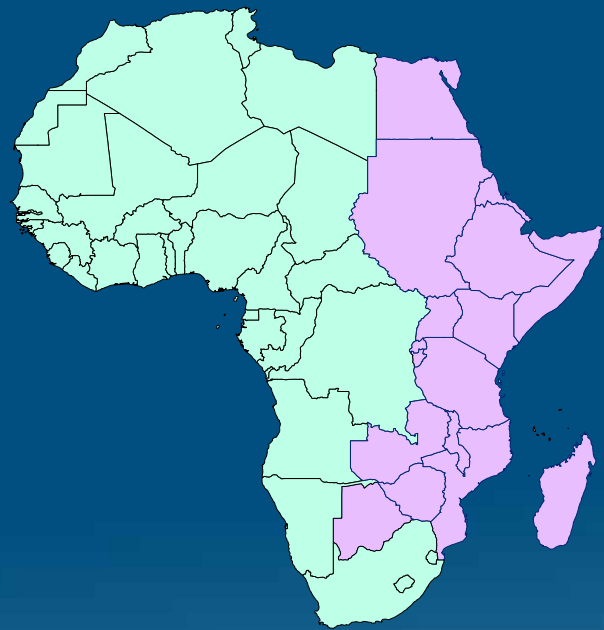


# IWMI Research in East Africa



- Filling the knowledge gap of the Nile Basin to improve decision making on water resources
- Agricultural water management to improve livelihoods, productivity and sustainability
- Using rainwater management to increase agricultural productivity
- Water storage: Providing mechanisms to deal with variable water availability
- Using modern technology for knowledge generation and sharing



## Our vision

Water for a food-secure world

## Our mission

To improve the management of land and water resources for food, livelihoods and the environment

## About IWMI

IWMI is an international non-profit organization that is one of the 15 research centers supported by the Consultative Group on International Agricultural Research (CGIAR).

## Introduction

The East Africa Region is one of the most food-insecure areas of the world, despite having significant land and water resources. The International Water Management Institute's (IWMI's) research seeks to find solutions to the agricultural water challenges that contribute to the lack of food security faced by the countries in the region. The Nile Basin, encompassing 10 countries, approximately 160 million people and the world's longest river, continues to be one of the benchmark basins of the CGIAR Challenge Program on Water and Food (CPWF) and a focus of IWMI's broader research. Over 70% of the people within this region depend on subsistence rain-fed agriculture for their livelihoods. Such a reliance on rain-fed agriculture is becoming more problematic with the increasingly unpredictable and variable rainfall occurring in the region. Land degradation, erosion, low crop yields, negative effects of climate change, unsustainable water use and sharing of water resources are also all important issues that need to be addressed. Appropriate management and development of land and water resources is crucial to reduce poverty, improve food security and increase economic growth throughout the region.

IWMI supports the effective management of land and water resources in the region by:

- generating knowledge and making recommendations on the management and development of land and water resources to governments, planners, policymakers and donors;
- partnering and collaborating with various organizations to generate a greater impact from the knowledge generated from the research carried out; and
- building the capacity of institutions, researchers and students.



Donkeys used to transport water for domestic use.

Photo credit: Prue Loney, IWMI.

## Building capacity through educational partnerships

Since the opening of the East Africa office in 2003, IWMI has supported and supervised over 150 Masters and PhD students. IWMI maintains strong links with nine Ethiopian universities and also works in partnership with universities in Sudan, Tanzania and Uganda.

For the past 4 years IWMI has contributed to the training of East African students who are studying at Cornell University to earn a Masters of Professional Studies degree in International Agriculture and Rural Development. Students have worked on watershed management projects with supervision and assistance from IWMI researchers. IWMI is increasing its educational partnerships in Ethiopia by providing supervision to Masters and PhD students who are participating in a new program on integrated river basin management, which is being initiated in several universities.

# Filling the knowledge gap of the Nile Basin to improve decision making on water resources

IWMI's research in the Nile Basin is largely focused around projects in the Ethiopian Highlands, which generate 85% of downstream river flow to the Nile. To date, the greatest benefits have also tended to be reaped in the downstream countries. Changes in land and water management practices upstream can affect livelihoods along the Nile. Identifying and adopting best management practices upstream could increase the amount and quality of the water reaching downstream users.



