, South Africa, Uganda, United Arab Emirates and United States of America. Then there are the silent crises, the millions of people deprived of the water they need to live and to sustain their livelihood. It is indeed a powerful argument that a global crisis need not stem from a single cause with widespread impact alone, but rather that a crisis can be made up of many similar incidents across the globe, even if the incidents are isolated from one another.

Conscious of the increasing pressure on limited water resources, UN-Water has identified water scarcity as the theme for World Water Day 2007. This day will provide an opportunity to reflect on the challenges posed by the unsustainable increase in water use and its degradation across the globe. It will also serve as a spur to action to reverse current trends and work towards a more efficient and more equitable distribution of water for all.

The multiple dimensions of water scarcity

Water is essential for all socio-economic development and for maintaining healthy ecosystems. As population increases and development calls for increased allocations of groundwater and surface water for the domestic, agriculture and industrial sectors, the pressure on water resources intensifies, leading to tensions, conflicts among users, and excessive pressure on the environment. The increasing stress on freshwater resources brought about by ever-rising demand and profligate use, as well as by growing pollution worldwide, is of serious concern.

There are several ways of defining water scarcity. In general, water scarcity is defined as the point at which the aggregate impact of all users impinges on the supply or quality of water under prevailing institutional arrangements to the extent that the demand by all sectors, including the environment, cannot be satisfied fully. Water scarcity is a relative concept and can occur at any level of supply or demand. Scarcity may be a social construct (a product of affluence, expectations and customary behaviour) or the consequence of altered supply patterns – stemming from climate change for example. Scarcity has various causes, most capable of being remedied or alleviated. A society facing water scarcity usually has options. However, scarcity often has its roots in water shortage, and it is in the arid and semi-arid regions affected by droughts and wide climate variability, combined with high population growth and economic development, that the problems of water scarcity are most acute.

Imbalances between availability and demand, the degradation of groundwater and surface water quality, intersectoral competition, and interregional and international conflicts, all bring water issues to the fore.

Symptoms of water scarcity include severe environmental degradation (including river desiccation and pollution), declining groundwater levels, and increasing problems of water allocation where some groups win at the expense of others.

A major study, the Comprehensive Assessment of Water Management in Agriculture, reveals that one in three people today face water shortages (CA, 2007). Around 1.2 billion people, or almost one-fifth of the world's population, live in areas of physical scarcity, and 500 million people are approaching this situation. Another 1.6 billion people, or almost one quarter of the world's population, face economic water shortage (where countries lack the necessary infrastructure to take water from rivers and aquifers).

UN-Water

UN-Water is the mechanism coordinating the actions of the United Nations (UN) system aimed at implementing the agenda set by the Millennium Declaration and the World Summit on Sustainable Development (WSSD) in all aspects related to freshwater. UN-Water has grown out of many years of extensive collaboration and partnership among the UN Agencies. These efforts have helped to achieve significant progress and to bring water and water-related issues to the top of the political agenda. The large number of UN Agencies dealing with water reflects the multiple roles water plays in our societies and the complex interactions it implies. Advancing the implementation of sustainable water management for the benefit of all is a collective responsibility and challenge. It calls for coordinated action within the UN system and with other partners and stakeholders – including organizations from the public and private sectors, civil society and labour – as part of a global, comprehensive effort.

The main purpose of UN-Water is to complement and add value to existing programmes and projects by facilitating synergies and joint efforts in order to maximize the coherence and effectiveness of the support provided to countries pursuing the goals agreed upon by the international community. This is in line with the integrated water resources management (IWRM) approach, which calls for collaboration among all stakeholders in water management.

In most countries, the agriculture sector is the predominant consumer of water. Historically, large-scale water development projects have played a major role in poverty alleviation by providing food security, protection from flooding and drought, and expanded opportunities for employment. In many cases, irrigated agriculture has played a major role in the development of rural economies, supporting economic growth and poverty reduction. However, at the same time, poor communities have tended to suffer the greatest health burden from inadequate water supplies and, as a result of poor health, have been unable to escape from the cycle of poverty and disease. Thus, growing scarcity and competition for water stand as major threats to future advances in poverty alleviation, especially in rural areas. In semi-arid regions, increasing numbers of the rural poor are coming to see entitlement and access to water for food production, livestock and domestic purposes as more critical than access to primary health care and education.

Most countries in the Near East and North Africa suffer from acute water scarcity, as do countries such as Mexico, Pakistan, South Africa, and large parts of China and India. Irrigated agriculture represents the bulk of the demand for water in these countries. It is also usually the first sector affected by water shortage and increased scarcity, resulting in a reduced capacity to maintain per-capita food production while meeting water needs for domestic, industrial and environmental purposes. In order to sustain their needs, these countries need to focus on the efficient use of all water sources (groundwater, surface water and rainfall) and on water allocation strategies that maximize the economic and social returns to limited water resources, and at the same time enhance the water productivity of all sectors. In this endeavour, there needs to be a special focus on issues relating to equity in access to water and on the social impacts of water allocation policies.

