WATER FIGURES

TURNING RESEARCH INTO DEVELOPMENT

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Water Storage and Climate Change

As climate change poses an ever-greater threat to water systems and agriculture, flexibility in choosing from a variety of water storage systems will become an increasingly important mechanism for adaptation. **Read more ...**

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IWMI
International
Water Management
Institute

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

EDITORIAL

WATER FIGURES ISSUE 2, 2009

Same Issues, More at Stake

Interest in climate change is heating up as we approach the UN COP 15 Conference in Copenhagen this December. Everyone seems to be looking for ways of linking their projects and programs to the issue of the hour, or should we say the century. IWMI's position on climate change is much the same as it has been over a decade now: as our climate changes in response to rising temperatures, adaptation will be the key to food security and livelihoods. Vladimir Smakhtin, IWMI's Theme Leader for Water Availability and Access, feels strongly that:

"A point too frequently overlooked in the debate on climate change is that climate is just one of the many drivers that are shaping water resources management and agriculture. There are other issues and drivers that may have a much greater impact on land and water resources in the short to medium term in different regions. We have to take the multitude of these factors into account."

Vladimir is not alone on this point. Roger Calow of the London-based Overseas Development Institute (ODI) makes the same point in his blog post of March 2009. He asks, "Is the overwhelming emphasis on water and climate change justified?" Roger believes that, "treating development and climate adaptation as separate issues is misguided. In Ethiopia, for example, extending access to secure water and sanitation, and reducing dependence on unprotected water sources, is central to both poverty reduction and climate adaptation. Together with demographic shifts, urbanization, water pollution and changing land use, climate change is just one of the many pressures on water."

Based on current scientific evidence, Prof Nigel Arnell, Director of the Walker Institute for Climate Systems Research, suggested that "robust, flexible climate adaptation" was the best way forward. Similarly, Margaret Catley-Carlson of the WEF Global Agenda Council on water, emphasized the need for "soft" solutions such as protecting forests and wetlands, addressing industrial pollution, and integrated water resources management.

This is familiar territory to IWMI scientists working in Asia and Africa. The people we work with, be they senior ministry officials or poor farmers in remote areas, are quite capable of understanding the significance of melting polar ice caps and the need for global agreements on carbon caps. Their main concerns tend to focus on how they will manage to grow enough food for growing populations and fill the growing demand for water from other sectors, including the environment.

Terry Clayton
Editor

EVENTS

Road to Copenhagen

Danish Climate Camp, Copenhagen, July 11-19

Stockholm World Water Week 2009, Copenhagan, Sweden, 16-22 August

IAAE-New Landscape of Global Agriculture, Beijing, August 16-22

3rd World Climate Conference, Geneva, August 31

PRODUCTION CREDITS

EDITOR Terry Clayton - t.clayton@cgiar.org

CONTRIBUTORS
Matthew McCartney - m.mccartney@cgiar.org
Vladimir Smakhtin - v.smakhtin@cgiar.org
Charlotte de Fraiture - c.fraiture@cgiar.org
Seleshi Bekele Awulachew - s.bekele@cgiar.org

LAYOUT Sumith Fernando - s.fernando@cgiar.org

IWMI
Headquarters - 127 Sunil Mawatha, Pelawatte, Battaramulla, Sri Lanka

MAILING ADDRESS:
P.O. Box 2075, Colombo, Sri Lanka.
Telephone: +94-11-2880000
Fax: +94-11-2786854

EMAIL: iwmi@cgiar.org

Rethinking Water Storage Options for Climate Change

This article is adapted from IMWI's Water Policy Brief No. 32, Rethinking Water Storage for Adaptation to Climate Change, by Matthew McCartney, Vladimir Smakhtin, Charlotte de Fraiture and Seleshi Bekele Awulachew.

As climate change poses an ever-greater threat to water systems and agriculture, flexibility in choosing from a variety of water storage systems will become an increasingly important mechanism for adaptation.

