

Water, Food and Poverty: An Overview of Issues in River Basins



The world faces emerging crises with regard to water and food. Its population is around seven billion and is forecast to be at least nine billion by 2050. The increased population will need 70% more food than it does today (Bruinsma 2009), which has major implications for the global environment that supports the food system. That goal will be a lot harder to achieve than the green revolution of last century.

Where will the water come from to produce 70% more food when agriculture already uses 70% of the world's freshwater resources? In the case of the Indus, the Yellow, and the Nile, the basins are essentially closed—that is, all the water is used. In some cases, the environmental flows essential to maintain ecosystem functions in the river estuaries have ceased or are threatened. The only solution in closed basins is to increase water productivity (WP)

of crops by using the water more efficiently, what former UN Secretary General Kofi Annan called, “More crop per drop” (Annan 2000).

The Consultative Group on International Agricultural Research (CGIAR) took up this issue through its Challenge Program on Water and Food (CPWF). One of the CPWF’s approaches was to examine in detail, the issues of development, poverty and water productivity in 10 river basins worldwide in the Basin Focal Projects (BFP).

The most fascinating outcome is that all the basins are different. Many of them have high levels of poverty and there are some similarities, but each presents different underlying problems, which must be addressed if the goals of increasing food production and overcoming poverty are to be met.

Water related concerns

Population growth has reduced available water in some basins below 1700 m³/capita/yr, the level conventionally considered secure (Falkenmark 1989). Absolute water scarcity worsens when the growing population depends on unsustainable irrigation as in the Yellow, Indus, Karkheh and upstream Limpopo basins.

Apart from the need to increase WP in closed basins, populations in the sub-Sahel are doubling every 30 years, with every indication that they will continue to do so. Food production has kept pace with the increase over the last 20 years, largely by increasing the cropped area. This can continue in the short term. For the longer term, however, it is necessary to address the cause of low WP of rainfed agriculture in the sub-Sahel (the Volta and the Niger basins). WP could be increased with

appropriate agronomy (high-yielding varieties and fertilizer) as demonstrated by the Millennium Villages project. As pressure on the available land increases, however, higher WP is the only solution to providing the food that will be needed.

For the rural poor in some basins, water quality is more important than quantity. Indeed water quality is a universal issue for the rural poor as in the Nile, Indus- Ganges, and Volta basins, but also in the relatively developed basins of the Andes, where mining and other uses threaten water quality. Moreover, it is difficult to provide safe water to the invariably dispersed populations of the rural poor. The success of “Thai jars” (small, artisanal, ferro-concrete water tanks) in Nepal suggests that there are feasible solutions, which could be applied more widely. Rainwater harvesting for domestic water receives little attention, but it is viable even in semi-arid countries. Rainfall collected from the roofs of dwellings and other structures was the source of domestic water for much of rural Australia during its pioneering phase, and still is in many places.

Water-related hazards of drought, flood and water-borne diseases have major impacts on development. The hazards cause more hardship where countries have little capacity to manage them, such as in the Niger, the Volta, or the Nile basins, or where the events can be extreme as in the Limpopo.

It is easy to say that poor water quality is an indicator of poverty. Yes, the poor often have bad water. But is this a cause or an effect? Certainly, poor-quality water brings with it problems like water-borne diseases and infant mortality. But if they had good water would they still be poor? Probably, but their quality of life would be improved.

Fish and the commons

Fish in general are a common resource and at least in the case of maritime fisheries have been plundered to the point of collapse with the advent of industrial fishing in the last century. Will the Mekong suffer a similar fate? There is evidence that the total catch has remained static for the last 10 years, so that per capita consumption has fallen as the population has increased. The productivity of the Tonle Sap fishery in Cambodia, which provides livelihoods for over one million people, depends on the seasonal ebb and flow of the Mekong. Will hydropower dams impact the fish catch by smoothing out this seasonality and cause wrenching social change? Will economic development based on hydropower provide compensation for the population that now depends on fishing? If there is a parallel between possible loss of the commons of the fish in the Mekong and the misery and migration caused by the enclosure of the commons in the United Kingdom 250 years ago, there is little cause for optimism.