Several factors drive the progression towards water scarcity and overallocation of water, in many cases caused by a supply-driven approach to development that does not take sufficient account of the limits of the water systems. As water becomes scarce, logics based on increased supply or a lack of understanding of the interrelations between the different sectors depending on water resources lead to increased shortages and conflicts between users. In most cases, the overriding political nature of water decisions takes precedence over the hydrological feasibility of projects, while their social consequences, in terms of deprivation of specific user groups are not well evaluated. In many places, the institutional and legal tools needed to adapt and manage water scarcity are not available, leaving the way open to abuse and inequitable access to the resource.

The appropriate scale for understanding water scarcity is at the local or regional level, notably within a river basin or sub-basin, rather than at the national or global level. In many countries, especially the larger ones, there are both water-scarce and water-abundant areas, such as in Brazil, China and Mexico. Such areas are often far away from each other with few opportunities for interbasin water transfers. Several other countries are naturally very arid within their own territory (e.g. Egypt, Niger, Mauritania, Turkmenistan) but their annual renewable freshwater resources are boosted by large perennial rivers

flowing from much wetter areas upstream (the Nile, the Niger, the Senegal and the Amu Darya rivers, respectively).

In a context of rapid change, a number of questions arise:

- How are the many competing interests involved in water being balanced?
- On what basis are decisions to be made in favour of certain developments at the expense of others?
- What are the scope and conditions for increasing water productivity in different sectors?
- Which tools should be used to enable more efficient and equitable development and allocation of water?
- How can the best use be made of the water available?
- Which measures should be put in place to protect water resources and increase water supply?
- Which institutional and legal set-ups are most appropriate for ensuring adequate coordination?
- What kind of information is needed, and how is wide public ownership of water-related problems to be ensured?

In conditions of water scarcity, the putting in place of effective and equitable management practices requires knowledge, expertise and investment at political, institutional and technical levels.

The vicious cycle of water & poverty – an issue of life & livelihood

First and foremost, water scarcity is an issue of poverty. Unclean water and lack of sanitation are the destiny of poor people across the world. Lack of hygiene affects poor children and families first, while the rest of the world's population benefits from direct access to the water they need for domestic use. One in five people in the developing world lacks access to sufficient clean water (a suggested minimum of 20 litres/day), while average water use in Europe and the United States of America ranges between 200 and 600 litres/day. In addition, the poor pay more. A recent report by the United Nations Development Programme shows that people in the slums of developing countries typically pay 5–10 times more per unit of water than do people with access to piped water (UNDP, 2006).

For poor people, water scarcity is not only about droughts or rivers running dry. Above all, it is about guaranteeing the fair and safe access they need to sustain their lives and secure their livelihoods. For the poor, scarcity is about how institutions function and how transparency and equity are guaranteed in decisions affecting their lives. It is about choices on infrastructure development and the way they are managed. In many places throughout the world, organizations struggle to distribute resources equitably.

Water for life, water for livelihood. While access to safe water and sanitation have been recognized as priority targets through the Millennium Development Goals (MDGs) and the Johannesburg plan of action of the World Summit on Sustainable Development (WSSD), there is increasing recognition that this is not enough. Millions of people rely in one way or another on water for their daily income or food production. Farmers, small rural enterprises, herders and fishing people – all need water to secure their livelihood. However, as the resources become scarce, an increasing number of them see their sources of income disappear. Silently, progressively, the number of water losers increases – at the tail end of the irrigation canal, downstream of a new dam, or as a result of excessive groundwater drawdown.

It is probably in rural areas that water scarcity affects people most. In large parts of the developing world, irrigation remains the backbone of rural economies. However, smallholder farmers make up the majority of the world's rural poor, and they often occupy marginal land and depend mainly on rainfall for production. They are highly sensitive to many changes – droughts, floods, but also shifts in market prices. However, rainwater is rarely integrated into water management strategies, which usually focus exclusively on surface water and groundwater. Countries need to integrate rainwater fully into their strategies to cope with water scarcity.

Growing demand for a finite resource

If all the freshwater on the planet were divided equally among the global population, there would be 5 000–6 000 m3 of water available for everyone, every year. As experts consider that people experience scarcity below a threshold of 1 700 m3/person, this global calculation gives an impression of abundance. However, the world's freshwater resources are distributed very unevenly, as is the world's population. The areas of most severe physical water scarcity are those where high population densities converge with low availability of freshwater. Many countries are already well below the threshold value. Jordan, like several other countries in the Near East, is an extreme case with less than 200 m3/person per year.