Small-scale irrigation in Laelay Agulae, Tigray.

Photo credit: Mastewal Degefa, IWMI.

## IWMI's guiding principles

- Poverty alleviation and gender equity
- Improving and safeguarding access to water as a pathway to poverty reduction
- Integrated water resources management
- Understanding how agriculture interacts with other ecosystems
- Providing scientific evidence for water policymakers and water managers

IWMI is generating knowledge on the hydrological, hydraulic, watershed and institutional process of the Nile Basin to:

- better comprehend and increase understanding of water availability, access, use and productivity;
- identify water management interventions that have the potential to increase water productivity and alleviate poverty;
- ensure cooperative management and development of the shared land and water resources between upstream and downstream users, including the resources across international borders; and
- inform development activities and further research.

Solutions for improving land and water management in the region involve a diversity of stakeholders both within Ethiopia and amongst downstream communities dependent on the Nile.

In the future, more demands will be made on the water resources of the Nile Basin, for agriculture, in particular, but also for hydropower and cities. Human and institutional capacity from the community to the regional scale needs improvement to ensure optimal land and water management in the Nile Basin.

For project specific information, please visit: <http://bfpnile.iwmi.org>

## Significant research findings from the Nile Basin

Research on water availability, access, productivity and use within the Nile Basin has shown that:

- there is scope for significant large-scale irrigation development in the Nile Basin. However, it must be planned and managed carefully to ensure that upstream development does not compromise current and future irrigation opportunities downstream;
- wetlands support the livelihoods of many people throughout the basin and in many places they are inextricably linked to agriculture. As pressure to intensify agricultural production increases, there is a need to better understand how agricultural practices affect wetlands and the ecosystem services that they provide;
- agricultural water management (AWM) interventions show promise to improve food security in rain-fed areas where poverty is high; and
- aquaculture and fisheries can make important contributions to increasing food security, income generation and employment in many Nile Basin countries. There is huge untapped potential for both these activities to be successfully expanded.

## Major donors

- Canadian International Development Agency (CIDA)
- Bill & Melinda Gates Foundation
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (formerly Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH)
- Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economic Cooperation and Development) (BMZ), Germany
- International Development Research Centre (IDRC)
- Japan International Research Center for Agricultural Sciences (JIRCAS)
- Rockefeller Foundation
- United States Agency for International Development (USAID)

## Agricultural water management to improve livelihoods, productivity and sustainability

IWMI and partners are identifying the most promising AWM solutions that can be promoted and upscaled to improve food security in the Nile Basin and across East Africa. These include small- and large-scale technologies and practices to capture, store or drain water, lift and transport it, and apply it to crops in the field. An important element of this work involves designing appropriate and sustainable technologies for specific contexts, including those in which weak institutions, adverse environmental conditions, lack of infrastructure or human capacity pose additional challenges.



Irrigation canals at the Koga irrigation scheme, Ethiopia.

Photo credit: Matthew McCartney, IWMI.

## Improving the performance of public irrigation systems

Public irrigation systems in East Africa and the Nile Basin rarely operate optimally due to a combination of inadequate maintenance, lack of application of appropriate irrigation technology, and inadequate policies and institutions surrounding their use. IWMI has:

- developed a method where irrigation professionals work together with farmers to analyze and improve the performance of irrigation schemes, thereby increasing farmer capacity to successfully improve irrigation schemes in the future. Use of this method has - and continues to - successfully improve the performance of public irrigation schemes in East Africa and has also been applied in West Africa. A manual of the method is available via the internet in French and English (visit: [ftp://ftp.fao.org/agl/iptrid/appia\\_manual\\_en.pdf](ftp://ftp.fao.org/agl/iptrid/appia_manual_en.pdf)); and
- diagnosed the key challenges facing Ethiopia's current and future irrigation schemes. Targeted recommendations on how to improve the performance of irrigation schemes have been presented to the Ethiopian Government, and these have contributed to the implementation of structures such as the Ethiopian Water Research Advisory Council.