Variations in climatic conditions are nothing new. Farmers anywhere in Asia or Africa will tell you that some years the rains come early and last longer or that every five years or so there is a prolonged period of drought. They can also demonstrate some creative ways of adapting to those variations. What global warming will do is increase the range of variation and dramatically alter climatic conditions in some regions. Adapting to the impact these changes will have on water resources and food production will be one of the world's most serious challenges over the next 50 years. Understanding how we adapt to our current state of climate variability is the key to adapting to future climates, which brings us back to the agenda of conventional water management measures but requires us to rethink them as options for adaptation. Take water storage as one example.

Farmers have always relied on the water stored in rivers, lakes, floodplains and wetlands.

Storage: An option for adaptation to climate change

Water storage is one of three perspectives we can take on adaptation; the other two being food storage and management strategies (Figure 1). These are complementary, not mutually exclusive approaches and the best results are obtained when there is a harmony among all three aspects. Figure 2 illustrates potential water storage options.

Farmers have always relied on the water stored in rivers, lakes, floodplains and wetlands. Groundwater is the other major store of water. Roughly one third of the Earth's freshwater supply is thought to be stored as groundwater and provides most of the water used for irrigation. In India, more than 19 million pumps withdraw 230 cubic kilometers of groundwater annually. In Spain, northern China and California, crop production is almost entirely dependent on groundwater. Technically, groundwater includes the moisture stored in the soil, which is one reason soil conservation is so important, especially in areas where there is little water or rainfall.

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Figure 1. Options for Adaptation

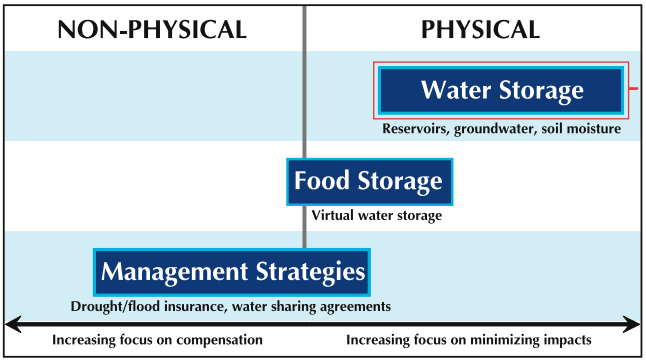
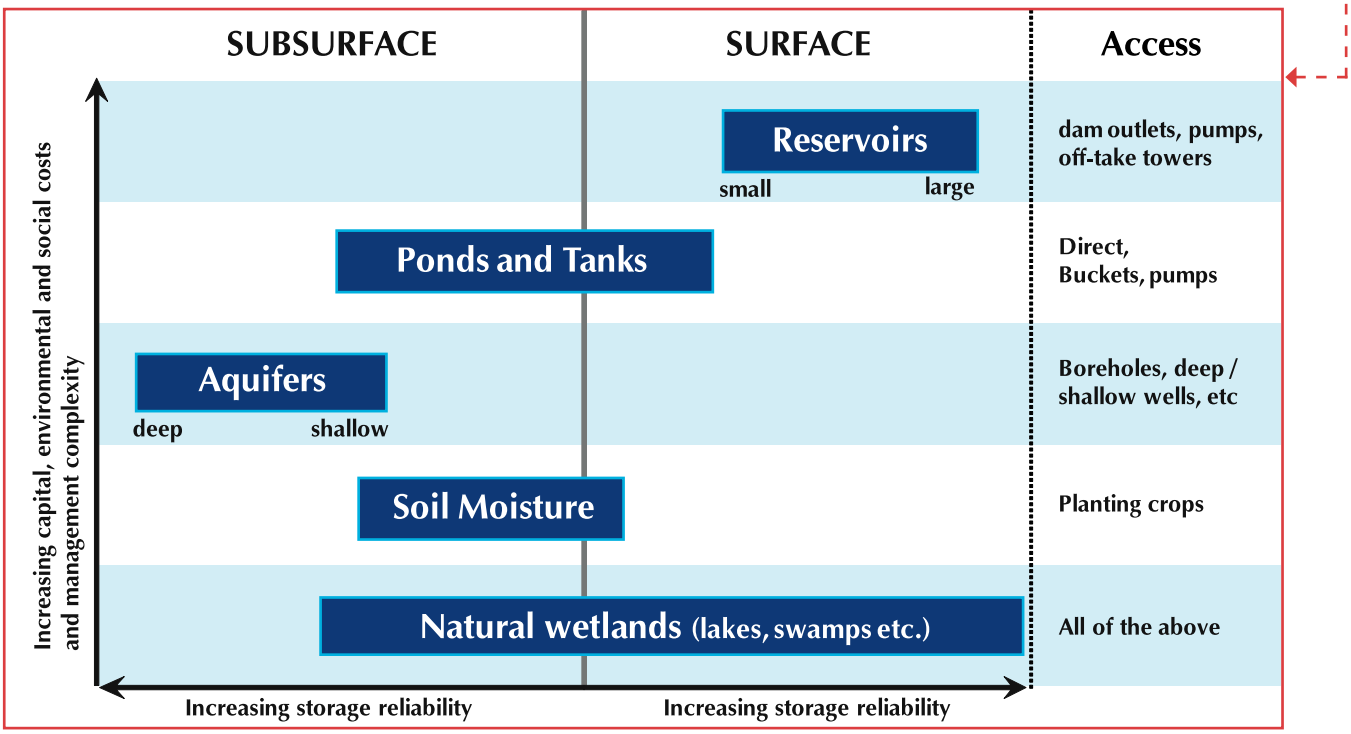