Central to the debate on water scarcity are the ways in which we need and use water. Water for drinking and for general household use, comparatively small in terms of volume, needs to be available in the home or, at the very least, close by. The inexorable growth of cities, concentrating large numbers of people in small areas, exacerbates this challenge locally. The water that supports ecosystems, fish, animals and invertebrates must, of course, be left to follow its natural pathways through the world's landscapes. The water that produces much of the world's energy, by hydropower generation or in cooling carbon-fired power stations, has to be available at the point of energy generation, with such decisions often dictated by factors other than water. The same is true of much of the water used in industry. However, most significant is the water that produces our food. The basic metabolism of each of our bodies – heart-beats, respiration and maintaining body temperature – requires about 1 800–2 300 kcal every day. Every calorie of the food that releases the metabolic energy within us consumes about 1 litre of water in its production.

Crop production, the process of converting carbon and water into the biomass needed to sustain our daily energy requirements, is by far the largest water-consuming sector. To produce enough food to satisfy a person's daily diet requires about 2 000–3 000 litres of water. In contrast, about 2–3 litres are required for drinking purposes, and 20–300 litres for domestic needs. As the world population continues to increase, more people will require more water for the cultivation of food, fibre and industrial crops and for livestock and fish. It is estimated that food and feed crop demand will nearly double in the coming 50 years. The two main factors driving how much more food we will need are population growth and dietary change. With rising incomes and continuing urbanization, food habits change towards richer and more varied diets – not only towards increasing consumption of staple cereals, but also leading to a shift in consumption patterns among cereal crops and away from cereals towards livestock and fish products and high-value crops that consume more water.

Agriculture accounts for more than 70 percent of the world's total water use. Its share drops to about 40 percent in countries that import food and have a developed and diverse economy, but rises to over 95 percent in many of the countries where agriculture is the primary economic activity.

Securing our food supply is not negotiable. We all need safe and good-quality food in order to live a healthy life. However, the way food is produced and the type of diet people adopt can have significant impacts on the total volume of water used in agriculture. Moreover, agricultural practices across the world have a substantial impact on the world's freshwater resources – the adoption of a clean and productive agriculture can have a positive impact on the quantity and quality of the water it uses.

Scarcity is also a question of water quality. Freshwater bodies have a limited capacity to process the pollutant charges of the effluents from expanding urban, industrial and agricultural uses. Water quality degradation can be a major cause of water scarcity.

Clearly, having 2 000 litres of water available to each of us in or near our homes every day is of little relevance to meeting our own metabolic needs. Many people are entirely isolated from food production, relying solely on purchasing food from shops or markets. Where that food is produced is fundamental to the debate on water scarcity. Countries that are wealthy enough to import food and industrial goods can typically cope well with a low national endowment of water resources. They can mobilize their limited water resources towards domestic and environmental needs – water elsewhere is used to produce the food they need.

In the last century, the world population has tripled. It is expected to rise from the present 6.5 billion to 8.9 billion by 2050, before levelling off. Water use has been growing at more than twice the rate of population increase in the last century, and, although there is no global water scarcity as such, an increasing number of regions are chronically short of water. By 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under conditions of water stress. The situation will be exacerbated as rapidly growing urban areas place heavy pressure on local water resources.

There will be four main drivers of increasing water scarcity during the coming decades. First, as already mentioned, there is the inexorable growth in population. Second, the world is expected to become increasingly urbanized, focusing the demand for water among an ever more concentrated population. Asian cities alone are expected to grow by 1 billion people in the next 20 years. Third, per-capita consumption, the amount of domestic water that each person uses, is expected to rise as the world becomes more developed. Fourth, while these factors will increase the demand for water, freshwater resources will change as a result of climate change. While the magnitude of this change is still subject to uncertainty and will vary from one region to another, it is recognized that semi-arid

regions will probably see an increase in the variability of precipitations, leading to more frequent periods of drought.

As farmers in particular face the challenge of accessing an increasingly scarce resource, groundwater levels are falling further each year, causing more rivers to dry up. Water is a major determinant of the health and productivity of ecosystems, placed in jeopardy in many parts of the world by reductions in water flows and water quality standards. Increasing water extraction has threatened the integrity of natural ecosystems, leading to the loss of significant biological diversity and undermining the ecosystem productivity on which so many poor people depend. Half of the world's wetlands disappeared during the twentieth century, many rivers no longer reach the sea, and fish species are endangered.

The strategic role of groundwater: In arid and semi-arid regions, where water scarcity is almost endemic, groundwater has played a major role in meeting domestic and irrigation demands. In many regions, massive use of groundwater has been practised for some time for irrigation. Groundwater mining and the lack of adequate planning, legal frameworks and governance have opened a new debate on the sustainability of the intensive use of groundwater resources.