Legal duality

Legal duality of institutions leads to the inability of herders, migrants and fishers to get access to land and water resources in West Africa (see the Niger and the Volta papers). Central governments have been unable to insist that rights to land and water should be by means of formal land title. The breakdown of traditional cattle herders' access to forage and water is having a profound effect on their livelihoods in West Africa.

Transboundary issues

Transboundary institutional weakness is a common theme, identified in all but the Karkheh, which is entirely within one country. Boundaries do not have to be international to be problematic; provinces in China and states in federal systems such as India are quite proprietary over the waters within their borders.

One reviewer of the Limpopo paper commented that the river is notable for not having a large dam that would encourage transnational co-operation. There is no large dam on the lower Limpopo because there is no suitable dam site. But it begs the question of whether large dams do indeed encourage transnational co-operation. Giordano et al. (2005) show that despite tensions, transboundary rivers encourage more cooperation than conflict.

Salman (2010) describes how upstream riparian countries can be "harmed by downstream [riparian countries] through foreclosure of their future uses [of water]". He concludes that co-operation amongst riparian countries is the cardinal principle of the law of international waters, and that the interests and concerns of both upstream and downstream riparian countries need to be considered by all parties. It is hard to argue against that conclusion, but implementing it requires good will on all sides, which is difficult to achieve if all parties continue to pursue their own narrow interests, as they often seem to do.

Transboundary institutions

Most of the transnational rivers do have a statutory institution, nominally with a coordinating role, but

the participating countries in general have not ceded any useful authority to the institutions they have created. They remain bodies that support dissemination of research, and convene conferences and meetings, but they do little to influence political outcomes, which can only be arrived at by consensus of the constituent countries. The Nile River Commission is dominated by the downstream countries, Egypt and Sudan, who insist on adherence to the arrangements made in colonial times, which did not consider upstream countries. Indeed, Egypt threatens to go to war with any country that presumes to reduce downstream flows of the Nile.

The Volta River Commission does achieve some useful collaboration between Ghana and Burkina Faso, which together occupy 84% of the basin. In contrast, each of the members of the Mekong River Commission (MRC), Cambodia, Lao PDR, Thailand and Vietnam, insist on their right to do whatever is in their own best interests. China's participation in the MRC is limited to observer status, and although it appears to be increasingly willing to co-operate, there is little reason to expect that it will be any less protective of its interests than other Mekong Basin states. Even though the number of nations involved is fewer, conflict in the Ganges is more intense. The Farakka Barrage in India, 10 km upstream from the border with Bangladesh, controls the Ganges by diverting it to the Hooghly River from its course through Bangladesh. India closes it during the dry season, but opens it when the Ganges floods so that Bangladesh gets no Ganges water in the dry season, but is inundated when the river floods. Repeated efforts to resolve the issue have not been successful.

Climate change

The threat of climate change hangs over all. The global circulation models forecast that temperatures will rise by 2°-3°C by 2050, which will increase water lost to evaporation. The effect of the higher temperatures on crop yield is harder to predict, but there are some indications with maize and rice that higher temperatures will reduce yields. Precipitation is not so clear-cut, but most basins are likely to decrease somewhat, which when coupled with higher temperatures, will cause more water stress on crops. Moreover, with less snow and ice to spread river flows, timing of flow peaks will change and there will be more floods. In some places, there will be plant-breeding solutions, such as crops that flower earlier in the day to avoid the heat, but these are possibilities rather than off-the-shelf solutions. There are also agronomic solutions, such as later planting to avoid high rates of evaporation during the very hot weather that precedes the monsoon to reduce the demand on groundwater in the Indian Punjab.



Basin summaries

The outstanding features of each basin are summarized below:

Andes

The Andes are a complex system of independent basins in which biophysical and developmental diversity are confronting change. The economies of the Andean countries are developing, although there are still large populations who do not share the benefits. The pressing issue the

countries confront is how to share the benefits of development more equitably.

Ganges

The Ganges Basin is under extreme population pressure. Low WP downstream contrasts with high WP upstream but unsustainable groundwater use. There were great benefits from the green revolution in the western states, but much less in the eastern states. The Farakka Barrage is a transnational issue, which forced Bangladeshi farmers to adapt to less water by changing from flooded, dry-season rice to other crops and irrigation by groundwater.



