ClimDev-Africa
Policy Brief 7

Agricultural Water Management in the Context of Climate Change in Africa

Climate change is likely to intensify the current challenges of water scarcity and water competition within and between communities and nations, particularly in those countries linked by transboundary aquifers and rivers. The Intergovernmental Panel on Climate Change has indicated that climate change is impacting Sub-Saharan Africa more than any other continent because its economies are largely based on weather sensitive crop-livestock and agro-pastoral production systems. However, rural poverty, and thus the weak financial capacity of communities to invest in water and agricultural inputs, has hindered the adoption and dissemination of good water management practices. Communities, governments, and local institutions are not yet well prepared to respond to the emerging challenges associated with climate change. Agricultural water management (AWM) offers a way of facilitating water-centred development to simultaneously reduce poverty, increase food security, and adapt to climate variability and change. It aims to decrease unproductive water losses from any water system and to increase the adaptive capacity of communities and institutions.

Key messages

- Climate change is likely to intensify the water scarcity challenges that Africa is already facing.
- Improving crop, livestock, and water productivity is central to agricultural water management.
- Many options exist for improving agricultural water management and adaptation to climate change.
- Many of these options can also improve the profitability of smallholder agriculture and reduce vulnerability.

Agricultural water management interventions

AWM encompasses a variety of approaches, including integrated watershed management, rainwater harvesting, use of small earth dams and weirs, use of sand and sub-surface dams, watershed harvesting and storage in the soil profile, and spate flow diversion and utilisation. *Integrated watershed managemen*t is a strategy to manage natural resources at the watershed level that takes into account naturally occurring biophysical processes, social institutions, and human activities within a watershed. Managing water at the watershed scale also entails managing run-off, controlling soil erosion, and improving vegetative cover. *Rainwater harvesting* is defined as capturing and storing seasonal excess runoff and diverting it for household and agricultural uses. Using rainwater harvesting, farm households have started to diversify cropping systems, introduce new vegetables and perennial crops, and increase their household income. *Small earth dams and weirs* can provide adequate water for irrigation projects as well as for livestock watering. Where seasonal rivers carry a lot of sand, s*and and sub-surface dams* can be used to store water for use during the dry season. This can be a cost-effective method for providing water for drinking and also

for irrigation. Because the water is stored under the sand, it is protected from significant evaporation losses and is also less liable to contamination. *Water harvesting and storage in the soil profile* involves harvesting runoff for crops from land, roads, and paved areas and channelling it to specially treated farmlands for storage in the soil.

Large- and small-scale irrigation

Irrigated farming is becoming a necessity in Africa's drought-stricken regions for various reasons. First it reduces the vulnerability of farmers to rainfall variability. Secondly it increases agricultural production per unit of land, water, and labour. Third, it enables communities to produce high value on their farms. And fourth, it strengthens collective action for broader land and water management. However, except for a few North African countries, the amount of irrigated land in Africa is low. As most irrigation schemes in Africa currently rely mainly on surface water, there exists huge potential for using groundwater for irrigation. To expand irrigable land in Africa, particularly at the household level, communities should explore groundwater opportunities. A wide range of irrigation technologies and methods are available. These include surface irrigation methods, like the furrow and small basin methods, and low pressure and pressurised systems, such as sprinkler, drip, and water-lifting technologies, such as pumps.

Crop and livestock water productivity

Improving water productivity would enable production of more livestock and produce more crops per drop from less water, which would reduce future water demands, limit ecosystem degradation, and reduce competition for water among multiple uses and users. One option is to genetically manipulate crops to maximise water use efficiency and/or recovery of water lost from the rhizosphere through evaporation and seepage. Another is to integrate livestock water needs into overall water management, including in the design, planning, and implementation of irrigation schemes. Interventions to improve livestock water productivity include water management, feed type selection, enhancing feed quality and quantity, improving feed water productivity, undertaking grazing management, increasing animal productivity, and improving animal health. Grassland management, which includes erosion control, grazing control, making strategic watering points available for livestock, and different forms of water harvesting are adaptation strategies to minimise effects of climate change and variability. Grasslands are almost as important as forests in recycling greenhouse gasses.

Climate-proof crop varieties

Drought denotes a prolonged period without considerable precipitation that may cause a considerable reduction in soil water and thereby cause plant water deficits. In Africa, farmers experience drought in a number of ways that may happen alone or in combination. The major drought resistance mechanisms in field crops are classified as drought avoidance (drought resistance with high plant water potential) and drought tolerance (drought resistance with low water potential). To date, no traits are known that confer global drought tolerance. Moreover, short-term responses to water stress at the cellular and sub-cellular level may not be beneficial to yields. Despite the growing demand for drought-resistant cultivars, breeders in Africa have been slow in achieving this goal due to the challenge in identifying traits that reflect true drought resistance. Adoption of crop varieties and forage with increased resistance to heat stress, shock, and drought is critical for minimising the effects of climate change. Another key strategy to mitigate the effects of climate change is improving the vegetative cover of African landscapes and increasing the potential of agriculture in carbon sequestration. However, landscapes devoid of vegetation are commonly degraded by erosion and by anthropogenic activities and may not be able to support good vegetation growth without employing soil and water management practices.

Recommendations

Options for agricultural water management and adaptation to climate change include rainwater storage for surface and underground reservoirs, various irrigation schemes to optimise water and crop productivities. They also include dryland farming, improved agronomics practices, livestock water productivity, seed genotype improvements, and improved policy and institutional frameworks. Despite uncertainty about the impacts of climate change on agricultural water resources, the water-related challenges Africa is already encountering are likely to increase with climate change. If water resource management decisions are taken without considering climate change, then mal-adaptation may result. AWM embraces a range of practices, including *in situ* moisture conservation and *ex situ* water management, and offers a way of facilitating water-centred development to simultaneously reduce poverty, increase food security, achieve environmental protection, and adapt to climate variability and change. The following recommendations address problems related to water needs in the agricultural sector.

- The area under sustainable land management should be extended, reliable small-scale water control systems should be developed, soil fertility and the moisture holding capacity of agricultural soils should be built up, and irrigation should be expanded.
- Support is needed to reform AWM policies and to better integrate them into the policy frameworks of African governments, thereby making them more responsive to the challenges posed by climate change.
- Coordinated monitoring and evaluation of the impact of water policies, as well as institutional arrangements at basin levels, should be pursued in addressing transboundary water issues.
- Local organisations should be guided in developing more integrated, climate proof crop-water livestock practices.
- The capacity of communities to use technologies that minimise water loss and maximise water productivity should be strengthened, and these technologies should be disseminated more widely.
- Water pricing policies should be considered. Pricing will improve irrigation efficiency and institutional performance at local and regional scales and will create a sense of community ownership of investments in water.

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