Sharing water – a cause of conflict or an opportunity to cooperate?

Water scarcity induces competition for water between users, between sectors of the economy, and between countries and regions sharing a common resource, as is the case for international rivers. Many different interests are at stake, and equitable solutions must be found between: cities and rural areas; rich and poor; arid lands and wetlands; public and private; infrastructure and natural environments; mainstream and marginal groups; and local stakeholders and centralized authorities. Water conflicts can arise in water stressed areas among local communities and between countries because sharing a very limited and essential resource is extremely difficult. The lack of adequate legal instruments exacerbates already difficult conditions. In the absence of clear and well-established rules, chaos tends to dominate, and power plays an excessive role, leading to inequitable allocation of water. A greater focus is needed on the peaceful sharing and management of water at both international and local levels.

The fact that so many of the world's rivers and aquifers are shared by more than one country places a major emphasis on water allocation agreements. A mature debate is now emerging about sharing the benefits of water rather than focusing on agreeing national quotas of bulk water. Analysts have shown that, under the prevailing internationalist setting of the past decades, water has been a source of cooperation between nations rather than a source of conflict. There is an expectation that such cooperation will continue, and indeed that there will be greater recognition of its importance to maximizing the benefits from water within development.

Water in rural areas – issues of vulnerability and sustainability

As most of the world's poor live in rural areas, one of the most effective ways of reducing hunger and poverty is to raise their productive capacity through agricultural development. The ways forward are complex and vary from region to region, but the opportunities for increased productivity and diversification do exist and they are considerable.

Many households (about 80–90 percent of all families in rural Africa) rely upon producing and eating their own food. Already compounded by long-standing problems of land degradation and desertification, and suffering difficulties in securing inputs of fertilizer and seed, they more than others face the very real world of water scarcity. Unpredictable seasonal rains and periods of just a few days without rain at critical stages in the cropping cycle can regularly decimate their production, leading to food shortages.

Water and poverty in sub-Saharan Africa. Water development is linked closely to poverty reduction, especially in low-income countries where the economy is highly dependent on agriculture. For many African countries, bereft of alternative economic opportunities in rural areas, agriculture is viewed as the principal avenue for social development. Expectations are high that agriculture can deliver national economic growth and at the same time lift millions of households out of poverty. Along with other factors such as markets, prices, inputs and security of land tenure, water is very important to meeting these aspirations.

Irrigation is a direct source of livelihood for hundreds of millions of the rural poor in developing countries because of the food, income options and indirect benefits it generates. There are high political aspirations that agricultural development, in particular across sub-Saharan Africa, will lift many out of poverty, a few as producers of marketable products, others as wage labourers, and others in small enterprises away from the farm. The anti-poverty effects of irrigation can be assessed at two levels: production, related to the national or regional economy; and livelihoods, related to the household and its well-being (Table 1). The former has been the method traditionally used to assess irrigation impacts; conversely, a livelihood-based approach to irrigation places adequate and secure livelihood aims before increased production.

Rural farmers can be enabled to produce their own food through local soil and water conservation practices or through conservation agriculture. These are ways of farming that recognize that most poor farmers own nothing more than a hand-hoe, and make the most

of local farming conditions, providing some security against the regular shortfalls in water. Most importantly, farmers will be able to keep control over the small revenues earned within the households themselves. Critically, farmers are enabled to take that first step on the ladder towards the more commercial forms of agriculture that will create sustainable livelihoods.

TABLE 1: Livelihood-related issues for water in rural areas

Capital		Production based approach	Livelihoods based approach
Physical capital	Infrastructure for rainfed and irrigation systems.	Rainfed and irrigation farming systems improved to increase agricultural production.	Improves decision-making ability through better rainfed and irrigation farming systems. Remove risk and uncertainty including maintenance and management of natural capital stocks.
Social Capital	Community approach needed to raising or managing other forms of capital, of crucial importance in irrigation management, associations (WUA), networks	Communities mobilized to establish Water User Associations to improve agricultural water management.	Identifies poorest households and strengthen participation in, and influence on, community management systems; create safety-nets within communities to ensure the poor have access to water; improve rights to land and water and establish right to access by poor households within communities.
Natural capital	Land and water availability	Develop new and enhance existing water resources using physical and social assets.	Enhanced through training in catchment protection and maintaining natural environment.
Fianancial capital	Cash, credit, savings, animals	Develop individual or community based tariffs and charging mechanisms for water use.	Secured through access to small-scale credit.
Human capital	Labour, knowledge (through education, experience)	Train people in agricultural water management and promote gender equity.	Knowledge of demand responsive approaches, community self-assessment of needs, participatory monitoring, gender mainstreaming.

