

# WATER FIGURES

## TURNING RESEARCH INTO DEVELOPMENT

QUARTERLY NEWSLETTER OF THE INTERNATIONAL WATER MANAGEMENT INSTITUTE



### CONTENTS

Editorial (p.2) / IWMI recognized for exceeding its Gender & Diversity staffing goals (p.2) / The changing 'figure' of irrigation in the Godino Irrigation System, Ethiopia (p.3) / Health impact of small dams in Morocco: Listening to the community for better planning and management (p.4) / The Basin Focal Projects of the CGIAR Challenge Program on Water and Food review progress and identify best practices for the next phase (p.5) / Interview: Mobin-ud-Din Ahmad talks about the Basin Focal Project in the Karkheh River Basin, Iran (p.6) / New Book: Irrigation and Drainage Performance Assessment: Practical Guidelines by M.G. Bos, M.A. Burton and D.J. Molden (p.7) / Recent Publications (p.8)

## ISSUE 1 2006



### ANNOUNCEMENTS: IWMI and WorldFish Collaboration

The WorldFish Center and IWMI have joined corporate services in order to facilitate closer collaboration. As an initial step forward, Barry Tan has been appointed joint Corporate Services Director for both IWMI and WorldFish. The next step is the establishment of a joint Information and Knowledge Group. This will enable the adoption of more efficient systems that reduce costs and share expertise.



# EDITORIAL

WATER FIGURES ISSUE 1 2006



## THIS YEAR WE LAUNCH WATER FIGURES.

The change may seem superficial to those familiar with the 'Research Update'—but it is significant. **WATER FIGURES** is our understanding of what research in development is meant to do. It communicates the work done at **IWMI** as it affects change. It's also about our renewed commitment to sharing knowledge with more people.

The choice of **WATER FIGURES** as the new name of our quarterly newsletter arises from its ability to communicate more than one meaning: "Water figures in the scheme of things..."; **WATER FIGURES** as a reference to the science of water management; **WATER FIGURES** as a visual representation of the spaces the resource occupies and the shapes it takes.

The focal piece of this issue, **Health impact of small dams in Morocco: Listening to the community for better planning and management**, comes from **IWMI**'s involvement in a project in Morocco. The project team engages the community to jointly evaluate health risks and opportunities associated with small dams. This is referred to as the 'eco-health approach'—an approach that facilitates a better understanding of the complex issues related to water resources management. **WATER FIGURES** will continue to highlight **IWMI** research such as this that demonstrates how people can **improve the management of water and land resources for food, livelihoods and nature**.

Samyuktha Varma  
Editor

### EVENTS AND CONFERENCES

#### IWMI ATTENDS THE FOURTH WORLD WATER FORUM IN MEXICO CITY

March 16-22, 2006, Frank Rijsberman, Director General is the beacon for the theme 'Water Food and the Environment'. **IWMI** co-organizes five sessions at the Forum.

[www.worldwaterforum4.org.mx/home/home.asp](http://www.worldwaterforum4.org.mx/home/home.asp)

#### ICUC EVENT

Consultation workshop: Strategies for research and development of underutilised plant species in Asia

Colombo, Sri Lanka, 16 & 17 March 2006  
[www.icuc-iwmi.org](http://www.icuc-iwmi.org)

#### MARCH 22 IS WORLD WATER DAY 2006,

the theme this year is 'Water and Culture'  
[www.unesco.org/water/wwd2006](http://www.unesco.org/water/wwd2006)

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## IWMI recognized for exceeding its Gender & Diversity staffing goals

At the CGIAR Annual General Meeting (AGM) in Morocco in December 2005, three centers were presented with awards of excellence for best progress in achieving policy, practice, and staffing goals. **IWMI** was the recipient of the 'Center of the Year Award for Staffing Goals Achievement' for 2005.

In its Strategic Plan 2004-2008, **IWMI** set the target to increase its researchers from the South to 50%. As of March 2006, 53% of **IWMI** researchers are from the South, and the North/South balance of 50-52% has been maintained for the last few years. The percentage of female researchers has increased from 24% in 2002 to 31% in 2006, showing the organization's commitment to achieving a gender balance.

