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Waters Crisis: Myth and Reality

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Abstract

There is enough water in the world for all the human needs, but not enough for the human greed. Thus, the water crisis is mainly a result of the inefficient practices that have been adopted worldwide. Society must begin to realize it can no longer follow the philosophy of use and discard of water. Everywhere, pricing, marketing, and regulatory actions must be used effectively to promote conservation, efficiency, and sustainable water use. As a result, groundwater may increase in importance in world water supplies, in part, as a response to the growing costs and other constraints in storing and treating surface water and partly because the advantages of groundwater are becoming better understood. For many countries this approach is not merely another alternative, but the only one available. Water should not appear as constraint in the overall planning process in the majority of the countries, rather realistic development and production targets should be matched to its availability. Thus, instead of the old saying "water is life" leads us to say we will have life for humans, and even for animals and vegetation where has been rational water management.

Introduction

The planet is passing through a period of dramatic growth and wide changes. Water problems are growing rapidly, in part because of population growth, but mainly because people are using and degradating more water per capita every year. Although, during the last decades, population growth is commonly assumed to be directly responsible for the water crisis, especially under conditions of poverty. In some cases the crisis has been related to drought-, in others, to increased demand-, and everywhere, to water pollution. In fact, in the majority of the world the water crisis deals more with per capita resource depletion and quality degradation than census figures.

An important feature of the water crisis is its regional nature. Many countries in the Northern Hemisphere, especially more developed ones in Europe, are facing a spectre of impending scarcity and water quality degradation. The result is that many prospecting studies and global programs, which are usually carried out by institutions strongly influenced by the northern countries, fail to adopt this kind of approach and proposals. In many countries the priority of development strategies must improve the quality of life through sanitation and good health, rather than promoting the development of industry and irrigation for export.

The efficient use of surface and ground water and the safe reuse of waste water are the most economical and often the only sources of additional water and, at the same time, the most effective ways of controlling water pollution.

Balancing Resources and Uses of Water

As only a small percentage of the world's total water is available to humans as fresh-water in rivers and lakes (0.009%), the water-business lobby has used this figure as a symptom of scarcity.

Although, the fact that water use is a recurring activity means that the most significant measure of water availability is the rate at which a particular fresh water source replenishes itself through the processes of the hydrologic cycle. The global average replacement time for water in rivers is 18-20 days. With rivers renewing so rapidly, humans have access to more than 40,000 km^3 per year, as presented in *Table 1*.

The year 2000 projection of the volume of water withdrawn from freshwater sources by mankind averages a per capita rate of about 700 m^3 annually, or around 11 % of the total per capita supply. This data indicates that in general terms of quantity, supply exceeds demand and that in the foreseable future there will be no major problems.

Although overall river runoff in a region may be high, seasonal fluctuations can result in water scarcities during parts of the year. Thus, from an economic point of view, groundwater storage is particularly important because it remains practically stable over time. Estimates of the amount in storage above 4,000 meters in depth range between 8.4 to 10.5 million km^3. Groundwater resources require several years, sometimes over a thousand year to renew, but their average world's discharge to streams represents about 13,000 km^3 per year. It should be emphasized that groundwater discharge values, which characterize the natural productivity of aquifers or aquifer systems, are the main indicator of groundwater resources available in an area.

Moreover, the long-term experience in ground water development has shown that it is good management practice to overdraft aquifer systems during prolonged drought, because use of part of their volume of water in storage may be far more beneficial than maintaining normal water level in rivers. In many areas of the world, exceeding the "safe yield" for periods as long as 10 to 15 years is not injurious to the volume of water in storage, because either all or nearly all of the overdraft can be made up in the first year or two of normal rainfall.

Obviously, a generalized evaluation of resources on a continental scale, as presented in *Table 1*, is not an adequate basis for describing the water situation in any individual nation or region due to significant variations in supply among nations and within individual regions. In addition, surface or ground water availability and population distribution do not coincide. In terms of continents, Asia, for example, will have 58% of the world's population, but only 26% of the average total river discharges. South America enjoys the most abundant freshwater river discharges. If the ratio of total river discharge to total land area is used as an index, South America has twice the runoff of all the other continents taken together. Africa, with a runoff index of only half the global value, has the least abundant flows. Rivers in North America and Asia correspond to the mean, and Europe's indexes are somewhat higher.

