Water Matters

News of IWMI Research in Sri Lanka

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This issue of "Water Matters" looks at "Water Scarcity" which is the theme of World Water Day, on March 22nd 2007. Water scarcity is becoming a global concern and will affect Sri Lanka too in the future. However, with proper management, there are ways of coping with it.

IWMI
International Water Management Institute

Water Scarcity in Sri Lanka: Fact or Fiction?

We in Sri Lanka have an average rainfall of 2200 mm a year. Our drier regions have 900. In contrast, India has 1100 mm, and Australia a mere 455 mm. What are we talking about? Do we really have a problem in Sri Lanka?

We often hear or see phrases like 'water scarcity' and 'climate change' in the mass media, and in technical and scientific reporting and conference proceedings. Unfortunately these and many other phrases cover some realities - 1.2 billion people without safe access to water, 5 million children dying annually due to water-related diseases, lakes drying up, drought stricken farmers committing suicide—not only in Polonnaruwa, but also in India and even Australia.

The equation is common right across the globe. We have a finite resource on the one hand and an increasing demand on the other, with populations and economies growing all the while. A growing population not only means an increased demand for water but also negative impacts on water availability (resulting from denudation of forests, salinization etc.) and even on quality. One must also not forget another user, the environment; the theory that residual water is sufficient for the environment is not acceptable anymore. In addition, extreme events like floods and droughts appear to be increasing in intensity and the regional and seasonal variations are quite high too.

Do these factors have an effect in Sri Lanka? Yes indeed they do. We all have experienced one or more of these factors in our daily life. We are aware that we have water scarcity, but how serious is it?

A quick definition : 'Physical scarcity' is what we have been talking about, when available water resources are insufficient to meet all demands. There is another form of scarcity - 'economic scarcity' when there are inadequate investments or human capacity to withdraw the water that is available. In fact the issue in many regions is not so much physical scarcity but economic scarcity.

IWMI studied water scarcity issues in Sri Lanka as far back as 1999 (Research Report 32) in the context of irrigation water. After all, 85% of our water is used for irrigation - and I would like to quote from conclusions derived after a district-wise analysis of various scenarios "The results of the study show that aggregated national level statistics on water scarcity are indeed misleading even for a small country like Sri Lanka in monsoonal Asia….Despite what national level statistics say, water availability in some districts will be a significant constraint for future social and economic development….. Some districts in the wet zone with ample per capita water supply will be severely water-scarce in the economic sense so that they will have to develop a substantial amount of withdrawals over the present level to meet their 2025 needs"

The report also points out that if we were to avoid this situation, we will need to substantially improve our water productivity, particularly irrigation efficiencies—the main user. It also goes on to question whether we will have the financial and the institutional capacity to attain these high irrigation efficiencies.

In short, water scarcity is a real issue in Sri Lanka's case as well, and we need to carefully develop coping strategies. Strategies built around the hard elements of availability and quality alone are not enough. In fact, more importantly, it is necessary to build strategies around the softer element of governance, our institutions, how we would manage inter-sectoral power plays, how we would manage scarcities arising from inequities and poverty. Don't we have to sit up and take some serious action urgently? I think research has a key role to play in laying bare the realities and providing the recommendations for decision makers to act on.

Dr. Sarath Abayawardana - Head, Sri Lanka Program

Expansion without Extinction

Managing Agricultural Development while Conserving Biodiversity

Ecosystem and biodiversity conservation are seriously threatened in countries pursuing irrigation as a strategy for economic development. This is true even for Sri Lanka which has been implementing large irrigation projects since the country gained independence, without paying adequate attention to the protection of its natural resources. As a result, degradation of natural ecosystems is now widespread with some 560 animal and 690 plant species under threat of extinction. At the same time, irrigation development is essential for agriculture in the dry zone areas, especially where there is high variability in rainfall. This is the challenge for development and conservation practitioners to seek innovative strategies to conserve biodiversity, while implementing irrigation development programs.

IWMI, together with the Mahaweli Authority of Sri Lanka (MASL), the World Conservation Union Sri Lanka (IUCNSL) and in collaboration with Nippon Koei Japan, implemented a project under the name "Expansion without Extinction". This project which ended in December 2005, looked at how biodiversity can be preserved in irrigation systems. It was funded by the Royal Netherlands Embassy of Sri Lanka, and provided an opportunity to get involved in research that would create valuable lessons and generate new knowledge on this topic for the first time. The project focused on the left bank (LB) of the Walawe Irrigation Scheme located in southern Sri Lanka. The project area covers two different types of irrigation development ; the rehabilitation of the upper portion of LB and new construction to create irrigation infrastructure in the lower part of LB. This also provides an opportunity to compare irrigation development–induced impacts on biodiversity and the livelihoods of the communities. The overall project goal was to ensure that agro-ecosystems were managed within a sustainable development framework that would contribute to improved livelihoods and biodiversity conservation.