The CGIAR's Gender & Diversity Program seeks to improve research and management within CGIAR Centers by drawing on the diversity of disciplines, nationalities, gender, cultures,

ethnicities, languages, religions and ages of its staff. It is a system-wide service for the 15 international agricultural centers that make up the CGIAR, to support their individual gender and diversity initiatives.

At **IWMI** the Human Resources department is supported by the CGIAR G&D Program in developing a range of policies that are in line with best practices and aim to create an inclusive workplace. New policies have been approved such as Spouse Employment, Flexi-time and Telecommuting in addition to the existing HIV/AIDS and family friendly policies. Plans are also underway to have crèche facilities by June 2006.

Visit the website of the CGIAR Gender & Diversity Program [www.genderdiversity.cgiar.org](http://www.genderdiversity.cgiar.org), also its online policy guide, the Inclusive Workplace e-Resource Center [www.genderdiversity.cgiar.org/inclusiveworkplace/index.htm](http://www.genderdiversity.cgiar.org/inclusiveworkplace/index.htm)

Alica Bahri Director for Africa accepts **IWMI**'s award which was presented by Ian Johnson, CGIAR Chairman - Photo Credit Sanjini de Silva



# The changing 'figure' of irrigation in the Godino Irrigation System, Ethiopia

FRANK RIJSBERMAN

*Since my recent visit to the Godino Irrigation System near Debre Zeit, I have been thinking about what the amazing things I saw imply for irrigation and agriculture in Africa. I'd like to share my experience with you.*

The Godino system is situated in the Awash basin that also provides water to Addis Ababa and to industries in the Addis-Debre Zeit corridor—the main highway from Ethiopia to Djibouti—the route to the sea. The highway also provides market access for the Godino System. The main dam and irrigation infrastructure were built in the 70s by Cuban engineers. Although the dam and reservoir have already outlasted their design life, the earth dam is in decent condition. And though the reservoir capacity has reduced over time due to siltation, the upper reservoir still irrigates about a thousand hectares, somewhat above the initial design area. But virtually all other control structures designed and built by the Cubans lie unused.

Water flowing out of the reservoir (the main reservoir outlet is operational) makes its way down the riverbed and is diverted into two main canals serving two communities, one of which is the Godino village. The system serves three sections—I'll call them head, middle and tail—that are incredibly different from each other. Driving from the dam to the tail end is like taking a journey through time.

## THE HEAD

Around the reservoir, and just below it, most agriculture is rainfed. In fact, there is a conflict between the people here and the irrigators downstream. The rainfed farmers would like to use the land that falls dry as the reservoir empties for rainfed crops in the wet season, while the irrigators want to keep the reservoir full for use in the dry season. The rainfed farmers have made several attempts to empty the reservoir, and the downstream people are now guarding the dam.

Life around the dam is picturesque, but very tough. There is hardly any farming equipment in sight, no electricity, transportation is by donkey, and water is hauled by women and girls from the river or irrigation canal up the steep hill where the houses are. The farmers grow "tef" (a local cereal of tiny grains, more resembling grass than cereal, that is used to make Ethiopian bread) and wheat where the conditions allow (i.e. water is available). Young children who should be in school herd livestock.

## THE MIDDLE

The middle section comprises the Godino village and its irrigation system. Apart from tef and wheat, farmers irrigate vegetable cash crops—particularly onions but also varieties of cabbage. Here, the APPIA project, funded by the French Ministry of Foreign Affairs and implemented by IWMI in East-Africa, has one of its sites. Philippe Lemperiere, the project leader, is working here, in collaboration with the regional irrigation agency, to improve the performance of the irrigation system.



He works with farmers and extension workers, for example, to help farmers multiply their own high quality vegetable seeds. A second IWMI project, funded by the Government of Austria and carried out in collaboration with BOKU, uses the same site to assess the impact of irrigation on poverty. Some villagers even buy water from metered public standpipes from a German-donated water supply system. While not rich, farmers here are clearly better off than in the head section.

