# Water Resource Issues in the Humid Tropics and Sub-tropics: An Agenda for the Next Two Decades

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Water in general is moving towards the top of the international agenda. There are fears that water will be increasingly the focus of international conflict especially in the Middle East, the Nile Basin, and other parts of the arid world. However, most attention has understandably been paid to the drier parts of the world, to the needs for basic supply of drinking, irrigation and industrial water for the chronically water short areas. Less attention has been given to the current and emerging water resource issues of the wetter tropical and sub-tropical zones. Yet these are the home of a large part of the world's people, some of the largest and most rapidly growing urban centers and increasingly water is a major issue for these areas. This paper and the other contributions in this issue of *UPDATE* attempt to outline some of the problems and prospects for water use in the humid areas of the developing world. For many of the world's people and the world's nations these will be the important issues for the next decade and beyond.

Table 1 provides an overview of the freshwater resources and use for selected countries in our target area (World Resources 1996/7). Together Africa, Asia and Latin America are home to sixty percent of the world's fresh water supply, but also home to near 75 percent of the world's population.

It is instructive to compare the gross figures for Africa, Asia, South America and the U.S. In terms of water availability South America has the greatest per capita supply at almost 30,000,000 cubic meters per annum, followed by the U.S. (9,413,000), Africa (5,488,000) and Asia (3,819,000). In comparing withdrawals of fresh water USA uses 1,870 cubic meters per capita per year, Asia 542, South America 332 and Africa 199. However at these withdrawal rates the United States takes off 19 percent of its available water, Asia 12 percent, Africa 4 percent and South America only 1 percent. Even at this gross level of analysis it is clear that if Asian rates of use were to approach those of the United States almost 50 percent of water would be extracted at current levels of population.

Within continents even in these generally humid and sub-humid countries there is a wide variation on both sides of the budget in both availability and use. In Africa, it appears (given the uncertainty about the numbers) that per capita availability ranges from around 1,000,000 cubic meters a year for Rwanda, Burundi, Kenya, Malawi and South Africa to over 50,000,000 cubic meters for Congo, Equatorial Guinea, Gabon and Liberia. Withdrawals both per capita and as a percent of available supply vary equally widely from 20 cubic meters or less per capita in Burundi, Congo, Equatorial Guinea, Guinea-Bissau, Malawi, Uganda and Zaire to over 400 cubic meters per capita in Madagascar, Mauritius, South Africa, and Swaziland. Countries with a low or moderate supply and relatively high use include Madagascar (5% withdrawal), Mauritius (16%), and South Africa (27%); obviously countries with a greater use of water for urban, industrial and irrigation purposes than most others on the continent.

In Asia per capita availability on national basis also varies considerably. China, India, Singapore, Sri Lanka and Thailand have less than 3,000,000 cubic meters available, while the smaller countries of Laos, Bhutan, Malaysia and Myanmar have over 25,000,000 cubic meters available. In terms of use only Bhutan has a level of use as low as the lower user countries in Africa. Most countries, including those with the largest population, use over 400 cubic meters per year, a level only reached by one country on the mainland of Africa. Chine (16%), India (18%) and Thailand (18%) show withdrawal levels, in relation to supply, comparable with the U.S. These numbers reflect the greater numbers of people in relation to the resource base, the greater urbanization and the much greater use of irrigation for agricultre.

In South America per capita availability varies through a much narrower range except for Guyana and Suriname, and per capita use shows no very low national figures. The typical South America withdrawal rate per capita is from 200-400 cubic meters per year compared with a typical Africa country

at around 50 cubic meters per year.

In summary the global data base for humid and sub-humid areas suggests that generally in South America water availability is high, uniformly high in the humid countries, and water use is also relatively high. In Africa availability is much lower but withdrawals are also at a much lower level, while in Asia availability per capita is lowest of all regions but withdrawal is usually high. These variations and the variations between countries within the regions are explained at one level by the degree of development of the economy especially the extent of urban/industrial use and the use of water for irrigation. The additional hidden factor behind the water data is of course the number of people being served and the potential for change in both the numbers and distribution of people and activities in the coming years. As populations continue to grow and as the numbers of people living in urban areas grows even more quickly, demands on water grow exponentially with a need for high levels of supply to particular areas.