Farmer and his furrow irrigation of his shallot/spring onion crop.

Photo credit: Prue Loney, IWMI.

## Using rainwater management to increase agricultural productivity

Rain-fed farming areas in East Africa and the Nile Basin suffer from low productivity, high land degradation, crop losses and inadequate water management. With a focus on the Ethiopian Highlands, IWMI works with partners to promote the adoption of improved rainwater management systems and practices by:

- examining how technologies can be combined with policy change and institutional strengthening to encourage widespread innovation and adoption;
- matching promising technologies with particular environments to achieve maximum gains in agricultural productivity from the technology;
- assessing and anticipating the consequences of successful innovations on livelihoods, productivity, land quality and downstream water quality; and
- ensuring that lessons learned are synthesized and communicated with the diversity of stakeholders working towards improving land and water management.

## Quantifying the impact of agricultural water management technologies and irrigation systems

Investing in AWM technologies and irrigation is most beneficial if it leads to a significant reduction in poverty or makes a positive contribution to a country's economy or both. Despite huge investments being made, little is known about the impact on poverty and the economy. IWMI has been:

- exploring whether the introduction of selected AWM technologies has led to a significant reduction in poverty;
- identifying which technologies have had the greatest impact; and
- estimating the contribution of irrigation to the country's economy.

Analysis from Ethiopia has shown that there is 22% less poverty among users of AWM technologies compared to nonusers, and that the magnitude of poverty reduction is technology specific. In addition, smallholder-managed irrigation systems were calculated as generating over double the income compared to that of rain-fed systems.

IWMI researchers quantified the actual and expected contribution of irrigation to the Ethiopian national economy for the 2005/2006 and 2009/2010 cropping seasons. Irrigation was calculated to contribute approximately 5.7% to agricultural Gross Domestic Product (GDP) and 2.5% to the overall GDP during the 2005/2006 cropping season. For the 2009/2010 cropping season, irrigation development was estimated to contribute approximately 9% to the agricultural GDP and 3.7% to overall GDP. With further investments in irrigation planned, AWM technologies and practices are expected to contribute to a rise in Ethiopia's agricultural GDP and overall GDP. Studies of this kind are being used to inform national policymakers and donor investment in AWM technologies and irrigation development.

For project specific information, please visit:

<http://awm-solutions.iwmi.org>

<http://challengingcontextawm.iwmi.org>

<http://waipro.iwmi.org>

<http://nilebdc.wordpress.com>



Farmer of the Blue Nile Basin.

### International partners

- Alliance for a Green Revolution in Africa (AGRA)
- Catholic Relief Services (CRS)
- Center for Development Research, University of Bonn (ZEF)
- CH2M HILL
- Cornell University
- Food and Agriculture Organization of the United Nations (FAO)
- International Development Enterprises (IDE)
- International Food Policy Research Institute (IFPRI)
- International Livestock Research Institute (ILRI)
- International Union for Conservation of Nature (IUCN)
- Japanese Aerospace Exploration Agency (JAXA)
- Keller-Bliesner Engineering, LLC (KBE)
- Overseas Development Institute (ODI)
- Potsdam Institute for Climate Impact Research (PIK)
- Stockholm Environment Institute (SEI)
- United Nations Environment Programme (UNEP)
- World Agroforestry Centre (ICRAF)
- WorldFish Center

## Regional partners

- Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA)
- Eastern Nile Technical Regional Office (ENTRO)
- Nile Basin Initiative (NBI)

# Water storage: Providing mechanisms to deal with variable water availability

Water storage provides a mechanism to address the reliance on highly unpredictable and variable rainfall in East Africa and the Nile Basin. By making water available during dry periods, storage can significantly increase agricultural and economic productivity and may provide people with an effective way to cope with climate change.

Large dams are one of a range of possible water storage options. Large dams have brought significant benefits to millions of people in East Africa through the provision of water for irrigation, hydropower and domestic use. Investment is increasing with numerous dams being planned or under construction, including dams on the Nile River and on other major rivers in the region. However, improved dam planning and management is needed to maximize the benefits and minimize the adverse environmental and social impacts of dam construction. IWMI has been conducting research to provide information that will assist policymakers and water resource managers in the planning and management of large dams. Research has illustrated how decision support systems can effectively guide decisions around complicated linkages between hydrological, environmental, social and economic factors.

