Debunking the water scarcity myth: understanding future water use challenges

Tassilo Tiemann², Simon Cook³


Can we feed 9 billion people with the water we have?

The human race is constantly growing and increasing pressures on natural resource. It is forecasted that due to population growth and changes in lifestyle, the world will need about 70 percent more food by 2050 than it does today. But is it biologically and physically possible to meet this demand? In many places we are already experiencing water shortages: where will the water for the thirsty agricultural sector come from? What do the largest basins in the world look like now and how could they look in the future? What is the link between increasing food security and reducing poverty? What is the ecological, social and economic price to pay for feeding the world and can it be sustainable?

Given the increasing number of apocalyptic visions regarding resource depletion and mass starvation, the Challenge Program for Water and Food (CPWF) developed the Basin Focal Projects (BFPs) to examine in greater detail development, poverty and water productivity in ten river basins worldwide and to provide a more nuanced picture of reality and future challenges.

The 10 river basins that were studied include: the Andes and São Francisco in South America; the Limpopo, Niger, Nile and Volta basins in Africa; and the Indus-Ganges, Karkheh, Mekong, and Yellow in Asia. The basins – distinct and gargantuan geographic areas defined by water flows from high-ground to streams that feed major river systems – cover 13.5 million square kilometers and are home to some 1.5 billion people, 470 million of whom are amongst the world’s poorest.

The BFPs were created simultaneously as ten independent subprojects under one theme and common framework (water-food-poverty) working in major basins in the tropics and subtropics to identify major food production-related trends in the world. Their objective was to produce data on the actual state of water availability, water productivity and use, poverty and institutions in regionally important and diverse watersheds.

Steering ten wild horses

The BFPs started as a three-year project but were extended by another two years to include a second phase. In the first six months of the first phase, project participants realized that a logical framework was needed to link the components and create a truly integrated research approach. This framework was actively developed in workshops over several months. The ten basin subprojects were only loosely connected, and it became clear that one central coordinating unit was needed to oversee the global picture and guide the specialized units working in local contexts with local partners.

In a series of workshops a work-package structure was developed by the sub-project scientists together with the central unit systems specialist (Figure 1). This approach ensured that the lead structure was clear to all subproject scientists and at the same time would be flexible enough to account for the highly diverse systems the subproject worked with.
One of the most exciting features of the BFPs – their multi-disciplinarity and extreme diversity – was also their biggest challenge. Covering a broad range of topics with many specialists, the central unit had to ensure that people were working on all aspects of the framework and not only on their specialty. Facilitating communication between disciplines and creating mutual understanding were the critical factors in successfully working across disciplines.

This culminated in cross-cutting analyses, addressing the work-package structure and additional globally relevant topics such as: water availability, water productivity, development/poverty, institutions, resilience and climate change (summarized in the special issue 2011, see references).

**Figure 1: Work-package structure developed as the central framework for the BFPs.**

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It's not about food, it's about people's lives

The outcomes of the BFPs remind us that while from a larger perspective the problems we scrutinize have to do with food security, development and sustainability, from the farmers’ perspective they are primarily to make a living in a complex environment, shaped by a multitude of interests. Farmers use land and water resources according to a social context, which cannot be engineered but evolves through a form of “bricolage” (tinkering). This complex process happens within the boundaries of the current level of development, which defines the society’s capacity to respond to challenges. Societies move on a trajectory which is largely defined by mastered challenges, emerging constraints and evolving demands. Based on this trajectory it is possible to roughly identify where to position basins on their development pathway and which factors will influence further progress as indicated in Figure 2.

**What does the future hold?**

The cross- basin analyses conclude that although water availability is limiting in some cases, smallholder development is much more strongly affected by low water productivity due to poor agricultural and water management practices, as well as constraining institutions. The latter can be related to general institutional weakness, legal duality, unclear responsibilities or inappropriate organizational arrangements to address complex transnational issues, leading to low overall performance, low investments and social tension.

The results show a diversity of potential evolution and a small Global Drivers workshop was held with mostly BFP invitees to identify the global drivers affecting the basins.

**Economic activity** – changes in demand and supply that link activities in basins with regional or global activities. Activity within basins generates demand that may be met by supply from outside, and activity outside the basin may stimulate supply from within.

**Population and demography** – pressure through population density (especially in Asia), evolution of total population (strong population growth in Africa), migration (driven by urbanization), and ‘feminization’ of agriculture (especially in Africa), all of which have an impact on agricultural development.

**Figure 2: Emerging constraints: Basins in the development trajectory for different societies indicating emerging constraints**
Political discourse – shape national and local formation and working of institutions which influence individualistic or collaborative behaviors. While international dialogue can be an important driver, at the local level, politics shapes the nature of arrangements between groups sharing resources.

Climate change – shifts in environment will lead to major crop losses but also gains on different scales. Incidence of extreme flood or drought events will increase. Increased uncertainty, partially as a result of greater variability of climate events, will constrain long-term investment, bring additional obstacles to negotiated settlements over water resources, and disrupt emerging supply chains on which high productivity depends.

Innovation and technology – innovation is an on-going process in which people adapt technologies to their own particular needs. Technology is largely top-down and is often imported from outside the community.

The specific role of these drivers in various basins was analyzed and used to develop scenarios for five basins in a step-by-step thinking exercise.

