

Water storage: a contribution to climate change adaptation in Africa

Water storage can help to safeguard livelihoods and reduce rural poverty. However, ill-conceived water storage will fail to deliver intended benefits and, in some cases, may worsen the negative impacts of climate change. More systematic planning is required to ensure suitable storage systems that support development targets, as an international research project demonstrates.

To provide water for households, agriculture and energy, diverse ways of storing water have been applied all over the globe. Researchers from Europe, Ethiopia and Ghana considered how this diversity could better contribute to food security and poverty reduction under conditions of climate change. They have developed the concept of a water storage continuum (see Figure on page 39).

When it is abundant, water can be stored in reservoirs, aquifers, soil and wetlands. Technical devices, such as pumps or dam outlets, enable this water to be used during drier periods. Importantly for agriculture, water can also be withdrawn directly from soils by plants and crops. Each type of water storage has its own niche in terms of environmental and social impacts. The impact of different types of storage on poverty and food security can vary significantly, with some options being more effective

than others. There is no best option per se but only a best option for a specific location at a specific time. To determine what this best option is, a number of

variables need to be considered. These include the cost of the water storage, environmental and health risks, politics and social-economic factors.



Irrigation canal.

Irit Eguavo

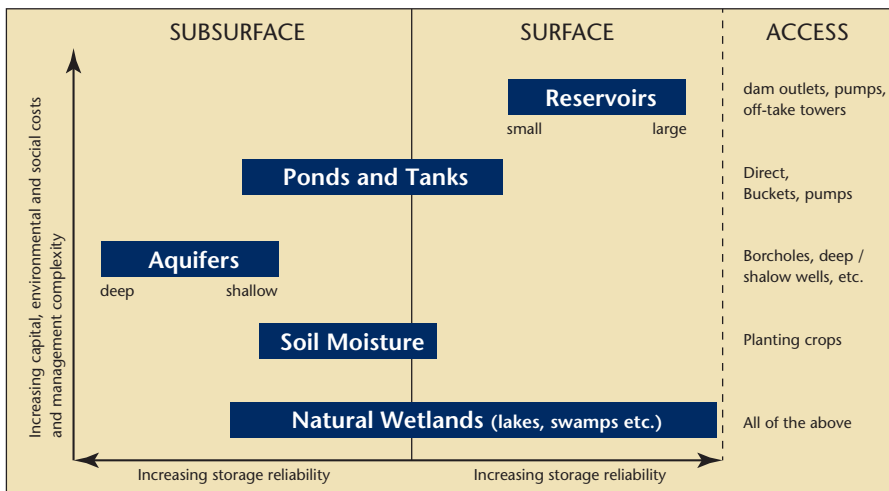
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The water storage continuum



■ The evaluation of water storage

In assessments for development cooperation, information on different variables is combined, based on cost-benefit analysis. The focus is, however, put on one option, rather than on a system of options with diverse components. The project “Re-thinking Water Storage for climate change adaptation in sub-Saharan Africa” (see Box below) suggests an alternative evaluation method called outranking, which fulfils the principle of efficiency but is based on more diversified variables and evaluation techniques to highlight the advantages and disadvantages of a storage option within a specific context.

Time is an important variable. The construction of large dams tends to interrupt agricultural production for a few seasons, especially when resettlement, land reallocation and new crops are part of the dam project and former activities, such as livestock rearing, cannot be pursued any longer. Farm households depend on compensation payments to bridge the intermediate period and are at serious risk of impoverishment. These risks finally diminish when the farmers generate financial benefits of the water storage after having been able to assess their new land plot, been connected to an irrigation

canal and gained experience with irrigation and finding good markets. Usually, additional investment in non-farm employment opportunities is required to provide a livelihood for those who cannot participate in the project. If these opportunities are not forthcoming, a number of targeted beneficiaries may remain trapped in poverty.

Immediate benefits can be generated in projects where the population is involved in work programmes such as terracing and the construction of small dams which provide opportunities for poor rural communities. Often, these schemes are food-for-work initiatives, but if farmers are paid, the money provided may serve to settle debt, repair houses and invest in agricultural and household equipment, as well as in livestock, education, health or weddings. Findings from Ethiopia show that farm-

ers were able to negotiate the amount of money with local authorities. Small dams do not necessarily result in the reallocation of land. Compensation claims and management problems are more easily settled at local level. Usually, rainy season cultivation continues and is expanded to dry season farming once the water is available. But small dams are not a panacea. If badly designed, they fail, and there are many instances where small dams have promoted malaria.

■ Lack of integrated planning

Since the impacts of climate change are uncertain it may be best to build on the complementarities of different storage types, and, in any given location, the best approach may be a combination of different storage options. The first step in the project was to compile data on all storage types in the Blue Nile basin of Ethiopia and the Volta basin in Ghana. There is a tendency to approach water storage from a purely technical perspective, concentrating on hydrology, crop productivity or environmental consequences in studies on single technical solutions. It is rare for all these issues to be considered together and even rarer for the social and political aspects to be incorporated. The researchers attempted to bring these aspects together in an integrated fashion.

Compilation of data from the two river basins revealed some common

The project

“Re-thinking water storage for climate change adaptation in sub-Saharan Africa” (2008–2011) was part of a research initiative co-ordinated by the GTZ Advisory Service on Agricultural Research for Development (BEAF) and funded by the German Ministry for Economic Cooperation and Development (BMZ). The studies were realised by a consortium including the International Water Management Institute (<http://africastorage-cc.iwmi.org>), Arba Minch University, the Ethiopian Economic Association, The Water Research Institute in Ghana, the Institute of Statistical, Social and Economic Research at the University of Ghana, the Center for Development Research at the University of Bonn (<http://www.zef.de/1393.html>), as well as the Potsdam Institute of Climate Impact Research.