An integrated approach is also needed that combines large- and small-scale storage options. IWMI is carrying out research to determine the sociopolitical, institutional and environmental conditions under which various water storage options are best implemented. Storage options being studied include water from natural wetlands, water stored in the soil, groundwater beneath the Earth's surface, and water collected in ponds, tanks and reservoirs.

IWMI researchers are also analyzing how climate change may affect existing water storage and how to account for climate change in planning and managing new water storage. Future water storage must be more reliable and resilient, and allow for greater uncertainty. This requires understanding a range of biophysical and socioeconomic issues that influence the need, effectiveness and suitability of the different water storage options. Storage systems that combine and build on complementarities of various storage types are likely to be more effective. IWMI's research will facilitate the comparison of water storage options under different climate change scenarios and environments to support future planning and investment.

For project specific information, please visit:

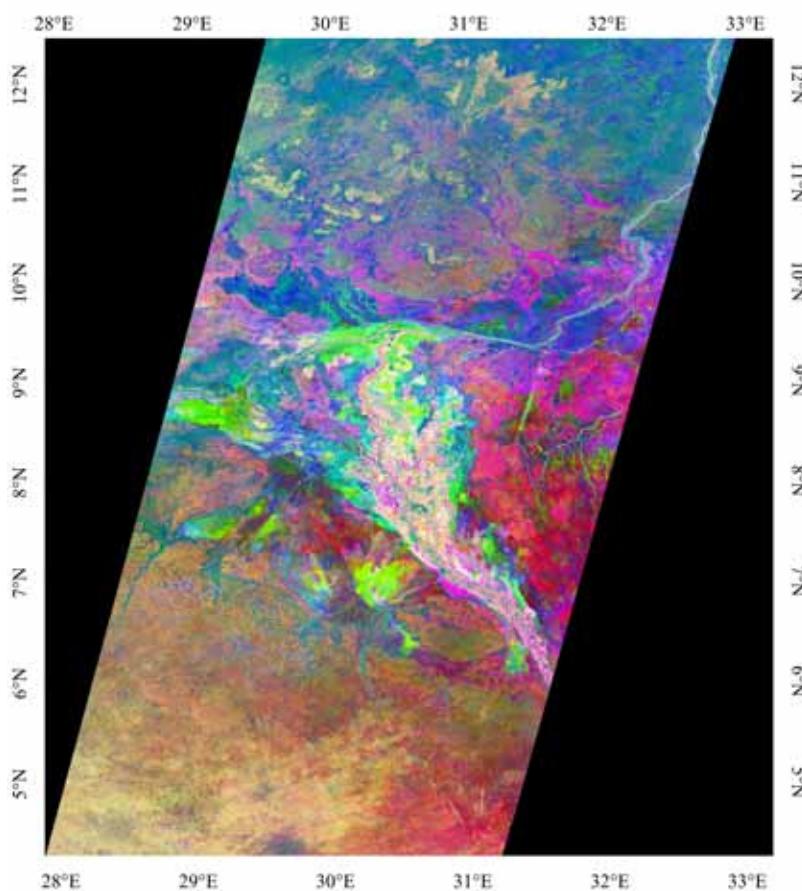
<http://africastorage-cc.iwmi.org>

## Using modern technology for knowledge generation and sharing

The diversity of conditions over the vast area of East Africa and the Nile Basin creates challenges for researchers. The utilization of modern technologies such as satellite earth observation and communications makes it possible for IWMI to extend the reach of its research.

Many IWMI projects use remote sensing technologies to gather information, in the form of images acquired from satellites or aircraft. By analyzing images taken at different times and across multiple years for the same area, IWMI researchers are able to determine landscape characteristics – e.g., vegetation cover, erosion rates, flood levels and land use change – both seasonally and over longer lengths of time. Remote sensing provides data over large areas which are often difficult to access on the ground, or where other forms of data are unavailable.