## THE TAIL

Driving towards the tail end of this 1000 hectare system, you suddenly see huge industrial-scale greenhouses with access to both surface water and groundwater irrigation, growing roses for export and vegetables for Addis Ababa. Ethiopian, Israeli and Dutch investors are rapidly building large-scale agro-industrial farms. They share—in part—the water of the same Cuban-built reservoir used by the head-ender farmers who irrigate with their bare hands and little else. Large numbers of farm workers. Lots of construction.

Genesis, a private farm that looks like an industrial "model farm", has a dairy with Frisian cows, each with a board above its head indicating age, calving status, milk stats and feed regime. Next door is the yoghurt and cheese production facility that looks as clean as a hospital. The same farm produces vegetables using groundwater, sprinklers, cheap Jordanian drip tape. It also has ornamental plant nurseries, an industrial poultry facility, and its own little supermarket where the flowers, cheese and yoghurt are sold. And oh, yes, they make and sell their own compost too: please choose between chicken and cow manure.

## WHAT DOES THIS MEAN?

Change is obviously very rapid at the tail end of the system—significantly more than in the middle reaches and radically more than at the head. What does this mean for the farmers? Will the new private investments bring them opportunities and decent wages? Or will it push them up into the marginal head sections? Will the tail-enders be able to find enough water? If it gets scarce at the end of the system, will they then move upstream?

Does the future for people in the middle and head sections lie in improving their irrigation performance with treadle pumps and drip kits? Or are they better off working for agro-industry? For IWMI, this means we should expand the scope of our assessment into a comparison of all options open to people living in the system. It should be interesting to map water productivity, and water poverty in this system as it changes—and see how we can contribute to reducing poverty—and keeping it down.

Acknowledgement: I thank Seleshi Bekele and Philippe Lemperiere of IWMI's office in Addis Ababa and colleagues, both for taking me on this visit in the first place, and for getting my facts right. ♡

Photo Credit: Frank Rijsberman

# Health impact of small dams in Morocco: Listening to the community for better planning and management

HAMMOU LAAMRANI (IWMI-WEST AFRICA), ELINE BOELEE (IWMI-NILE BASIN AND EAST AFRICA), A. AIT LHAJ (INRA-AGADIR)



Over the past few decades, hundreds of small community dams have been constructed all over Africa to impound water for multiple uses. In countries with arid and sub arid climates and erratic patterns of rainfall like Tunisia, Burkina Faso, Morocco, Zimbabwe and Ethiopia, small dams are an important tool in rural poverty alleviation, reduction of rural exodus, aquifer replenishment, prevention of floods and large dam siltation. They are also an important source of water for irrigation, drinking and domestic purposes. However, negative health impacts such as increased transmission of water-related diseases may be substantial and the investments do not always result in sustainable development.

The increasing numbers of small dams has resulted in a growing interest in their economic and social impacts. In a project in southern Morocco, funded by the International Development Research Centre, Canada (IDRC), IWMI and partners from the 'Institut National de la Recherche Agronomique' (INRA) and the 'Institut National d'Hygiène' (INH) are developing a participatory methodology to examine health impact. For local communities, health problems would normally refer to actual disease, and more complicated health risks may be missed, especially ecological changes that increase health risk. Health impact is thus not easy to define. The project views health impact assessment as a scoping process, in which the community and the project team act as facilitators, convenors or catalysts, who together evaluate, rather than assess, the health risks and opportunities associated with small dams. Project activities are based on this interdisciplinary agro-ecosystem approach to human health or the 'ecohealth approach'.

