

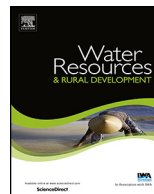


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Water management for sustainable agricultural intensification and smallholder resilience in sub-Saharan Africa

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ABSTRACT

Water management strategies and allocation policies that support agricultural intensification across agro-ecological zones and hydrologic basins are required for building resilient agrarian communities in sub-Saharan Africa. We provide an overview of the research and investments needed to enhance agriculture in the region, with a focus on technology and institutions, while describing opportunities for improving rainfed crop production. We discuss a range of water management practices in three river basins that were part of the Challenge Program on Water and Food research on Basin Development Challenges from 2009 to 2013. Our main message is that technical and institutional innovations in water management are required for creating and sustaining resilient agrarian communities in sub-Saharan Africa. Such innovations are best designed and implemented in consultations involving researchers, households, investors, and other participants with a management or regulatory responsibility. It is in this collaborative spirit that we introduce this Special Issue of Water Resources and Rural Development, in which several authors present results of studies on agricultural water management in the region, with recommendations for better planning and implementation of interventions to benefit smallholder farmers.

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1. Water scarcity in African river basins

Water is central to sustainable agricultural intensification, as it directly affects several dimensions of sustainability, including social, economic, health, and environmental aspects (WWAP, 2015). Competition for water is increasing, in both local and transboundary settings. Yet, in Africa, just 5% of the renewable water resource potential is developed, and freshwater resources are unevenly distributed in time and space (Vörösmarty et al., 2005). Some countries have abundant water resources, while others must cope with notable physical or economic water scarcity (Molden, 2007). A river basin can be characterized as both scarce and abundant at the same time, depending on the reliability of its water supply and the water uses considered (Harrington and Vidal, 2014). Scarcity in this context is defined as “a failure to achieve the right amount of the right quality of water for the right purpose at the right time for the right people (Vidal et al., 2014).” Even where water is abundant, extreme weather events, such as flooding and drought, can reduce the effective abundance of water in the near term.

The threat of water scarcity can be attributed to several factors, including urbanization, industrialization, climate variability, expanding agricultural needs, and the inappropriate use of land and water resources. According to FAO (2009), the demand for water for agricultural, industrial, and urban needs in Africa will increase by 40% by 2030. Moreover, agricultural output in SSA must double by 2050 to provide sufficient food for the increasing population (WWAP, 2015). Without substantial improvements in water productivity or shifts in production patterns, consumptive water demand in agriculture will increase by 70%–90% by 2050 (Molden, 2007). In addition, increasing population density and the encroachment of communities on to forest lands, wetlands, and critical watershed, have increased sediment loads and depleted the nutrient status of production systems, while affecting downstream investments, including irrigation schemes, hydropower dams, and roads (Amede et al., 2014; UNEP-GEF, 2013). Yet, there is limited investment and policy guidance regarding agricultural water management, such as the coordinated monitoring of the impacts of water policies and institutional arrangement at basin levels (Amede et al., 2014). Improvements in water allocation and management are needed across river basins in Africa to enhance water access and availability (Cook et al., 2012; Harrington and Vidal, 2014).

Water availability and soil fertility influence the sustainability and livelihoods of rural communities. Inadequate access to water and degraded soils expose communities to recurrent food insecurity, poverty, and potential conflicts. As most of the African continent is drought-prone and vulnerable to climate change, effective adaptation strategies are needed. The effects of recurrent drought are most notable in rainfed systems, where adaptive capacity is limited and local institutions are not yet well prepared to respond to emerging climate shocks. Improvements in land and water management practices in both rainfed and irrigated settings are needed to reverse the downward spiral toward poverty in the region.

2. Agricultural water needs for sustainable intensification

Sustainable intensification of agriculture is needed to meet the growing demand for food. However, increasing production is not sufficient to ensure food security. The equitable distribution of food and the preservation of ecosystem services also are essential. The availability of water to meet increasing food demands is the focus of much of the discourse on agricultural water management, particularly in regions with increasing competition for water and where it is difficult to negotiate transboundary water agreements (FAO, 2011). It is estimated that by 2050, rising population and incomes will result in about a 70% increase in global demand for agricultural production (FAO, 2011). While additional water resources will be needed for crop production, there is a trade-off between the resulting agricultural benefits and the benefits foregone in alternative uses of the water. Achieving sustainable intensification of agriculture will require increased irrigation, improved water use efficiencies, and higher yields, even as intersectoral competition for water increases. Physical constraints for water resources are exacerbated by external drivers, such as climate change, competition with other sectors, and socio-economic changes.

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