Source: UN, 2006: Chapter 7, p. 268.

Climate change – more troubled waters ahead

Now a major international issue, climate change is expected to account for about 20 percent of the global increase in water scarcity. Countries that already suffer from water shortages will be hit hardest. Significantly, there will be major increases in water scarcity even if the water impacts of climate change prove to be neutral or even enhancing of the world's hydrological budget. With neither being reasonably expected to happen, the impact of a changing climate will affect not only bulk water availability but also worsen the extremes of drought and floods. A 2006 study by the UK Meteorological Office concluded that, with no mitigation of climate change, the severe droughts that now occur only once every 50 years will occur every other year by 2100.

The way forward – we can do much better

Addressing water scarcity requires actions at local, national and river basin levels. It also calls for actions at global and international levels, leading to increased collaboration between nations on shared management of water resources (rivers, lakes and aquifers) and of the benefits thereof. Being intersectoral in its nature, the response to water scarcity requires: collaboration; the sharing of joint visions and policy principles; and joint action in addressing the issue. A major challenge in addressing water scarcity successfully in countries is the institutional fragmentation of responsibilities in the water development sector.

Improving investments in water to reach the Millennium Development Goals

Wise use of water will be needed if all the MDGs, most of them to be reached by 2015, are to be attained. In its own right, improved access to water and sanitation is an established MDG target. In recent years, a very strong case has been made that improved access to water, sanitation and health will contribute across all of the MDGs, including targets in education and health. On World Water Day, UN-Water wishes to raise the profile of the wider contribution that must be made by water – beyond domestic water and sanitation alone – across all of the MDGs. Judicious management of increasingly scarce resources is needed if benefits in economic growth, hunger reduction, lifting households out of extreme poverty, and ensuring environmental sustainability, among others, are to be achieved. Failure to take action on water will be to the detriment of MDG attainment. With 2015 looming, now is not the time for weak governance. Worst of all, bad governance will bring with it real costs in terms of MDG attainment for millions.

Many countries are falling behind in their progress towards the specific MDG on water and, in particular, sanitation. While there are a few locations around the world where difficulties in access can be attributed to the physical scarcity of water, the overwhelming challenge is one of water governance.

Many actions are necessary to attain the MDGs that tackle poverty in ways that are entirely unconnected with water. However, water can play a key role as part of strategies for achieving most of the MDGs, including hunger reduction, universal education, empowerment of women, improved health and combating disease, environmental sustainability, and advancing a global partnership for development (Table 2). In particular, the eradication of poverty and hunger in rural areas is linked closely to fair and equitable access of the most vulnerable people to basic livelihood assets (including land and water) for domestic and productive uses. Because increased demand usually threatens the sustainability of the environment in situations of scarcity, water scarcity management is also crucial to achieving the goals of environmental sustainability.

This close relationship between MDGs and water is often not understood. Consequently, water management actions are poorly represented in the poverty reduction strategies of developing countries. Water can contribute both directly and indirectly by creating the conditions where the different goals and targets are more likely to be attained. Studies by the World Health Organization have shown that the benefits of investing in water far

outweigh the costs of making the improvements – by as much as 60 times (and never less than 3) in the major regions of the developing world.

TABLE 2:

How coping with water scarcity can affect the achieving of the Millennium Development Goals

MDG	Linkage with water scarcity
Eradicating extreme poverty and hunger	Access to water for domestic and productive uses (agriculture, industry, other economic activities), which has a direct impact on poverty and food security. Vulnerability to water-related shocks including droughts. Impact of water scarcity on both irrigated and rainfed agriculture for increased grain production; for subsistence agriculture, livestock, fish and other foods gathered in common property resources; capacity to produce cheap food with impacts on nutrition in urban and rural areas.
Achieving universal primary education	Incidence of catastrophic but often recurrent events, such as droughts, that interrupt educational attainment; drought preparedness programmes.
Promoting gender equality and empowering women	Access to water, in particular in conditions of scarce resources, with important gender-related implications, which affects the social and economic capital of women in terms of leadership, earnings and networking opportunities.
Reducing child mortality and improving maternal health	Improved nutrition and food security, which reduces susceptibility to diseases. Equitable, reliable water resources management programmes that reduce poor people's vulnerability to shocks, which in turn gives them more secure and fruitful livelihoods to draw upon in caring for their children.
Combating HIV/AIDS, malaria and other diseases	Access to water, and improved water and wastewater management in human settlements, which reduces transmission risks of mosquito-borne illnesses, such as malaria and dengue fever.
Ensuring environmental sustainability	Adequate treatment of wastewater, which contributes to less pressure on freshwater resources, helping to protect human and environmental health. Improved water management, including pollution control and water conservation, as a key factor in maintaining ecosystem functions and services.
Promoting global partnerships	Water scarcity increasingly calls for strengthened international cooperation in the fields of technologies for enhanced water productivity, financing opportunities, and an improved environment to share the benefits of scarce water management. upon in caring for their children.