Main project objectives:

- Monitoring trends in biodiversity and socio-economic conditions during the construction and irrigation phase of the project.
- Using monitoring outcomes to identify and strengthen existing biodiversity conservation and livelihoods-support activities in the project area through awareness creation and social mobilization.
- Developing, promoting and implementing a range of eco-agriculture strategies and practices with the active participation of the Mahaweli Development Authority and other relevant government agencies, non-governmental organizations and local communities. The emphasis was also on institutional and technical capacity building and knowledge sharing.
- Establishing and strengthening of institutions and other mechanisms for participatory conservation-based management in irrigation projects.
- Structured monitoring and documentation of the processes of implementation and capacity building.

Photo Credit: B. Ranjith Ariyaratne

A section of the Uda Walawe Left Bank area before it was cleared for extension. Small species such as the snake shown in the picture can become endangered through the use of insecticides in crop cultivation and the clearing of natural habitats.

While the upper Left Bank of the Walawe was developed for irrigation, the southern part of the Left Bank remained undeveloped. The Walawe Left Bank Irrigation Upgrading and Extension Project (WLBIUEP) Phase II was initiated for this purpose. It was the last large-scale irrigation development project envisaged in the country for the foreseeable future and a significant aspect of this project was that it set environmental conservation as one of its main project objectives.

Some of the eco-agricultural strategies put in place by the project were the identification and designation of biodiversity "refuges" in the project area during the pre-development assessment, prior to clearing and development activities. Small tank systems which support dry zone aquatic biodiversity were incorporated into the main system through carefully planned rehabilitation. A biodiversity park is planned for construction and use as a community education center, a repository for dry zone biodiversity (genetic material) as well as a potential eco-tourism location. Other conservation-relevant measures to mitigate the adverse impact of irrigation development on the environment include the protection of tank reservations and large trees of high resource value, as well as the establishment of a high proportion of indigenous trees in road reservations and fuel wood plantations. The project promoted the development of home gardens with live fencing and other measures to enrich vegetation. A comprehensive action plan was developed with the participation of MASL agency officials, local farmers and other community members for biodiversity conservation and enrichment of natural resources in different locations. The project created a conducive environment (institutional and social) for stakeholders to plan and implement bio-diversity and eco-friendly irrigated agriculture development strategies in the project area. Lessons learned from the research project are generic and replicable in Sri Lanka or elsewhere for helping to develop biodiversity-friendly irrigation.

Water Scarcity- The Big Picture

Water Scarcity Defined:

Water scarcity can be defined as the non-availability of a required amount of water of useable quality at the required time and location, for human and environmental use. The most often quoted indicator or measure of water scarcity is the Falkenmark Indicator, which relates the more or less fixed amount of renewable fresh water resources in the world to population, using a per capita estimate of water required to satisfy domestic, agricultural and industrial needs. This method suggests that a country with less than 1,700m^3 of water per person per year will experience water stress, and that this becomes acute at less than 1,000m^3 per person per year. However, it is pointed out that this calculation has little use from a water management point of view as it does not tell us what the actual demand for water in a country is, and whether or not the amount of water available is adequate to meet this demand. It also ignores the fact that demand will vary from the relatively small quantities used by households (50 liters per person per day), to the much larger requirements of agriculture (2,000 to 5,000 liters per person per day, depending on diet), industry and the environment. More accurate assessments of scarcity therefore focus on relating available water to the demand for water, rather than to population. Some have gone further and replaced water demand with water withdrawals (the amount of water taken out of rivers, streams or groundwater aquifers to satisfy human needs) to more accurately assess actual water use. They present scarcity as the total annual withdrawals as a percent of available water resources, in what is referred to as a water resources vulnerability index. They suggest that a country is water scarce, if annual withdrawals are 20% of annual supply, and severely water scarce, if this figure exceeds 40%. As can be seen, these methods become more complex as their creators strive for greater accuracy.