The use of radar data has allowed IWMI to obtain information on flood levels. In contrast to optical remote sensing data, the radar data sees through clouds. As a result, the data have proved critical for mapping the extent of flooding in Southern Sudan's extensive Sudd Wetlands, as peak flooding occurs during the rainy season when there is maximum cloud cover. Little is known about the current flood extent and seasonal changes in the wetlands, despite the vast extent of the Sudd, its high levels of biodiversity, and its importance to the hydrology of the region and the livelihoods of millions of people. An understanding of the extent and seasonal change in flooding is fundamental for the wise use of this vast resource. Plans for hydrological interventions in the region to increase economic benefits and food security make this research vital.



The Sudd Wetland, South Sudan, June–December, 2007 (Source: ALOS PALSAR data © JAXA/METI; processing by Lisa-Maria Rebelo, IWMI; Notes: ALOS = Advanced Land Observing Satellite; PALSAR = Phased Array type L-band Synthetic Aperture Radar; JAXA = Japan Aerospace Exploration Agency; METI = Japanese Ministry of Economy, Trade and Industry).

Access to information and knowing how to effectively act on that information are two of the biggest barriers preventing farmers from increasing yield and income in East Africa. IWMI and partners are, therefore, investigating whether affordable communications technologies, such as mobile phones, can be successfully used to provide farmers with detailed crop-specific advice in a timely manner. This project will also make use of satellite remote sensing technology to take plot-specific measurements that can be turned into location-specific management instructions. It is envisioned that with the information delivered by mobile phones, farmers will be able to optimize their farm profits by providing the right quantity of water, at the right time and in the right place.

### National partners

- Addis Ababa University (AAU), Ethiopia
- Amhara Regional Agricultural Research Institute (ARARI), Ethiopia
- Bahir Dar University (BDU), Ethiopia
- Ethiopian Economic Association (EEA)
- Ethiopian Rainwater Harvesting Association (ERHA)
- Forum for Social Studies (FSS), Ethiopia
- Geospatial Consultants Pvt Ltd., Ethiopia
- Haramaya University, Ethiopia
- Ministry of Agriculture and Rural Development (MoARD), Ethiopia
- Ministry of Water and Energy (MoWE), Ethiopia
- Nekemet University, Ethiopia
- Omdurman Islamic University (OIU), Sudan
- Oromia Regional Agricultural Research Institute (ORARI)
- UNESCO-Chair in Water Resources (UNESCO-CWR), Sudan
- Wollo University, Ethiopia

## Contact Information

### IWMI Headquarters

127 Sunil Mawatha  
Pelawatte  
Battaramulla  
Sri Lanka

### Mailing Address:

P. O. Box 2075  
Colombo  
Sri Lanka  
Telephone: +94 11 2880000, 2784080  
Fax: +94 11 2786854  
Email: [iwmi@cgiar.org](mailto:iwmi@cgiar.org)  
Website: [www.iwmi.org](http://www.iwmi.org)

### IWMI Offices in Africa

#### Subregional office for East Africa and the Nile Basin

C/o International Livestock Research Institute (ILRI)-Ethiopia Campus  
Wereda 17  
Kebele 21  
Addis Ababa  
Ethiopia

### Mailing Address:

P. O. Box 5689  
Addis Ababa  
Ethiopia  
Telephone: +251 116 457222/3  
Fax: +251 116 172001  
Email: [iwmi-ethiopia@cgiar.org](mailto:iwmi-ethiopia@cgiar.org)  
Website: [eastafrica.iwmi.org](http://eastafrica.iwmi.org)

#### Regional office for Africa

C/o, CSIR Campus  
Martin Odei Block  
Airport Residential Area  
Accra  
Ghana

### Mailing Address:

IWMI Ghana  
PMB CT 112  
Cantonments  
Accra  
Ghana  
Telephone: +233 302 785753/4  
Fax: +233 302 784752  
Email: [iwmi-ghana@cgiar.org](mailto:iwmi-ghana@cgiar.org)  
Website: [westafrica.iwmi.org](http://westafrica.iwmi.org)

Director, Africa: T. Olalekan Williams ([t.o.williams@cgiar.org](mailto:t.o.williams@cgiar.org))