Water scarcity is also linked closely to the five key areas for action identified by the UN Secretary General on the occasion of the WSSD: water, energy, health, agriculture and biodiversity. Last, it also has an impact on all the issues identified in the WSSD Johannesburg Plan of Implementation, and, in particular, on: poverty eradication; changing unsustainable consumption and production patterns; and protecting and managing the natural resources base of economic and social development.

Unlocking the potential of Africa's water for agriculture

The doubling of Africa's irrigated area is currently very high on the political agenda. Achieving this goal means that the factors that have constrained investment will need to be addressed. With less than one-third of the continent's potential under irrigation, opportunities exist across much of the continent to invest further in water for agriculture. Markets, commodity selection, ownership, land tenure, water storage for reliable supply, and international agreements on water allocations within river basins are all key factors in unlocking this potential. Many see the importance of reducing the US$18-billion food-import bill borne by the continent. Many also see the potential for boosting household incomes by creating labour opportunities. However, some recognize that, even in an optimistic scenario in which every hectare created two new jobs, the significant uplifting of 60 million households would be insufficient to make major in-roads into the extreme poverty that pervades the continent. Consequently, a dual approach is gaining ground, one in which improvements in rainfed food production for the very many vulnerable African farmers must take place alongside the seizing of viable irrigation opportunities.

Improving health through better access to water

Globally, 1.1 billion people lack access to improved water supply, and 2.6 billion are without improved sanitation. Most of these live in rural areas, but the number of urban dwellers without adequate water and sanitation services is increasing rapidly. The majority of those without adequate sanitation services live in Asia, but sub-Saharan Africa has the highest proportion of people without water. Water-related diseases, linked to inadequate access to safe water and basic sanitation, are endemic in many regions. There are 4 billion cases of diarrhoea each year, causing 2.2 million deaths (5 000 every day), mostly of children under the age of five. One million people a year, almost all under the age of five, are killed by malaria, and millions are affected by filariasis, schistosomiasis, intestinal worms and other water-related diseases. Many women suffer permanent skeletal damage from carrying heavy loads of water over long distances day after day. Poor nutrition so weakens people that they die from illnesses and infections that are not usually fatal in developed countries. The numbers of deaths and illnesses from preventable diseases are dramatic in their own right. Their impact on the economies of countries and the livelihoods of poor households is even more insidious.

Water and health are intimately linked. Water conveys pathogens to people, and provides the habitat for vectors and intermediate hosts of pathogens. Shortages of water and, above all, inadequate sanitation limit the ability of a family to cope with these threats. Worst of all, using poor quality water that is unsafe only exacerbates matters by causing further illness and infection. Diseases associated with water affect the poor in a disproportionate way, and this burden of ill health maintains the vicious cycle of poverty and sickness.

It is against this backdrop that the potential for access to improved water sources and best water management practices, basic sanitation and improved hygiene behaviour must be developed to the full. Major health gains can be achieved at household level through personal protection, whether through oral rehydration salts or the use of chlorination tablets for drinking-water. Farmers can choose options that reduce health risks and their exposure to illness without detriment to their production. Communities can mobilize to work towards improved drinking-water facilities. They can learn about drinking-water contamination risks in their homes, and about the treatment and safe storage of drinking-water from the unreliable sources upon which so many depend. Governments can take action to bring their health sectors and water managers together in successful partnerships.

Producing more with less water

Increasing water productivity holds the key to future water scarcity challenges. Without further improvements in water productivity or major shifts in production patterns, the amount of water used for agriculture, industrial and domestic activities will increase by 60–90 percent by 2050, depending on population, incomes and assumptions about water requirements for the environment. In agriculture alone, the total volume of water used in crop production would be 11 000–13 500 km3, almost double the 7 130 km3 of today. Cotton production, a high-demand agricultural practice, is projected to grow by 1.5 percent annually, and a further burden is expected to come from increased demand for biofuel. By 2030, world energy demand will rise by 50 percent, and two-thirds of this demand will come from developing countries.

However, there is scope for an accelerated increase in water productivity. Water productivity in agriculture has increased steadily in recent decades, largely owing to increasing crop yields, and the potential exists for further increase. However, the pace of such increase will vary according to the type of policies and investments put in place, with substantial variations in the impact on the environment and livelihoods of rural populations.