The International Water Management Institute (IWMI), divides water scarcity into three types that reflect the different reasons for scarcity to occur in each case: absolute or physical scarcity, economic scarcity and institutional/political scarcity. Absolute or physical water scarcity refers to a situation where a country or river basin does not have enough water to satisfy its needs, even if it takes all reasonable measures to increase available water supply and maximize its use efficiency (or productivity). Many such countries will not be self-sufficient in food production and will have to import part of their food. Economic water scarcity refers to countries or basins that have the water resources to satisfy their demands, but would have to develop new infrastructure, such as dams and reservoirs, in order to make this water available to the people who need it at the appropriate time. Finally, institutional or political water scarcity refers to people not having access to water, even if the resources and infrastructure are available, due to inequities in access to the resources, due to various political or social reasons.

Water Scarcity in Sri Lanka

IWMI research in Sri Lanka has observed water scarcity occurring due to different reasons; physical scarcity, economic scarcity and institutional and political scarcity discussed above. If we examine the physical situation in Sri Lanka, the country is divided in to two zones; a Wet Zone and Dry Zone, based on annual rainfall. About 80% of the country falls under the Dry Zone. The Dry Zone areas get an average annual rainfall of 2000 mm, 60% during the period from October to January known as the Maha (major) season and about 30% from March to May known as the Yala (minor) season. The rest of the year is characterized by dry weather conditions during which only 10% of annual average rainfall is received. In the Wet Zone, the annual average rainfall varies between 2000mm to 4500 mm and is distributed throughout the year; hence the Wet Zone does not experience water scarcity, quantity wise.

Sri Lanka's Wet Zone is highly populated and characterized by semi urban and urban centers, industries and commercial agricultural plantations, growing tea rubber, coconut cinnamon etc. Farmers in the Dry Zone are engaged mainly in paddy and seasonal crop cultivations using rain water stored in reservoirs. Temporal and spatial water scarcity has been a major problem in the Dry Zone areas from ancient times and as a response irrigation development emerged as a main strategy for socio-economic development in the country. Successive governments after independence pursued irrigation development as the main strategy for the development of the country under which new irrigation settlement schemes were established in the Dry Zone areas to which landless people from the densely populated Wet Zone areas were made to migrate. Recent studies show that the Dry Zone accounts for more than 90% of current water withdrawals (mainly due to the higher share of irrigation demand), whereas only 44% of the population lived there in 1991. Demand projections for 2025 show that the Dry Zone will continue to absorb over 90% of total water withdrawals.

IWMI studies have further highlighted the increasing demand for water by different sectors such as the domestic sector, hydropower and industry along with population growth. This leads to conflict within and between water user sectors. In addition, water quality deterioration due to urban pollution, hazards like the tsunami, and agrochemical use are also reported from many parts of the country leading to a scarcity in usable water. Studies also reveal institutional problems and weaknesses that lead to inefficient use of water in many irrigation schemes.

P. G. Somaratne (Researcher)

B. Ranjith Ariyaratne (Benchmark Basin Coordinator)

IWMI Studies Highlighting Water Scarcity

Related Issues

Irrigation Management and Crop Diversification - Kirindi Oya - Highlights issues like over-estimation of water availability, institutional and political problems over crop diversification and water allocation, conflicts over water sharing between new system and old system farmers, negative impacts on downstream areas like the Malala lagoon due to agricultural diffusion. IWMI developed a seasonal water allocation strategy and plan based on its long term study in Kirindi Oya to solve water related conflicts between old and new system farmers.

Irrigation Management and Crop Diversification - Udawalawe - Inefficient use of water, head and tail problems over water use, deviation from original plans to grow OFCs in some areas of the system, institutional problems related to water management.

Deduru Oya Study on Effective Water Resource Management Institutions - Institutional weaknesses related to managing water resources, excessive sand mining, ground water depletion, sea water intrusion due to excessive sand mining, urban pollution, inefficient management of water in irrigation schemes, excessive ground water exploitation.

Water Scarcity Variations within a Country: A Case Study from Sri Lanka - Sri Lanka is a country with vast spatial and seasonal variations of water supply and demand. Statistics in the form of aggregated information at national level sometimes mask issues of local water scarcity. But when the same indicators are used at sub-unit level, a substantial area of the country comes under severe water-scarce conditions. Knowledge of sub-unit level water scarcities is very important because most of the food requirement of the country at present comes from water-scarce regions and projected additional requirements are also to be met by the same regions.