**Water Issues for the Coming Decades**

The data discussed above provide a basis for projections about the kind of water supply and use problems that lie ahead for the humid and sub-humid tropics. These are outlined below in relation to
(a) growth in numbers of people
(b) urbanization trends
(c) irrigation
(d) water management and quality issues

(a) Population Growth

Table 2

POPULATION millions

| | 1950 | 1995 | 2025(est) | Growth 1995-2025 |
|---|---|---|---|---|
| Africa | 222 | 745 | 1600 | 855 |
| Asia | 1380 | 3400 | 4900 | 1500 |
| S. America | 111 | 320 | 451 | 131 |
| Total | | | | 2486 |

Table 2 expresses the numbers part of the issue dramatically. In the next three decades some 2.5 billion more people will need fresh water, plus water to cultivate their crops and promote their livelihood. Although these are totals for the whole continents most of this growth, some 2 billion people, will occur in the humid and sub-humid tropical zones, over half of it in Asia.

The implications for water use are potentially staggering. If no increase in per capita use occurs, the withdrawal in each continent will increase by nearly 60 percent. But in the expectation that levels of development of a large proportion of the population will increase, it seems very likely that from numbers and quality of life issues total demand for water in the region being considered will increase over 100 percent in three decades. Providing that water with consistent supply to where that people are constitutes one part of the challenge.

(b) Urbanization Trends

The current Habitat II conference is addressing the issues of urban growth and its implications over the next few decades. The projections are that in the year 2025 the huge urban complexes of the world will, with the exception of Tokyo, all be in the developing world, Lagos, Calcutta, Bombay, Buenos Aires, Dacca (Bangladesh), Delhi, Shanghai, Beijing and Manila are all projected to be cities of over 20 million by the second or third decade of the new millennium, some will reach that level much sooner.

The implication of such massive urban growth for all aspects of water supply and disposal are considerable. Rural communities and the smaller urban areas tend to take their water supply from ground water or localized stream sources. The mega cities, as they first develop, often have areas where water supply and sanitation mirror those of the rural areas with well fields and streams providing the supply and local sanitary pits the disposal systems. But as levels of income rise and as cities expand there is a critical need for regular (and fairly continuous) supplies of water ro serve the major supply and complementary water based disposal systems of the modern city. Even at the standpipe level of service the water need for these huge conglomerations will need high levels of new investment. Along with growth in urban and general populations is a parallel expansion of industry at all scales. As industry develops in scale and numbers of institutions the growth in this sector is a major new user of water. In the USA and in Europe the industrial sector uses 45 and 54 percent respectively, of total use. Asia (8 percent), Africa (5 percent) and South America (23 percent) have great potential for rapid growth in

this sector with a concomitant growth in water use.

(c) Irrigation

Rising expectations of standards of living, growth in world population and increasing proportions of people living in urban areas all place demands on food producing systems everywhere. Food and industrial cropping systems need to produce large quantities of food, more reliably and with better quality to meet this demand. Additional watering or full scale irrigation is usually necessary to achieve these production needs. Despite the increases in efficiency of water use in agriculture irrigation is a major user of water. Currently this sector is responsible for 88 percent of total water use in Asia. Plans for increasing irrigated land are being made in Asia, Africa and Latin America. Any increase in this sector obviously weighs heavily on total water use. While increased efficiency is clearly possible it seems likely that this will be implemented rather slowly in most parts of the world.

(d) Water management and Quality issues

The picture presented in the preceding sections illustrates the demand side of the equation of water use in the humid tropical zones of the world. Most of this projected demand will be met by the utilization of surface waters and for most places, especially in Africa and Asia, large scale diversion of water will be necessary at national and regional levels. Some of these are already planned e.g. the Three Gorges project in China and the Mekong River Valley plans. Many billions of dollars are being and will be spent on water storage, transport, treatment and disposal in the humid and sub-humid tropics. But as is illustrated in the Mekong and also in Africa and South America many of the opportunities for sound water development lie on international waterways. Most river basins in Africa are international involving several countries and most major rivers in Asia and South America across at least one international boundary. This means that efficient long term water use becomes a matter for international negotiations as well as technical integration. The history of such developments illustrates the difficulties and uncertainties involved.

This is not the place to outline the issues in detail but some unanswered questions, not in a priority order, may be the most effective way to present the agenda for the coming years.

1. Can the projected demand by continent and region be met without massive environmental disruption?
2. Can the lessons learned of integrated management water development be adjusted to and incorporated in the mainly new ecological settings of the humid and sub-humid tropical environment?
3. Can new technologies of information and action help create new ways of providing and dispersing water more cost effectively and with fewer large structures?
4. Can water strategies become part of decision making at all levels as water is recognized as a crucial resource?
5. Can the health issues of water provision be appropriately dealt with especially in areas of rapid urban growth?
6. Can investment in water saving technology parallel that in other branches of the industry?
7. Can we adjust management structures to more effectively project social, environmental and political perspectives into overall water management goals and objectives?

The way in which we approach these issues over this decade will set the stage for this important aspect of human development well into the next century.

REFERENCE

World Resources: A guide to the Global Environment 1996/1997 World Resources Institute, Washington DC 1996