Targeted investments in all sectors, combined with a package of institutional measures that promote enhanced efficiency while guaranteeing equity in access to water, can do much to alleviate water scarcity and secure environmental sustainability.

Agriculture and water scarcity – imperatives for increasing water productivity at all levels

Today, agriculture accounts for 70 percent of all water use globally, up to 95 percent in several developing countries. Adding to the pressures on agricultural use is the increased awareness of the instrumental value of water in maintaining environmental services and ecosystem resilience. Increasing the efficiency of water use and enhancing agricultural water productivity at all levels of the production chains are becoming priorities in a rapidly growing number of countries. A systematic approach to agricultural water productivity requires actions at all levels, from crops to irrigation schemes, and up to national and international economic systems, including the trade in agricultural products. It calls for an informed discussion on the scope for improved water productivity in order to ameliorate intersectoral competition for water resources and optimize social and economic outcomes. To keep pace with the growing demand for food and taking into consideration an increase in water productivity, it is estimated that 14 percent more freshwater will need to be withdrawn for agricultural purposes by 2030 in order to obtain the 55 percent increase in food production needed

Integrated water resources management (IWRM) – the framework for action at local, national and regional levels

At the WSSD in Johannesburg in 2002, the international community acknowledged the importance of the water scarcity challenge by adopting the short-term target of developing "integrated water resources management and water efficiency plans by 2005, with support to developing countries, through actions at all levels." In particular, the Johannesburg Plan of Implementation calls for:

- strategies and programmes for integrated river basin, watershed and groundwater management;
- measures to improve the efficiency of water use, to reduce losses and to increase recycling of water in a way that gives priority to the satisfaction of basic human needs while preserving or restoring ecosystems and their functions;
- programmes for mitigating the effects of extreme water-related events;
- diffusion of technologies and capacity building for non-conventional water resources and conservation technologies to developing countries and regions facing water scarcity conditions or subject to drought and desertification.

While there has been progress, much remains to be done in order to develop and implement such plans. IWRM is the overall framework within which all UN-Water efforts for addressing water scarcity take place.

Managing uncertainty for the benefit of the poor

The people facing the greatest problems of water scarcity on a day-to-day basis are the many rural poor. This is especially the case for those living in marginal areas where food production is at the mercy of the vagaries of climate and where they face the consequences of weak delivery of services in water and sanitation. This is a widespread and insidious problem that also affects urban dwellers, notably in Asian cities.

Many rural households produce their own food, and in their particular case, it is essential that the 800–1 000 m3 of water per person they need to secure their annual food production is available locally on their fields. However, investments in household food security are rare and largely insufficient. Consequently, many million rural dwellers have to rely on rainfed agriculture, with all of the vagaries and vulnerabilities that accompany the unpredictability of that rain. It is this dependence on local rain for food production that make the impacts of drought so widespread and so long-lasting. Few die of thirst during drought, but very many are affected by extreme hunger for a year or more.

Enhanced economic growth is essential for poverty reduction in most parts of the world, but the quality of growth and, in particular, the extent to which it creates new opportunities for the poor also matter. Improved water management can be a catalyst for such growth. Water provides vital inputs into many productive activities and creates opportunities for local entrepreneurs in supplying technologies, constructing facilities and providing services. Local investments generate high returns and, importantly, they retain benefits in the local economy and generate significant multiplier effects. Improved water management can also be a catalyst for growth at national and regional level, where major water infrastructure investments can transform development prospects. It is essential that such investments are accompanied by effective impact assessments and proper safeguards (taking into account all the costs and benefits generated). Where this is the case, and where major infrastructure investment is accompanied by incentives that trigger private enterprise and livelihood opportunities, then water investments can play a key role in poverty reduction.

There are massive opportunities to improve the ability of poor people to lift themselves out of poverty under conditions of greater water security and sustainability. Making sure that adequate and reliable supplies of water are available for agricultural activities (including: producing the food that households grow to feed themselves and the extra they sell at markets to earn small amounts of cash; livestock; aquaculture; and horticulture) is a key to rural poverty reduction throughout the developing world. Supporting domestic water

schemes that make water available for home-based livelihood activities, such as vegetable production, pottery and laundering, is effective in targeting the poor and supporting diversified livelihoods. In many countries, broad-based agricultural growth represents the best opportunity for stimulating economic growth

Pathways for reducing poverty and vulnerability in rural areas

Ensure secure access to water for productive use for poor women and men through clarifying water rights. At the same time, address the need for redistributive policies to solve the rural poor's lack of access to assets, markets and services.

Target livelihood gains directly through small-scale, individually managed water management technologies that provide water at lower unit costs than large-scale hydraulic infrastructure and can be easily implemented locally

Acknowledge indigenous knowledge, customary laws and informal institutions in water management.