Water Scarcity and Managing Seasonal Water Crisis: Lessons from the Kirindi Oya Project in Sri Lanka. Coping with scarcity of water supply for managing irrigation under uncertain and inadequate conditions has become part and parcel of many irrigation systems in the semiarid tropics of Asia. Based on a case study of the Kirindi Oya Irrigation and Settlement Project (KOISP) in southern Sri Lanka, this report provides evidence of the uncertain and inadequate inflow into the reservoir and its impact on seasonal planning.

Balancing Irrigation and Hydropower : Case Study from Southern Sri Lanka; Highlighting the negative impacts of water resources development on downstream areas. This report analyzes a case from southern Sri Lanka, where the Samanalawewa hydro power generation project and the Kaltota Irrigation Scheme (KIS) compete for water in the Walawe river. At the catchment level, it is shown that dam releases are well attuned to the needs of KIS and to the occurrences of natural runoff, and that little of the dam water is "lost" to the river.

Institutional Changes to Reduce Land Preparation Delay in the North Central Province of Sri Lanka

Although many irrigation systems in the Dry Zone of Sri Lanka have water shortage problems, water consumption is very high during land preparation. This paper analyzes the impact of institutional interventions on efficient water management, especially during the land preparation period. It provides a comprehensive understanding of the factors behind prolonged periods of land preparation so that system managers and farmer communities can develop appropriate interventions to reduce water consumption.

The Wastewater Agriculture and Sanitation for Poverty Alleviation in Asia (WASPA) Project - Studies the impacts of waste water,released from Kurunegala town on downstream areas (Maguru Oya).See overleaf.

Photo Credit: B. Ranjith Ariyaratne

Water scarcity is a real issue in Sri Lanka and we need to carefully develop coping strategies. The image shows portions of a dried up tank in the Dry Zone.

Can Wastewater Help Overcome Issues of Water Scarcity?

Over the years, research by IWMI and partners has shown that wastewater is an important resource for farmers in urban and peri-urban areas because it is both cheap (often free) and reliable throughout the year. Rapid urbanization in developing countries is increasing the demand for water for drinking and household needs and other sectors of the economy are feeling the pressure of scarce water resources. Wastewater agriculture is addressing the problem of increasing water scarcity as the demands of the city grow.

The Wastewater Agriculture and Sanitation for Poverty Alleviation in Asia (WASPA Asia) Project, piloted in Kurunegala, Sri Lanka and Rajshahi in Bangladesh under the European Union, Asia Pro Eco II Programme fund, is using an approach that entails stakeholder involvement through learning alliances. Both cities have areas with inadequate sanitation facilities, open sewers and areas where wastewater is used untreated to irrigate agricultural land. WASPA Asia, is being implemented by IWMI, the International Water and Sanitation Centre (IRC), NGO Forum for Drinking Water Supply and Sanitation (NGOF), COSI Foundation (COSI) and the Stockholm Environment Institute (SEI). The project involves a wide range of stakeholders in developing and testing solutions for sanitation and decentralized wastewater management, and for mitigation of health risks from wastewater use in agriculture.

There are many advantages to supporting wastewater agriculture in cities. In addition to providing employment and helping to diversify the livelihoods of poor urban dwellers on the peripheries of cities, the food that is grown by these farmers also contributes to their domestic food supply, and can save on cash that would otherwise be used to purchase food. The main problems associated with wastewater irrigation pertain to water quality. The quality of the water can vary to include grey water, sanitary waste and industrial waste, all of which can have potential health impacts for farmers and consumers, and downstream environmental impacts.

Wastewater flowing from a hospital in Kurunegala.IWMI and partners are developing and testing solutions for wastewater management and mitigation of health risks from wastewater use in agriculture.

Wastewater agriculture provides employment and helps diversify the livelihoods of poor urban dwellers, however the main problems associated with wastewater irrigation relate to water quality.

The WASPA project recognizes the link between sanitation and wastewater in agriculture, and that holistic solutions are required in both sectors. It also tries to address the fact that in many countries around the world wastewater use in irrigation, and even the existence of urban and peri-urban agriculture, is not officially recognized. Consequently, no single agency takes responsibility for these issues and it is necessary to bring together all the relevant agencies and stakeholders into a single platform to effectively address the risks associated with wastewater agriculture and to enhance the benefits. Local authorities need to recognize this association and plan wastewater strategies accordingly, taking into account the livelihoods benefits that can be derived by farming families and the possibility of inexpensive wastewater disposal. There is a need for adequate management to protect the health of farmers, their families, and consumers.