Indus

The Indus is a closed basin that is under extreme population pressure, with aging, unreliable water infrastructure, and increasing, unsustainable use of groundwater. The challenge is to upgrade the infrastructure to reduce dependence on groundwater, and to manage use of groundwater to maintain the resource.

Karkheh

The Karkheh Basin is under pressure to meet Iran's need for food self sufficiency. In general, the rural population of the basin is not the poorest in Iran. Water for the downstream Hoor-al-Azim wetlands on the border with Iraq is not a political priority.

Limpopo

The riparian countries of the Limpopo have vulnerable populations, unreliable water and low WP. Upstream is a juxtaposition of productive commercial agriculture and unproductive subsistence farming. Downstream is characterized by a poor population vulnerable to the basin's damaging floods and droughts.

Mekong

The Mekong is a diverse basin facing the tensions of development. The commons of the fishery resource on which many depend for their livelihoods is vulnerable to changed hydrology by hydropower dams. The countries as a whole may benefit, but those whose livelihoods depend on fishing likely will not. China's role remains an enigma.

Niger

Water poverty and actual poverty in the Niger are caused by illiteracy, poor-quality water and dysfunctional institutions. Planned dams upstream of the Inland Delta threaten its annual flood on which much of its productivity and the livelihoods of a million people depend.

Nile

The Nile Basin is characterized by downstream-upstream conflict and unmet agricultural potential in the upstream countries. Eighty per cent of the water that arrives at the Aswan Dam comes from Ethiopia, which wants to develop some of its irrigation potential. Egypt and Sudan want to maintain the flows agreed in colonial times.

Volta

Ghana in the Volta Basin is regarded as a model in West Africa being further along the development pathway than Burkina Faso or any of the Niger countries except oil-rich Nigeria. Ghana's "rural households accounted for a large share of a steep decline in poverty induced in part by agricultural growth" (World Bank 2007), and the fertility rate is falling as a consequence. Upstream small dams will have little effect on hydropower at Akasombo.

Yellow

China's burgeoning economy puts increasing pressure on agricultural water, and in the case of the Yellow River Basin, has caused extreme basin closure and increased water scarcity. The Yellow River Basin shows that a centrally directed economy can facilitate dramatic shifts in water allocations in the absence of firm and litigable rights to water, but it is not without cost. After not reaching the sea for a number of years in the late 1990s, there is now a minimum year-round flow, but achieving it caused hardship to upstream water users.

The Role of Agriculture for Development

Ogilvie et al. conclude in their paper on the Niger that "improved agriculture and water management require technical, sociological, and regulatory changes to address the wider causes of poverty". This could be said of all basins. The tough question is how to make these changes happen. The short answer is economic development. But how can that be achieved? According to the World Bank (2007),

the solution is through support of agriculture: "Agriculture has served as a basis for growth and reduced poverty in many countries, but more countries could benefit if governments and donors were to reverse years of policy neglect and remedy their underinvestment and misinvestment in agriculture" (World Bank 2007).



The World Development Report (World Bank 2007) goes on to argue that agriculture was heavily taxed to support industrialization, which, coupled with continued anemic investment in agriculture, reflects a political economy in which urban interests dominate policy that "proved lethal in Africa" (Byerlee *et al.* 2009).

In the twenty-first century, agriculture continues to be a fundamental instrument for sustainable development and poverty reduction, even while economies move beyond agriculture to more industrial economies: "The global development agenda will not be possible without explicitly focusing on the role of agriculture for development" (Byerlee *et al.* 2009).

Using agriculture as the basis for economic growth in the agriculture-based countries requires a productivity revolution in smallholder

farming. To pursue agriculture-for-development agendas, local, national and global governance for agriculture need to be improved. Growth in GDP from agriculture is at least twice as effective in reducing poverty as growth in GDP in sectors outside agriculture. In the case of China, growth in agriculture reduced poverty 3.5 times more than growth outside agriculture, while in Latin America it was 2.7 times more (World Bank 2007).

Agriculture is therefore the basis for economic growth, even though development moves economies beyond it. But increased agricultural activity has major impacts on the river basin systems that support it. Furthermore, as development moves

beyond agriculture, demand increases from other sectors and from the populations they sustain. Achieving processes that support balanced development of water and food systems requires detailed insight of conditions as they occur in basins, together with analysis of processes that cause them.

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