## METHODOLOGY—THE 'ECOHEALTH APPROACH'

The 'ecohealth approach' was proposed and operationalized by the IDRC ([www.idrc.ca/en/ev-68491-201-1-DO\\_TOPIC.html](http://www.idrc.ca/en/ev-68491-201-1-DO_TOPIC.html)) and takes a holistic view of issues based on community participation. It is being used to assess all positive and negative health impacts of the selected small dams. According to preliminary studies in Morocco, a small dam could lead to the improvement of community health but could also lead to increased transmission of water-related diseases such as urinary schistosomiasis and malaria. If, however, the small dams have indeed led to improved livelihoods, people have better access to more varied food, resulting in improved nutrition, and also to preventive and curative health care.

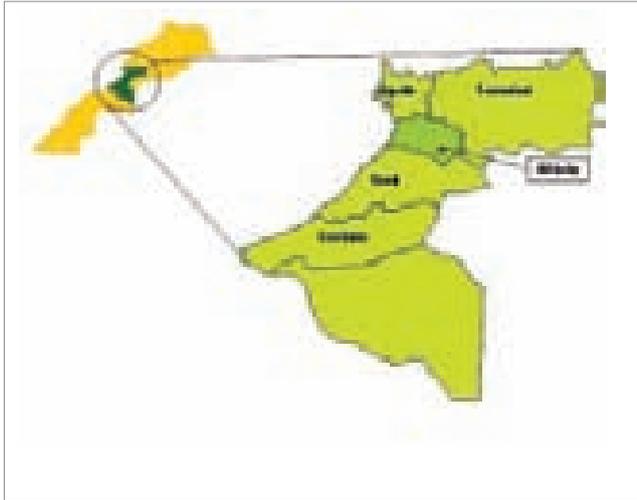
The ecohealth approach integrates gender and equity concerns to ensure that effective participation of all stakeholders is maintained throughout the project. By also looking at the degree of community involvement, the approach accounts for economic as well as social benefits. The construction of a small dam, for example, could be accompanied by other infrastructure development, such as roads, schools, markets and health posts. The project also examines the planning history of the dam and related infrastructure, to understand how technical shortcomings may hamper the desired impacts on the environment, socio-economic situation, and community health status.

By considering all of these elements, the project will develop a methodological "tool box" for better planning and management of small community dams. The integrated approach engages community participation to elaborate the "balance sheet" of benefits and potential health hazards, associated with or magnified by the implementation of the small dams. It does this through surveys, community meetings and community workshops, with local and regional NGOs, as well as different provincial departments. The complex links and "reverse loops" between agriculture, domestic and environmental impacts are investigated through this process

## THE PROJECT DEVELOPMENT PROCESS

The Assghekkiss small dam in the Moroccan province of Chtouka-Ait Baha was selected for the project. Community members, local NGOs and local councils were involved from the outset to develop the research perspective. Community involvement at this stage revealed differences in perceptions between them, the research team and development practitioners, leading to the original outline of the proposal being revised. This was a crucial phase, as the villagers were also asked to reconsider their expectations.

Villagers formed into a 'project committee' to ensure that community expectations were met, and to play a role in planning and undertaking project tasks. This also meant that the project activities would be sensitive to social mores. For example, the research team wanted to carry out a stool analysis survey in villages around and downstream of the dam, to investigate the prevalence of intestinal parasites. Villagers were reluctant to provide samples due to cultural reasons. The committee then suggested that a survey be first conducted in schools, the results communicated, and the school children with infections



then treated. The idea was that information about the benefits of such surveys would be passed on to the parents through the children. This approach helped facilitate the project's anchorage and acceptance and drew support from the community.

#### HEALTH AND ENVIRONMENTAL INTERLINKAGES

A survey showed that the dam is a breeding site for the snail vector of schistosomiasis that prevailed in the area in 2004. According to the community members, and health district records for 2003, diarrhea and skin diseases are a major health problem in the study area, as are urinary tract infections. These are related to hygiene and can be impacted on positively by increased water availability, and improved individual and community health. Other community perceptions of health risks that emerged from the study were that the dam served as a breeding site for mosquitoes. This was confirmed by findings of *Culex* larvae which were collected at shallow water pockets along the lake shore.