Figure 2. Water Storage Options



Facts and Figures

64% of the total population of Africa relies on water resources that are limited and highly variable. How much irrigation do crops need in relation to what the climate provides?

75% of Africa's cropland is located in arid and semi-arid areas, where irrigation can greatly improve productivity and reduce poverty. Where can supplemental irrigation increase crop yields? Where is irrigation essential for viable agriculture?

4.8% of Africa's potential hydropower is currently being used. With renewed interest in hydropower development fueling investment, can we apply the many lessons we have learned about the social, economic and environmental impacts of big dams?

Photo Credit: Terry Clayton

Human adaptation to climate change

19,000,000 pumps withdraw 230 cubic kilometers of groundwater annually in India. Fuel and electricity for pumps accounts for approximately 4% of the country's total Greenhouse Gas emissions. The demand for groundwater in some regions is approaching the limit of what can be sustainably extracted.

1% Biofuels use 1% of the available irrigation water and cover nearly 1% of the cropped land at present. India and China will account for almost 70% of the projected global growth in biofuel requirements between now and 2030.

1 mm The amount of rain that fell in large parts of Australia in June 2009. The last decade has seen very low rainfall in southern and central Victoria. In contrast, rainfall in northwest Australia has increased substantially since 1950.

Practical measures

45 working days per household per year - the number of days women and children used to spend collecting water before the DHAN Foundation, a local development organization, helped restore previously non-operational traditional tanks called *ooranis* in Tamil Nadu in India.

5% of the total area of a farmer's land recommended for use as a pond to store runoff water for use during dry spells. These "Five Percent Farm Ponds" are being promoted by PRADAN, a local NGO working in the Purulia district of West Bengal. This practice improves water availability, minimizes soil erosion and improves land productivity during times of low rainfall. Five Percent Farms was a DIFD-funded project.

Photo Credit: Matthew McCartney

Photo Credit: Matthew McCartney

Research for development

160 reservoirs in the Upper East Region of Ghana plus 1,400 reservoirs in Burkina Faso and 250 in Northern Cote d'Ivoire. IWMI worked with the CGIAR Challenge Program on Water and Food, sponsored by the German Technical Cooperation (GTZ), and six partners to develop a 'kit' of 30 tools and techniques for people working in NGOs, research institutes, universities, donor agencies, multilateral organizations, and government agencies.

25% of domestic vegetable production in Pakistan depends on wastewater. IWMI has worked with local partners to document livelihood and health implications associated with wastewater agriculture.

IWMI on climate change

A lot of good things are already happening but we need to pick up the pace if we want to meet the rising needs for water and food. Innovative financing and policy reform are essential to progress.