The approach of the project is therefore to establish stakeholder coalitions at town and national level, called Learning Alliances that will bring together the main stakeholders including community members, government agencies, NGOs, community based organizations, scientists and practitioners. Gradually, through a process that involves discussions and learning activities, the various stakeholders at each level are brought together into a single Learning Alliance to develop a single vision and the approach needed to achieve it. The project team will support the process, providing seed money and small-scale interventions. However, the link between the different Learning Alliance levels; from local to national, should provide opportunities for implementation of the plans developed by local stakeholders that are more sustainable and replicable.

For more information visit the project website:
http://www.iwmi.cgiar.org/WASPA

Different Perspectives:

An Interview with Dr. C.R. Panabokke

Deshamanya Vidyajothi Dr. Christopher Panabokke is recognized for his valuable work in the agricultural sector of Sri Lanka and also as a leading authority on tropical soils in Asia. His landmark achievement, the Agro-Ecological Map of Sri Lanka is the most reproduced and referenced document in this field to date. Dr Panabokke was a Research Fellow at IWMI in 1995.

Dr. Christopher Panabokke, a leading authority on tropical soils in Asia, in conversation with a rural farmer.

Dr Panaboke, your contributions to the agricultural sector in Sri Lanka have been immense, including your publication on "Soil and Agro-Ecological Environments of Sri Lanka, published by NARESA in 1997. What prompted you to write this?

This book crystallizes 30 years of thinking and it includes not just my thinking but that of a team of people. I was concerned that if this knowledge was not documented, it would be lost for good. I also realized that a basic understanding of agro-ecological environments was not there in this country. This book provides that basic understanding as well as the "genesis" of the knowledge and its subsequent evolution.

Increasingly there is a concern that agricultural development can have negative impacts on the environment. What are your views on this and how can this issue be resolved?

I will answer this from the perspective of soil environments. Our soil in Sri Lanka is fairly robust, but there are also fragile environments which must be cared for, like the poorly structured soils in the Dry Zone, or sloping lands in the hill country. These are susceptible to erosion and instability. Such areas are best kept under natural cover or used as game reserves. This brings in returns from wildlife enthusiasts. In fact, in 1969 I documented areas in the country suitable for natural reserves. Land development in catchment areas is a biological process -something like the 9 month gestation period in humans. The process cannot be rushed at an accelerated pace, but must be gradually developed over a period of time. You are not only building structures but you are dealing with people and their livelihoods. On the other hand, our paddy lands are robust and have weathered generations and seasons of use. We should utilize these environments to the maximum. They also absorb and retain a lot of water and minerals. They are good "sinks".

Has the interaction you have had with IWMI helped you in your work, and have you been able to work directly with IWMI on any projects?

When I first came to IWMI, I worked on a study of irrigation for crop diversification. This study gave us an -in-depth understanding of the subject but we were unfortunately unable to implement the project because of institutional instability in the country. Subsequently I worked on a project on small village tanks which lasted 5 years and which was appreciated even outside Sri Lanka by the Dhan Foundation in India. This could not have happened if I had not been at IWMI. I also appreciate the contribution made by Dr. R. Sakthivadivel who helped me in initiating and developing the small tank work. In 1995 our studies recognized the fact that small village tanks occur in cascades in inland valleys. I must say I have enjoyed the interactions I have had with IWMI and the intellectual and library facilities offered by the Institute.

What are your views on the issue of water scarcity in Sri Lanka and what recommendations do you have for coping with it?

It is important to be able to harmonize wet season surpluses and dry season scarcity. I think one needs to also understand groundwater as it is the most misunderstood resource. Because wells get recharged easily they are being dug indiscriminately everywhere. In some places people understand the resource. In many, they don't. The rapid use of groundwater needs to be taken under control to prevent overexploitation. In our study on "Groundwater in Hard Rock Areas", IWMI analyzed the carrying capacity of hard rock wells and this study was a major breakthrough showing how groundwater occurs in inland valleys. It provided the basic framework for further studies. The Agro-Ecological map which I conceptualized and developed based on pioneering efforts by other researchers showed the water balance in the country, marking the spatial and temporal distribution of surface water. This went through ten years of evolution. Presently I am working on a study of small anicut systems in Sri Lanka. There is a lot to learn from these. We have found that there are as many anicut systems (in mid and up-country areas) as there are tanks (in the dry zone). There are approximately 14,000 of each. The two systems complement each other. There is a need for a good research program on small tank systems and a research agenda on anicut systems.