An integrated approach - integrated in terms of surface and ground water resources, economic and social patterns for river basin planning - offers the best opportunity to provide equitable access to adequate quantities of water of appropriate quality for all users and to protect the environment. Seeking a dynamic balance between water availability and demand, taking into account that the supply varies with time and space, will enable us in broad terms to reach sustainable development.

Inefficient Water Practices

Despite the progress made during the past few decades, mismanagement is likely to increase the frequency and severity of water-related problems, by encouraging the urbanization, industrialization and irrigation in critical areas. For example, irrigation is usually considered the engine of economic growth in arid and semi-arid regions, but without appropriate and reliable water control and management, sustainable development is simply not possible.

Water quality issues are much more serious than anyone had anticipated before. Initially, pollution from domestic wastes and the sanilzation of irrigation systems were the major problems. Concern about heavy metals, nitrates and organic micropollutants must now be added. Morever, many of the regional and local water supply and sanitation problems are the result of ill-planned development, lack of domestic sewage treatment, or other forms of private and public mismanagement; other problems arise from the combination of urbanization pressure and land use tenure problems. Thus, much untreated domestic wastewater is discharged into rivers making the water unsuitable for drinking, even after conventional treatment. Another source of disease or other health hazards is untreated waste water used to irrigate vegetables grown for urban food supplies.

Table 1 shows, of the 4,660 km^3 of water withdrawn for urban domestic use, by the year 2000, some 2,000 km^3 of wastewater will be returned to rivers and other freshwater sources. Wastewater is sometimes treated before it is returned to rivers and other freshwater resources, but all too often it is returned without treatment, mainly in developing countries. Even when it has been treated, wastewater usually needs to be diluted to reduce concentrations of pollutants still further before the water is fit for reuse. The potential for dilution of wastewater is increasingly limited because as water withdrawals increase, the amount of clean water remaining decreases and the volume of wastewater grows. Globally, wastewater can be diluted by clean water in a ratio of 1:25, but by the year 2025 this ratio is projected to worsen slightly in Europe and substantially in Asia. In fact, Europe, North America, and the former U.S.S.R. together produce 55% of the world's wastewaters. In Africa and Asia, substantial withdrawals for irrigation result in greater consumptive use (71 and 76%, respectively, of withdrawals. By the year 2000, developing countries are projected to increase industrial use and to decrease the relative proportion of consumptive use to 56-70% (WRI, 1990).

In many urban areas, groundwater can provide the most appropriate solution to the population's water needs, because it can be used inexpensively to supply a large volume of good quality water. However, in most cases when surface water sources are exhausted or degraded, the decision makers prefer to invest considerable funds in the construction of new dams and pipelines to bring water from more remote sources.

Another of the most chronic problem areas involves inefficiencies in domestic water supply systems. For example, in the great cities of Brazil, breakages (and subsequent water losses) are common, with frequent drops in pressure increasing the amount of leakage and the risk of contamination of waterlines. At the same time, water policies do not encourage conservation. Urban water supply systems in Brazil present water loss rates between 40 and 70% (IBGE, 1991).

Worldwide, the average water losses from distribution networks reach as much as 50%, while at the most efficient levels of use, these values are approximately 15% (Garduño, 1994). Improving the efficiency of resource use comprises one means of meeting sustainable developments goals. Although, it was not until the early 70s, during the severe droughts that affected the southwestern United States, that actions to increase water use efficiency emerged in urban context (Van Dyke et al., 1990). Recommendations to improve water use efficiency include: metering with reductions of water losses or wastage of up to 25%, leakage repair (9%), tariffs (1 0%), saving devices (at least 10%), regulations (10%), restrictions (10 to 20%), reuse (25%), education (5%), (Grisham and Flemming,1989).