Climate change is one more challenge to reducing poverty, hunger, disease and environmental degradation.

Integrated land and water management are the most effective measures for adapting to climate change.

Strengthening institutions for land and water management is crucial to effective adaptation and must build on principles of participation of civil society, gender equality, subsidiarity and decentralization.

Information that enables local adaptation to climate change is a public good to be shared by all.

IWMI has 4 decades of experience helping the world adapt to water scarcity.

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In terms of adaptation to climate change, we can predict with a fairly high degree of certainty that we need to store more water.

One of the few things we know about climate change with some degree of certainty at this stage of our knowledge is that we can expect increased rainfall variability and an increase in average temperatures. Both will affect the supply and the demand side of the water storage equation. In some parts of the world, annual snow and rainfall will decline, which means there will be less water in rivers and it will take longer to recharge groundwater aquifers. In other places, total precipitation may increase, but it will all fall within a shorter period of time and annual dry spells will be longer. Higher temperatures will also increase the amount of water plants require for growth. We can't yet quantify these impacts with a high degree of accuracy, but we can predict with a fairly high degree of certainty that we need to store more water, not just for irrigation, but for the many other domestic, industrial and environmental uses our growing global population will need.

The diagram shows the range of storage options we have to work with. Each option can be evaluated in terms of cost and complexity (the vertical axis) and storage reliability (the horizontal axis). Natural wetlands are by far the least expensive to maintain and the most reliable. Ask the State of Florida. They now spend hundreds of millions of dollars a year restoring wetlands because they discovered they can't do without the environmental services those wetlands provide. In the long run it will be far cheaper to conserve existing wetlands, a message yet to be heard by many economic planners. Based on the strength of its research, IWMI was recently named a Ramsar Convention Partner. IWMI's role in the Ramsar Convention represents a stronger focus on sustainable development and integrated management of wetlands and acknowledges the important roles that water management and agriculture have in wetland loss and degradation.

An appropriate water research agenda will help guide investments by filling the knowledge gaps between water, food and climate change.

At the other end of the scale, large-scale dams are the most controversial. On the positive side, large dams have contributed significantly to economic development. It is also true that inappropriate construction and operation have been the cause of significant social and environmental costs with the heaviest burden falling on the poor. Most were constructed with the emphasis on maximizing the economic returns from and with little understanding of the long-term consequences of changing river flow patterns downstream.

Concerns about negative social and environmental impacts led to reduced investment in large dams in the 1990s. In light of the transformations climate scientists are forecasting, we will need to rethink our approach to large dams. Already, investment in large dams in Africa and Asia is increasing. From 2005 through 2007, IWMI led a GTZ-funded collaboration in Ghana that resulted in a national stakeholder dialogue that offers a good example of a practical participatory process.

These and related issues point to an urgent need for a better understanding of the impacts of increased investments in water storage on the environment and long-term feasibility of larger scale interventions. The right investments now in agricultural water storage and management can significantly lessen poor people's vulnerability to climate change by reducing water related risks and creating buffers against unforeseen changes in rainfall and water availability. An appropriate water research agenda will help guide those investments by filling the knowledge gaps between water, food and climate change.

Traditional stonelined artesian well, Ethiopia.

Straight Talk:

Climate Change: New Questions about Old Issues

An interview with Vladimir Smakhtin, Theme Leader Water Availability and Access at IWMI

Vladimir Smakhtin

Q: Can humans adapt to climate change?

A: There has always been variability in the climate. Throughout history, people in different parts of the world have adapted quite successfully to alternating periods of droughts and floods, two common extremes in the availability of water. The great 'hydraulic civilizations' of the Khmer in Southeast Asia, the Sinhalese in South Asia and the Egyptians in the Middle East were an adaptation to variations in climate. One of the things humans have done rather well throughout our evolution is adapt. There is no reason this will stop. In fact, a great many people are working very hard on just this issue worldwide. IWMI has effectively been doing research on adaptation since 1990s. What's different now is that the degree and range of variation are changing and the changes are happening more rapidly than in the past.