Mountainous areas harbour rich biodiversity that can be preserved or changed by small dams. However, some unexpected environmental changes were observed after the dams were constructed, such as an increase in the wild boar population of the region. From the community perspective, this development was considered the most negative environmental impact. The animals pose a real threat to the crops but they are not killed. People in the area are Muslims, and do not eat pork. A potential health risk identified was the possibility of parasitic diseases being transmitted to humans. Another change ac-

knowledgeed by the communities was the increased occurrence of migratory birds since the construction of the dam. The birds were not perceived as a risk by the communities, though the health authorities expressed fear of the spread of bird flu.

#### LESSONS AND INSIGHTS FROM EMPLOYING A PARTICIPATORY APPROACH

Community structures often play an influential role in remote areas, and a participatory approach provides a means by which these structures can be understood. Such an approach was imperative to understanding how community perceptions affect water resources management. One of the major constraints in the operation and maintenance of small dams is that the ownership of the dam is often unclear to the community members. In Morocco, the National Small Dam and Hill Reservoirs Policy stipulates that the beneficiaries should be involved in planning the small dams, eventually taking over the responsibility for their management after completion. However, in practice, the community is often unconcerned by issues of maintenance such as cracks in the dam wall and seepage, as they believe 'the state' is responsible for such matters. Community participation provides the location specific information required for tackling such maintenance issues.

At this stage in the present study, the 'ecohealth approach' has demonstrated its strength in providing an inclusive and integrated understanding of the complexity of water resources development in mountainous regions; the policy environment; and the health determinants and their links. The ecohealth approach has been able to capture these links. ♡

For more information on this project contact Dr. Eline Boelee e.boelee@cgiar.org



# Basin Focal Projects review progress and identify best practices for the next phase

NADIA MANNING

The CGIAR Challenge Program on Water and Food (CPWF) hosted an international workshop for its Basin Focal Projects (BFP) February 8–10 in Colombo. It sought to ‘*explore opportunities and strategies for sustainable increases in basin scale water productivity*’. The workshop brought together institutions responsible for the implementation of the current round of Basin Focal Projects for the four basins presently piloting this new project framework—the Mekong, Volta, Sao Francisco, and Karkheh basins. The purpose of the workshop was to review progress made so far and to deliberate on BFP outputs, approaches and methodologies with a view to providing guidelines needed to prepare a competitive call for proposals to implement the remaining BFPs in the Indo-Gangetic, Yellow, Limpopo, Nile and Andes basins.

While the workshop's main aim was to arrive at recommendations on the most appropriate and cost-effective approaches and methodologies, it also served as a forum for the projects to share their proposed methodologies and to talk about these and other aspects of the project. The components discussed were: poverty analysis; water productivity analysis; interventions analysis; stakeholder participation; and outputs and outcomes. The BFPs represent a scientific challenge being met by the different BFP teams, namely to develop (for the first time), methods to analyse, for entire basins, the specific relationships between agricultural water use and poverty. These methods require multi-scale assessment linking hydrology, sociology, agronomy, fisheries biology and econometrics to put the demographic face to hydrology. While presentations on methodology by each basin project team revealed certain uniqueness and disparity amongst the projects, a constructive discussion breaking down these methodologies using a matrix with defined

categories, facilitated a wider understanding and recognition of coherence across the projects. It was a positive experience, both for the projects to learn about each others' methodologies and approaches, as well as for BFP Central to gain a cross-project perspective and a sense for the overall coherence. This helped plan further activities within BFP and provide insight for the next call for proposals.

The challenge of achieving food security becomes greater as the world's water crisis worsens. The CGIAR Challenge Program on Water and Food (CPWF) has taken up this challenge from a research perspective—working in nine river basins across the world. The program is creating research-based knowledge and methods for growing more food with less water, while developing a transparent framework for setting targets and monitoring progress. The initiative brings together water experts, NGOs and river basin communities in Africa, Asia and South America.

Five interrelated Research Themes ensure that key topics are addressed. The themes serve as focal points for synthesizing results from the various countries and regions, and bringing out generic conclusions.