Basin characteristics and potential scenarios can briefly be summarized as follows:

In the Limpopo basin, riparian countries have unreliable water availability and low water productivity, in addition to historically grown civil conflicts. Upstream productive commercial agriculture and unproductive subsistence farming are found side by side. Downstream the poor population is vulnerable to the basin's damaging floods and droughts.

**Scenarios**

a) Mining and industrialization leads to the continued feminization of agriculture. Increased demand for high quality food, scarce land and market opportunities lead to intensification and increased mechanization, financed from profits from livestock. Political progress brings in land reform, together with infrastructure development and transboundary water use agreements.

b) Climatic variability and reduced rainfall limit the capacity of agriculture to respond to market demand and opportunities. Labor shortage due to migration, HIV, feminization and aging. Investments in mechanization are not viable despite government promotion. Investment in food import instead of infrastructure or social security. Land reform fails due to labor shortage and low returns to farming.

The Nile basin is characterized by downstream-upstream conflict and unmet agricultural potential in the upstream countries. Eighty percent of the water reaching 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. The preservation of critical ecosystems is not a priority for development.

**Scenarios**

a) FDI on sustainable hydropower development in upstream countries through building sustainable water storage facilities for local industries promote benefit sharing and guarantee irrigation water access for downstream communities. Strengthened local institutions and increased flow of knowledge and interventions create more resilient societies. Positive implication on public-private partnerships, including eco-tourism, fisheries etc., benefit the rural population and wider public.

b) In a context of regional power imbalances, and against a background of global economic uncertainty, FDI driven by self-interest lead to poor domestic economic development characterized by inequity and land grabbing. Food and fertilizer prices rise, while a basin wide pact is far away. Countries strive for water but there is no effective responsive governance and water competition. Deforestation and land degradation worsen. Poverty and inequality increase, resilience lowers.

In the Volta basin the increased risk of practicing rainfed cropping throughout the country where rainfall becomes less reliable from south to north is reflected also in higher rural poverty. Yields are low due to drought and dry spells during the growing season, infertile soils, poor infrastructure, low inputs and labor productivity. Water-related diseases are widespread and half of the rural households depend on low-quality water. The duality between the legal state and the traditional hierarchy complicates land tenure and hinders investment.

**Scenarios**

a) Rise in temperatures and unpredictable rainfall patterns alongside 3% population growth force rural populations to marginal lands and then into urban poverty. Acquisition of remaining productive land by foreign investors paying off government officials.

b) Temporary urban migration imposed by basin stresses and shocks, raise the possibility of diverse livelihoods options, including access to micro finance, increased demand for alternative products and markets. These are facilitated by civil society initiatives and effective government and regional subsidies and so offset some of the impacts of climate variability.
The Mekong is a diverse basin facing the tensions of development. The fishery resource and rice production in the delta on which millions depend is vulnerable to changed hydrology by hydropower dams which favor certain sectors and groups. Increasing urbanization and rural powerlessness leave smallholders largely behind.

**Scenarios**

a) Power demand in Thailand and Vietnam leads to a sharp increase in hydropower development. Dams result in sharp decrease of downstream fisheries. Widespread private sector corporatization of fish and farming occurs. Migration increases. Civil society develops with economic growth and CSOs engage with decision-makers and advocate for change. Corruption skyrockets. Flood pulsing decreases; dry season flows increase, and ecosystem services are lost. Nutritional demands are not covered for the poor. As FDI still take place, stakeholders give in.

b) Similar to a) but as a consequence of dam development violent protests emerge, destabilizing the region.

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.

**Scenarios**

a) Global depression hits national economies and resources for rural development become unavailable. Green economy stagnates, uncontrolled foreign direct investments (FDI) threatens rural poor. Climate change affects agricultural systems. Populations migrate to cities despite dire economy.

b) A sustained growth of the economy including green economies, sustains the development of Ecosystem Services. Due to higher investments in rural support, population stabilizes and increased prosperity leads to political stability. Adaptation to climate change is enhanced by improvements in governance, international cooperation and diversity in the rural economy.

The BFPs produced a wealth of information of the state of affairs that has been published in the form of a book\(^4\), three special issues\(^5\), individual project reports\(^6\) and many sub-project publications for a variety of audiences, often published in local languages specifically tailored for the people in the respective basin area.

A major communication campaign was carried out to release the findings at the global level. The findings were carried in more than 500 regional, local and global news outlets. Members from the European Union Commission on Water related issues used the messages from the BFP as their core messages for Rio+20. The work also facilitated CPWF working with major players such as the EDF (French Electricity Agency) on the World Water Forum High Level Panel on the Water, Food and Energy Nexus.

Another direct impact of this work is its influence on new program strategies, such as the EU R4D funding strategy, and its contribution to setting the scene for the CGIAR Research Program on Water, Land and Ecosystems and others.

The actual usefulness of the scenarios developed on the basis of these results will largely depend on the ability to communicate the importance of as crucial identified decisions to policy makers and other lead-player. One of the lessons learned from the BFPs was that more facilitation and active linkage to policy makers at the very beginning of the research process is required to ensure ownership and use of the information and findings at the local level to influence regional and basin level dialogues.

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**Citation:**


**Contact information:**

Author of the brief Tassilo Tiemann (t.tiemann@cgiar.org). The Brief series coordinator Robin Bourgeois (Robin.Bourgeois@fao.org).

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