Interviewed by Dawn Rodriguez

Contact Person
Dr. Sarath Abayawardana
Head of Sri Lanka Programs
s.abayawardana@cgiar.org

Postal Address
P O Box 2075
Colombo
Sri Lanka

Location
127, Sunil Mawatha
Pelawatta
Battaramulla
Sri Lanka

Telephone
+94-11-2787404

Fax
+94-11-2786854

E-mail
iwmi@cgiar.org

Website
www.iwmi.org

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Water Management
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IWMI - Sri Lanka Publications and Resource Websites

Research Reports

RR 96. Locating the Poor: Spatially Disaggregated Poverty Maps for Sri Lanka

RR 94. Balancing Irrigation and Hydropower: Case Study from Southern Sri Lanka

RR 87. Economics and Politics of Water Resources Development: Uda Walawe Irrigation Project, Sri Lanka

RR 77. Simulating the Hydrology of Small Coastal Ecosystems in Conditions of Limited Data

RR 75. Prospects for Adopting a System of Rice Intensification in Sri Lanka: A Socioeconomic Assessment

RR 68. Malaria and Land Use: A Spatial and Temporal Risk Analysis in Southern Sri Lanka

RR 66. Agro-wells and Pumps in Irrigation Schemes in the Dry Zone of Sri Lanka: Past Trends, Present Status and Future Prospects

RR 62. Irrigation Sector in Sri Lanka: Recent Investment Trends and the Development Path Ahead

RR 55. Water Scarcity and Managing Seasonal Water Crisis: Lessons from the Kirindi Oya Project in Sri Lanka

RR 51. Valuing Water in Irrigated Agriculture and Reservoir Fisheries: A Multiple-Use Irrigation System in Sri Lanka

RR 32. Water Scarcity Variations within a Country: A Case Study of Sri Lanka

Working Papers

WP 103. An Assessment of Hydrology and Environmental Flows in the Walawe River Basin, Sri Lanka

WP 92. Small Tank Cascade Systems in the Walawe River Basin

WP 89. Adaptive, Participatory and Integrated Assessment (APIA) of the Impacts of Irrigation on Fisheries, Evaluation of the Approach in Sri Lanka

WP 69. Institutional Changes to Reduce Land Preparation Delay in the North Central Province of Sri Lanka

WP 61. Anicut Systems in Sri Lanka : The Case of Upper Walawe River Basin

WP 59. Multi-Level Participatory Consultative Approach for Institutional Change in River Basins: Lessons from the Deduru Oya Case Study

WP 58. Developing Effective Institutions for Water Resources Management: A Case Study in the Deduru Oya Basin, Sri Lanka

WP 44. Simulating Impacts of Irrigation on the Hydrology of the Karagan Lagoon in Sri Lanka

Websites

The International Water Management Institute is a nonprofit scientific research organization focusing on the sustainable use of water and land resources in agriculture and on the water needs of developing countries. IWMI works with partners in the South to develop tools and methods to help these countries eradicate poverty through more effective management of their water and land resources.
http://www.iwmi.cgiar.org/

IWMI Library
http://www.iwmi.cgiar.org/

Drought Monitoring
http://www.iwmi.cgiar.org/drw/info/default.asp?PG=HOME

Global Irrigated Area Mapping (GIAM)
http://www.iwmigiam.org/info/main/index.asp

Integrated Database Information System (IDIS)
http://dw.iwmi.org/dataplatform/home.aspx

Malaria Control
http://www.iwmi.cgiar.org/malariacontrol/index.asp

Online Irrigation Benchmarking Services
http://oibs.iwmi.org/LoadBench.htm

Model for National Level Water and Food Policy Dialogue
http://www.iwmi.cgiar.org/tools/podium_sim.htm

World Water and Climate Atlas
http://www.iwmi.cgiar.org/WAtlas/atlas.htm

Remote Sensing and Geographic Information System
http://www.iwmidsp.org/iwmi/info/main.asp

Hydro-Ecological Databases
http://www.lk.iwmi.org/ehdb/wetland/index.asp

Pro-Poor Intervention Strategies in Irrigated Agriculture in Asia
http://www.iwmi.cgiar.org/propoor/index.asp

Smallholder Water Management Solutions
http://www.iwmi.cgiar.org/smallholdersolutions/index.asp

Wastewater Agriculture and Sanitation for Poverty Alleviation (WASPA)
http://www.iwmi.cgiar.org/WASPA/