Q: What changes can we expect?

A: It's difficult to be specific. The climate is an enormously complex system. The best models we have are getting better at guessing what a future climate might look like at the global scale. For example, the Intergovernmental Panel on Climate Change (IPCC) can say with some degree of certainty that there will be a significant decrease in river runoff in the north and south of Africa, while runoff in eastern Africa and parts of semi-arid sub-Saharan Africa will increase. A lot of people in the climate change community are trying to 'downscale' the big climate models to make predictions that will be useful at the river basin scale.

Q: Given the level of uncertainty with climate change predictions, what can we do?

A: Our best course of action is to continue working on adaptation. That doesn't sound quite as exciting as seeding the oceans with iron filings to soak up carbon dioxide or building huge 'solar umbrella's' to shade the planet. Those are technically possible, but rather unlikely, solutions to mitigation. Mitigation is about reducing the amount of Greenhouse Gases in the atmosphere. That we must also do, but it will be decades before we see the results of our efforts on that front. In the meantime, we can promote adaptation as much as possible. I personally feel that adaptation is not yet as high on the big climate change agenda as it should be and as compared to mitigation. IWMI has lots of data, information and knowledge on practical measures that poor farmers, governments and environmentalists in developing countries can use right now.

Q: What are some of those 'practical measures'?

A: We have a whole catalog of off-the-shelf solutions of proven technologies that can be applied fairly easily and cheaply. Where we expect to make the greatest gains is by revisiting a lot of 'old technologies' with a new view to climate change. For example, we are rethinking the entire range of surface and sub-surface water storage options ranging from natural wetlands through to rainwater harvesting, networks of small reservoirs, artificial groundwater recharge and yes, big dams too. The important point is we are looking at a continuum of storage options without any biases. IWMI partnerships and research collaborations are reshaping institutional arrangements and challenging some of the old disciplinary barriers between sectors such as agriculture and environment or sanitation and irrigation. That's paying off in terms of innovations like multiple use water systems.

Q: How does climate change affect IWMI's agenda as a research for development organization?

A: Just within the last decade there have been a lot of new developments and policy changes with significant implications for water management and use and these also need to be examined. How much water will biofuel production take away from food crops? Are we investing enough in desalination technology? Can we capture more of often disastrous flood water to use in time of droughts? How will countries in transboundary basins address increasing flow variability in their water sharing agreements? IWMI may play a role in providing rigorous scientific analysis of water and agriculture issues that can influence donor investments in the climate change research and development arena. Our basic research agenda stays, but now we will be looking at the impact of increased climate variability on water for food security, livelihoods and the environment. Better water management now is the solution for the future.

Q: What's IWMI's 'position' on climate change?

A: A point I feel is somewhat lost in the debate on climate change is that climate is just one of many drivers shaping water resources management and agriculture. There are other issues and drivers that may have a much greater impact on land and water resources in the short- to medium-term in different regions. We have to take these factors into account. IWMI's core business will continue to be providing the scientific basis for planners and managers who must make increasingly difficult decisions about how we use water. Climate change raises some new questions and adds a high degree of urgency to our work. There will be 9 billion people on the planet in another 40 years and the same amount of water. If we act quickly and in concert, we may just be able to provide everyone with the water they need.

Interview by Terry Clayton

Cahorra Bassa Dam, Mozambique.

Photo Credit: Matthew McCartney

The International Water Management Institute (IWMI) is a non-profit research organization and one of 15 international research centers supported by the Consultative Group on International Agricultural Research (CGIAR). IWMI has offices in Sri Lanka (headquarters), India, Pakistan, Nepal, Laos, Vietnam, Ghana, Ethiopia, South Africa, Syria and Uzbekistan.

IWMI Headquarters

127, Sunil Mawatha, Pelawatta, Battaramulla, Colombo. Sri Lanka.
Mailing Address: P. O. Box 2075, Colombo, Sri Lanka.
Telephone: +94-11 2880000, 2784080
Fax: +94-11 2786854
Email: iwmi@cgiar.org

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