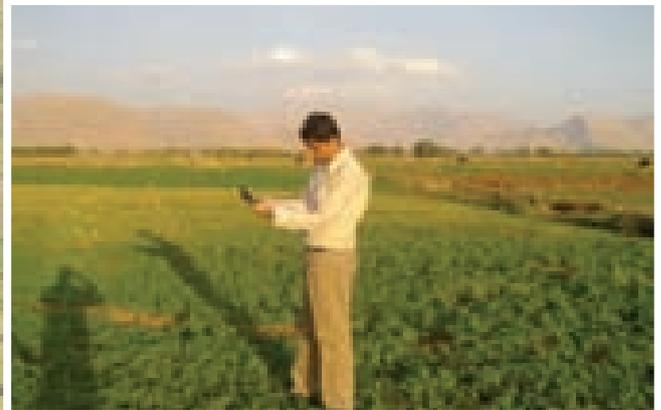
- Theme 1: Crop-Water Productivity Improvement
- Theme 2: Water and People in Catchments
- Theme 3: Aquatic Ecosystems and Fisheries
- Theme 4: Integrated Basin Water Management Systems
- Theme 5: The Global and National Food and Water System

For more information on the Challenge Program on Water and Food visit: <http://www.waterforfood.org>



## Interview: Mobin-ud-Din Ahmad talks about the Basin Focal Project in the Karkheh River Basin, Iran

Dr. Mobin-ud-Din Ahmad joined IWMI in November 1994 and worked for almost four years in Pakistan. After completing his Ph.D. at ITC Netherlands, he returned to IWMI, joining the Global Research Division in Colombo in 2003. Mobin specialized in the application of remote sensing and modeling techniques for water balance analysis from field to basin scale. He acquired the advance knowledge of Surface Energy Balance Algorithm for Land (SEBAL), and has demonstrated his skills for the estimation of actual evapotranspiration, soil moisture and groundwater use in large irrigation systems. He has also worked with various multidisciplinary international research teams to develop robust methods for Integrated Water Resources Management, to increase the productivity of water at the basin scale. Mobin is the Project Leader of the Basin Focal Project (BFP) in the Karkheh Basin of Iran.



Top: The Karkheh Basin in Iran - Photo credit Sara Marjanizadeh  
Bottom: Dr. Mobin-ud-Din Ahmad in the Karkheh Photo credit - Ilyas Masih

### WHAT ARE BASIN FOCAL PROJECTS?

BFPs are the new investments of the CGIAR Challenge Program on Water and Food. They were established to understand and map poverty and water productivity in different parts of a basin. The projects aim to evaluate potential interventions to mitigate water-related poverty while improving overall basin water productivity within the safe limits of resource utilization. They also intend to show where the poverty/productivity links or tradeoffs lie.

The main purpose of having a basin perspective is to see what broad lessons may apply to other regions faced with similar issues. These would provide policymakers and other stakeholders with guidelines for better resource management for food, livelihood and environmental security.

For example, in the Karkheh river basin where I work, the upper and middle reaches are facing acute water shortages, which in turn affects the land productivity and livelihoods of the people in these areas. In response, some farmers have installed high capacity pumps to withdraw water from rivers and groundwater aquifers. In addition to this, the Ministry of Jihad-e-Agriculture is introducing various water harvesting techniques in these reaches. This has resulted in an increase in productivity and improvement in the livelihoods of people. However, the impact of upstream water development on downstream water availability/equity, livelihood, productivity and the environment, is not well understood. We hope to perform an in-depth analysis of all these issues under this project.

### HOW DO YOU WORK IN THE KARKHEH BASIN?

The Karkheh Basin Focal Project (KBFP) which began in September 2005 is one of four pilot projects established by the Challenge Programme on Water and Food. IWMI has been appointed to lead the work in this basin, which lies to the west of the country bordering Iraq. Of its total area of 5.08 million ha (Mha), only 1.07 Mha is irrigable and 0.9 Mha is suitable for rainfed agriculture. Our Iranian partners include institutes under the Agriculture Research and Education Organisation (AREO), Universities, and the Khuzistan Water and Power Authority (KWPA) which is a development enterprise belonging to the Ministry of Power.