The agricultural sector is the largest consumer of water resources. It accounts for about 80% of all water use in many countries. Futhermore, agriculture is recognized as an essential component of sustainable development in many countries. Today, irrigation systems cover approximately 275 million hectares and account for around 50% of the world's food production. In the drive to expand irrigation, however, comparatively little attention has been paid to the efficiency with which irrigation systems operate. Worldwide, the efficiency of irrigation systems is estimated to average 37% and only a few reach levels of around 50% (FAO, 1990). Of the total losses, it is estimated that evaporation accounts for 5%, leaks 30%, seepage 30%, and poor operation 35%. Much of the losses are rendered unproductive or become severely degraded in quality as the water picks up salts, pesticides and toxic elements from land (Postel, 1986).

Evaluating Water Management Needs

Human welfare and environmental protection must be considered as priorities to be achieved through the efficient use of water and the safe reuse of wastewater, in planning economic development. Citizen participation should be encouraged in the water resources planning and implementation process.

Water use is still growing in the developing world but is stabilizing in the industrial countries, with the result that the world withdrawal rate increase is slowing. Withdrawals are expected to rise only 2-3 percent annually from now until the year 2000. Nevertheless, only about 4 percent of the world's population uses as much as 100-150 cubic meters per person annually, or 300-400 liters per day per capita. By the year 2000, a projected 17 percent of the population will be using ore than 100 m^3 per capita per year, however 30 percent, some 1.8 billion people, will still be using less than 20 m^3 per capita per year, or around 50 liters per capita per day (WRI I 1 990).

An additional perspective for evaluating water availability and needs is provided by considering the annual per capita potential, in terms of average river discharges to satisfy per capita demands. As *Figures 1* and *2* show, the amount of freshwater per capita withdrawn (taken for use) is not correlated with either a country's economic wealth or the size of its internal renewable water resources. Moreover, in several parts of the world, water demands are fast approaching the limits of resources. Annual withdraw of 1 000 m^3 per capita seems to be the water use sustainable level reached in the most harmonic and relatively developed societies.

In about 30% of the European countries withdrawal of 1000 m^3 per capita per year is approaching the limit of their resources. The United States, for example, uses 2,162 m^3 per capita annually; its total use is higher than any other country, but only 20% of the country will suffer occasionally from severe water supply restrictions, most of which will occur in the arid and semi-arid regions of the southwest (Maddaus, 1987).

Canada, The Netherlands, Portugal, Bulgaria, Romania, Australia Pre using around 1,000 m³ per capita annually. In South America only Argentina and Chile use around 1,000 m³ per capita annually, certainly as a result of their irrigation activities.

The nature and extent of water problems are not related to the scarcity within the area under consideration. For example, despite the high per capita annual water availability in South America (35,000 m³ per capita per year), domestic waste problems are especially critical, because little, if any, of the urban sewage is treated. As a result, twice as many rivers as in other regions have fecal coliform counts of more than 100,000 per 100 mi. The World Health Organization (WHO) recommends a coliform count of 0 per 100 ml for drinking water.

In many cases, a more efficient use of existing water resources, including groundwater resources, is feasible.

Other things being equal, arid and semi-arid regions require a greater efficiency of water use than humid zones

Conclusions

As demand for water-related services continues to increase in relation to a resource that is relatively fixed in supply and subject to degradation from many sources, water management efforts will become even more significant.

The approach must be gradually expanded in order to cover not only hydrological processes considered in interrelationship with the environment and human activities, but also the ecological aspects of multi-purpose utilization and conservation of water resources to meet the needs of economic and social development. In many areas the groundwater resources are huge, and their occurrence and hydrological significance cannot be neglected in water management and planning.

The objectives of development must include, at a minimum, a reduction of pain and suffering associated with factors such as inadequate water supply and health conditions, or a reduction in what has been called illfare.

Water and land should not appear as constraints in the overall planning process for the majority of countries, if realistic development and production targets had been matched to their availability. What is urgently needed is the formulation of long-term development policies, on a sustaining basis, which reflect changing water supply and demand patterns, consistent with efficient use, and better understanding of the social and environmental implications.

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