Promote multiple water-use systems – a single system for domestic use, crop production, aquaculture, agroforestry and livestock – that are effective for both reducing poverty and improving water productivity.

Protect the natural resources on which the rural poor's livelihoods depend. Fisheries, in particular, represent an important source of livelihoods and nutrition in rural areas.

Source: CA, 2007

Investments to reduce vulnerability to water-related risks and to improve agricultural productivity are compelling for environmental and equity reasons. Realizing the potential of existing rainfed areas reduces the need for water withdrawals from rivers and groundwater for new large-scale irrigation development. On the other hand, improving rainfed production also requires infrastructure, but often smaller and more distributed. Realizing this potential requires risk-mitigation measures. Water harvesting techniques are useful for bridging short dry spells, but longer dry spells may lead to crop failure. With the right incentives and measures to mitigate risks for individual farmers, improving rainfed agriculture holds considerable potential to increase food production and reduce poverty, while ensuring the maintaining of ecosystem services.

Valuing social and environmental services

As water becomes scarce, a main question today is how to best support stakeholders in managing their water demands in a context of increasing competition and interdependence. This question is especially significant for agriculture as it is the largest water user globally and faces increasing difficulty in: (i) securing a sufficient share of water resources to meet the needs of a growing world population; and (ii) managing the impacts of its activities on the resource base. Supporting stakeholders in managing their water resources means supporting them to make choices and to reach a common understanding on the necessary arrangements for sharing and allocating water-related goods and services.

Assessing and communicating the values associated with different water-related goods and services is the basis on which stakeholders have to seek a well-informed decision. This explains the growing focus on water valuation as a means to support water resources management. Water valuation means expressing the value of water-related goods and services for sharing and allocation decisions. It covers use and non-use values, extractive and in situ use values, and consumptive and non-consumptive use values. The notion of scarcity is central, and this can refer to aspects of water quantity and quality, and have both temporal and spatial dimensions.

Valuation is an increasingly important tool in the process of allocating scarce water resources. However, the indiscriminate use of a purely economic approach risks over-emphasizing monetary expressions of value at the expense of environmental and social values. Valuation frameworks are needed that recognize these three dimensions and in which stakeholders play a central role. Various methods have been developed that help to express the value of water-related goods and services in quantitative, monetary units. Although potentially very useful, these methods are complicated and demanding in terms of the expertise, time and data required for their application. This hinders their widespread application, especially in developing countries. As a result, their development in the field of water valuation has been mainly academic and much more effort is needed in order to apply valuation results and processes to support water resources management and decision-making effectively.

Making water scarcity everybody's business

World Water Day 2007 is a day for raising the profile of water scarcity. Actions to cope with water scarcity are needed at various levels:

- At international level, countries need to seek increased cooperation in dealing with transboundary water management issues, within the IWRM framework, focusing on negotiations and dialogue and on the quest to optimize the overall societal benefits of water.

- At national level, policies and governance need adapting in order to better account for increased scarcity and address competing uses in a fair and equitable way. The institutional integration of water policies and increased stakeholder involvement in decision-making processes are paramount to this process, and the development of effective conflict-resolution mechanisms will become increasingly important.

- At local level, better management practices are needed in all fields, leading to increased productivity and sustainability in water use and to improved sectoral integration in the management of water resources.

The UN-Water Plan of Action "Coping with water scarcity"

A multidisciplinary approach is needed in order to consider the social, economic, cultural, legal and institutional constraints relevant to local communities, urban centres, rural areas, user groups and administrative, public and private organizations. When reconsidering development schemes at local and national level, due consideration must also be given to societal and cultural changes that induce the transformation of related water management scenarios.

Several UN Agencies have focused at length on the issues of water scarcity and have produced valuable contributions at several levels and from different perspectives. At national and local levels, many countries have developed scientific and technical knowledge, backed by policies and legislation, to prevent and remedy water scarcity impacts. There is a widespread need to share the results achieved with, and to raise awareness among, all decision-makers, managers and end users, including the general public.

The UN Agencies and Programme Members of UN-Water have identified "Coping with water scarcity" as one of its priorities for the decade "Water for life" and have developed a joint Plan of Action (PoA) to address this challenge. The primary objective of the PoA is to provide a coherent and comprehensive set of information, policy and international advice and technical support to countries and stakeholders that will enable them to address water scarcity issues more effectively at local, river basin and national levels.

Source: UN-Water, 2006

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UN-Water. 2006. *Coping with water scarcity: a strategic issue and priority for system-wide action*.

Useful web sites

UN-Water: www.unwater.org

World Water Day 2007: www.worldwaterday07.org

World Water Development Report 2: www.unesco.org/water/wwap/wwdr2/

Human Development Report 2006: hdr.undp.org/hdr2006/