### WHAT ARE THE MAIN ISSUES YOU ARE LOOKING AT?

The main BFP challenge to improve productivity and alleviate poverty will be taken on in the Karkheh. Several strategies will be adopted to address a range of issues.

One important area we will look at is the degradation of land in the upper catchment caused by over grazing, and the subsequent sediment export in the lower basin.

Another area is the impact of groundwater use in the upper reaches, direct pumping in the middle regions, and the effects of these activities on livelihoods and productivity.

Yet another is that of upstream development, and the extent to which it has been considered in the recently constructed Karkheh dam.

We will also assess the environmental impacts of new irrigation interventions downstream of the Karkheh dam, along the Iran-Iraq border, as well as the sustainability of land use in the area.

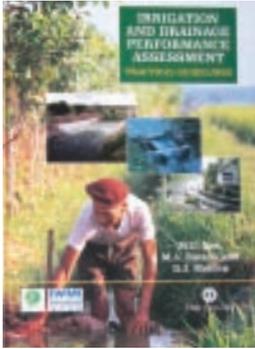
As you can see there are a wide range of issues we will examine!

### THIS PROJECT IS LARGE IN TERMS OF AREA AS WELL AS IN THE RANGE OF ISSUES IT ADDRESSES.

#### WHAT PARTICULAR ASPECTS OF THE RESEARCH ARE YOU MOST INTERESTED IN?

Personally, this is an opportunity to manage a large and multi-disciplinary project – linking IWMI's main concerns of water productivity and water poverty. I have worked in many large irrigation systems before, like in the Rechna Doab, but there, we did not get the whole picture, a holistic view of the issues. This project, on the other hand, provides a unique opportunity to analyze a range of issues.

The Karkheh basin is also relatively data rich—sufficient literature is available on land and water management issues. Moreover, as Karkheh is located in the arid regions, it is an ideal location for optical remote sensing applications. We will be using satellite imagery for land use mapping, crop classification and evapotranspiration estimation.♾



## New Book: Irrigation and Drainage Performance Assessment: Practical Guidelines

AUTHORS: M. G. BOS, M. A. BURTON AND D. J. MOLDEN  
CABI PUBLISHING, 2005

The challenges of improving water management within irrigation and drainage systems are increasing. Addressing the demands of water for agriculture, environmental degradation, and farmer livelihoods and poverty are all important priorities of irrigated agriculture. Improved irrigated agriculture production and livelihood support occurs through better use of natural resources. A performance-based management process can help achieve this.

*Irrigation and Drainage Performance Assessment: Practical Guidelines*, takes on the task of dealing specifically with 'performance assessment' in irrigation agriculture, by bringing together experience over the last 15 years in the area. It provides practical guidelines on how to design and carry out performance assessment and implement performance based management.

The book was developed by the International Commission on Irrigation and Drainage (ICID) Working Group on Irrigation and Drainage Performance Assessment. It captures a range of international perspectives based on case studies from all parts of the world, and is targeted to an audience of irrigation water managers, water management departments in national ministries, universities and training institutes, research institutes, policy makers. It is also a valuable reference guide for students and professionals working in the area of water management.

## Recent Publications

For on-line access to IWMI Research Reports and Working Papers, see [www.iwmi.org/pubs](http://www.iwmi.org/pubs)

### IWMI Research Reports

1. **Amarasinghe, Upali; Samad, Madar; Anputhas, Markandu.** 2005. Locating the poor: Spatially disaggregated poverty maps for Sri Lanka. Colombo, Sri Lanka: IWMI. v, 33p. (IWMI research report 96)