Photo: S. Marx

This boy's family had to relocate for the construction of the Koga dam. Many farmers say that they are considering moving to Merawie town to improve their children's education.

a key role in ascertaining the possible implications of changing temperature and rainfall for existing and planned water storage in both river basins.

These studies showed that in both basins, despite continuing great uncertainty about how climate change will impact the water resources, the technical performance of large reservoirs is likely to be adversely affected by the changes in climate. Although investment in reservoir storage brings benefits, both in terms of irrigation and hydropower production, these benefits are significantly reduced as a consequence of climate change. The changes are likely to have significant consequences for economic development and food security in both river basins. Against this background, water resource development requires interventions that bolster resilience and water security. This necessitates much more systematic planning, greater co-operation between the riparian states in each basin and consideration of innovative approaches to water storage, such as managed aquifer recharge.

practices and knowledge gaps, which likely represent the current situation in many African countries. Despite the fact that researchers, policy-makers and development agencies recognise the importance of water storage for economic development, there is a considerable lack of reliable information on both existing and planned storage. For both basins, basic understanding (e.g. of groundwater availability and groundwater recharge) is insufficient or simply lacking. Data and information for a range of storage types are unavailable or dispersed and difficult to access. With the exception of large dams, past storage development has occurred in a piece-meal fashion, largely through local initiatives and with minimal planning. It is generally characterised by absent or poor data management and little communication between local stakeholders, research

communities and water resources authorities, and lack of any integrated planning. From the review, it was clear that this gap had led to less than optimal investments. From an academic perspective, there are too few articles that discuss the synthesis of research findings on various storage options and from a multidisciplinary angle giving adequate consideration to social and political concerns. And more effort is required in translating the research findings for a non-scientific readership.

■ Options under climate change

The research aimed to bring together all sorts of information and knowledge, including local characteristics, different disciplinary approaches, as well as the diversity of water storage options. In addition, climate modelling played

■ Lessons from the Ethiopian Blue Nile

In addition to climatic and hydrological modelling, the project conducted ethnographic and economic research. The typical options for water storage in the Blue Nile basin are dams, terraces to increase soil moisture, tanks, river diversion, wells and ponds. The studies dealt with distributional conflicts over land and water, gender relations, as well as the acquisition and management of storage facilities, for example in the vicinity of large dams, such as the Koga dam, and in the Fogera Plains.

Fogera on the eastern shore of Lake Tana is a landscape that will be transformed in the near future as a consequence of the construction of dams for large-scale, commercial irrigation and hydro-power generation. The studies conducted for this project analysed the current diversity of water storage and will continue to observe the changes in the plains as a result of the on-going large dam projects. Fogera is located in a larger region where the German government is taking the initiative to establish a UNESCO biosphere reserve in co-operation with the Michael Succow Foundation, the Nature and Biodiversity Conservation Union (NABU) and Ethiopian partners, including the national government.

In the Fogera plains, despite similar social-political conditions and the same administrative framework, irrigation facilities are established and managed differently. Currently however, all water storage is small-scale and managed by users. Farmers are already perceiving changes in climate and believe it is having a negative impact on agricultural production. Many farmers are taking the initiative to develop new water storage and irrigation infrastructure, but often, they are reliant on assistance from government and NGOs.

Understanding the adaptive capacity of local communities and how this might change as a consequence of different water storage options is a prerequisite for choosing best options for the future. If given the opportunity, farmers will take some initiative in developing ways to minimise the ecological and economic risks arising from the installation of storage. Better communication with farmers, local authorities and donors is a precondition for community support and “buy-in” for local initiatives. The “Re-thinking Water Storage” project indi-

cates the value of farmers’ initiatives. It argues for an approach that extends storage capacities and considers small and large schemes as complementary, instead of eradicating existing systems as a side effect of large dams.

■ Consideration of different development targets

The priority to increase agricultural production may contradict other development objectives. The biosphere reserve initiative, for example, underlines the importance of the wetland (in particular Fogera) around Lake Tana in terms of biodiversity hotspots and the regulation of ecosystem functions, and as a source of local livelihood and an important carbon store. The initiative equates drainage and land use change for irrigated agriculture and livestock keeping with wetland degradation. Its feasibility study concludes that free grazing, crop production and eucalyptus plantations must be better controlled and that awareness building among the rural population on the “wise use and ecological benefits” of wetlands would be advisable.

Studies of the “Re-thinking Water Storage” project, however, have shown that it is the Ethiopian government that has decided to transform large parts of the Fogera Plain into irrigation

schemes. In fact, the government has identified the Tana Basin as part of an “economic growth corridor” for which investment is being targeted for socio-economic development of the country. This includes investment to increase agricultural production. Farmers are not involved in any form of political decision-making that concerns the future of their region. Currently, there is no local civil society response to the large dam projects and practically no co-determination by the donor community because Ethiopia does not depend much on these factors in its water development.

This is not meant to say that the expansion of irrigation is necessarily inconsistent with the conservation of biodiversity around Lake Tana. The findings emphasise that a debate on the suitability of technical options across different research communities is necessary to suggest measures that contribute equally to different development goals and climate change adaptation and reduce the impoverishment risks of interventions. The key is more systematic and integrated planning at all scales without losing sight of the political conditions. If planned and managed correctly, water storage in its various forms, including wetlands, can make a vital contribution to increased agricultural productivity, nature conservation and adaptive capacity throughout Africa.

Project staff and farmers in the Koga irrigation scheme, Ethiopia.

Photo: I. Eguavoen