### IWMI Working Papers

1. **Awulachew, Seleshi; Merrey, Douglas; Kamara, Abdul; van Koppen, Barbara; Penning de Vries, Frits; Boelee, Eline.** 2005. Experiences and opportunities for promoting small-scale/micro irrigation and rainwater harvesting for food security in Ethiopia. Colombo, Sri Lanka: IWMI. x, 86p. (IWMI working paper 98)
2. **Morardet, Sylvie; Merrey, Douglas; Seshoka, Jetrick; Sally, Hilmy.** 2005. Improving irrigation project planning and implementation processes in Sub-Saharan Africa: Diagnosis and recommendations. Colombo, Sri Lanka: IWMI. xx, 71p. (IWMI working paper 99)
3. **Namara, Regassa.** 2005. Synthesis of Sub-Saharan Africa case study reports. In van Koppen, Barbara; Namara, Regassa; Safilios-Rothschild, Constantina. Reducing poverty through investments in agricultural water management. Colombo, Sri Lanka: IWMI. pp.20-66. (IWMI working paper 101)
4. **Narain, P.; Khan, M. A.; Singh, G.** 2005. Potential for water conservation and harvesting against drought in Rajasthan, India. Colombo, Sri Lanka: IWMI. vi, 25p. (IWMI working paper 104 / Drought series: Paper 7)
5. **Penning de Vries, Frits; Sally, Hilmy; Inocencio, Arlene.** 2005. Opportunities for private sector participation in agricultural water development and management. Colombo, Sri Lanka: IWMI. xxiii, 50p. (IWMI working paper 100)
6. **Smakhtin, Vladimir; Weragala, Neelanga.** 2005. An assessment of hydrology and environmental flows in the Walawe River Basin, Sri Lanka. Colombo, Sri Lanka: IWMI. v, 13p. (IWMI working paper 103)
7. **van Koppen, Barbara; Safilios-Rothschild, Constantina.** 2005. Poverty and gender issues. In van Koppen, Barbara; Namara, Regassa; Safilios-Rothschild, Constantina. Reducing poverty through investments in agricultural water management. Colombo, Sri Lanka: IWMI. pp.2-18. (IWMI working paper 101)
8. **van Koppen, Barbara; Namara, Regassa; Safilios-Rothschild, Constantina.** 2005. Reducing poverty through investments in agricultural water management. Colombo, Sri Lanka: IWMI. xvi, 66p. (IWMI working paper 101)

### BOOKS

1. **Bos, M. G.; Burton, M. A.; Molden, David J.** 2005. Irrigation and drainage performance assessment: Practical guidelines. Wallingford, UK: CABI. viii, 158p.
2. **Illaszewicz, J.; Tharme, Rebecca; Smakhtin, Vladimir; Dore, J.** (Eds.) 2005. Dong chay moi trung: Danh gia nhanh Dong chay moi trung cho luru vuc song Huong, mien Trung Viet Nam. [Environmental flows: Rapid environmental flow assessment for the Huong River Basin, Central Vietnam] Hanoi, Vietnam: IUCN Vietnam. ix, 81p.
3. **Illaszewicz, J.; Tharme, Rebecca; Smakhtin, Vladimir; Dore, J.** (Eds.) 2005. Environmental flows: Rapid environmental flow assessment for the Huong River Basin, Central Vietnam. Hanoi, Vietnam: IUCN Vietnam. ix, 81p.
4. **IWMI.** 2002. Ways of water conservation. Tashkent, Uzbekistan: IWMI; Scientific-Information Center of Interstate Water Coordination Commission of Central Asia (SIC ICWC) 136p.
5. **Lundqvist, J.; Falkenmark, M.; Bertell, A.; Bergkamp, G.; Molden, David;**

**Rosegrant, M.** 2005. Let it reign: The new water paradigm for global food security. Working report to CSD-13. Stockholm, Sweden: SIWI. 40p.

6. **Phansalkar, Sanjiv; Verma, Shilp.** 2005. Mainstreaming the margins: Water-centric livelihood strategies for revitalizing tribal agriculture in Central India. New Delhi, India: Angus & Grapher. xi, 212p.

### IWMI ARTICLES IN INTERNATIONALLY REFEREED JOURNALS

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