Water Matters

News of IWMI Research in Sri Lanka

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IWMI has set a new research agenda for its work in Sri Lanka after collaborative discussions last year in Colombo. An array of new projects are highlighted here that will help prepare Sri Lanka for future food, livelihood and environmental security needs. Some of our new projects include a study of water quality in Jaffna, GIS mapping of agro-wells, revisiting participatory irrigation management in Gal Oya and more....

IWMI International Water Management Institute

IWMI Celebrating 25 years 1985-2010

EDITORIAL

Mapping a New Research Agenda for Sri Lanka

On September 20, 2010, IWMI held a consultative committee meeting with its partners in Sri Lanka to discuss IWMI's research agenda for this country. Among those who participated in this meeting were the departments of Irrigation, Agrarian Development, Agriculture, Surveys, and National Planning, the Mahaweli Authority of Sri Lanka (MASL), Water Resources Board, National Water Supply and Drainage Board (NWSDB), Sri Lanka Council for Agricultural Research Policy (CARP), Hector Kobbekaduwa Agricultural Research and Training Institute (HARTI) and several universities.

It was reassuring to find that IWMI's assessment of Sri Lanka's current research needs was almost similar to that of the Irrigation Department and the Water Resources Board on issues relating to surface water and groundwater. Other participants also contributed to the discussions and highlighted the importance of linking up with national institutions and policy-making bodies. This was consolidated into a set of objectives for IWMI's Sri Lanka Initiative:

Objective 1: Generate value-added information and knowledge that enhances water resources management in general, particularly agricultural water management (AWM).

Objective 2: Establish a knowledge network among national institutions (government agencies, nongovernmental organizations and projects, etc.) that work in the areas of land and water management (capture at least 90% of these organizations) in the next 2 years.

Objective 3: Become an established knowledge hub among stakeholders, water managers, researchers and policymakers in Sri Lanka within the next two years.

Objective 4: Participate in 'community activities' and provide 'knowledge services' to various local and international agencies engaged in, or interested in, water management in Sri Lanka.

Over the next few months, as part of objective 1, the Sri Lanka Initiative will study water quality in Jaffna, develop a procedure for georeferencing shallow agro-wells using satellite images, revisit participatory irrigation management (PIM) in Gal Oya, look at how Agricultural Water Management (AWM) is helping to restore the livelihoods of conflict-affected communities, and carry out an assessment of major irrigation systems and sustainable development of lagoons. Some of these projects are outlined in this issue of Water Matters.

Over the years, very prominent scientists like Dr. C. R. Panabokke, Dr. S. Sakthivadivel, Dr. Doug Merrey and the late Dr. Felix Amerasinghe, to name a few, have carried out research in Sri Lanka. We acknowledge their contributions and also the work of our partners. We look forward to welcoming others who will join the research network that will be established to add value to Sri Lanka's growing knowledge base on water resources management.

Dr. Herath Manthrithilake
Head, Sri Lanka Initiative

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Georeferencing Shallow Open Wells with Remote Sensing

Herath Manthritillake

Traditionally, in Sri Lanka, shallow wells have been a source of freshwater for drinking in rural and semi-urban regions. The Jaffna region in northern Sri Lanka and the Kalpitiya region in the west, although lacking surface water sources, have a high groundwater table which is suitable for shallow wells and were used for agriculture too. The 'Dry part' of the country has been relying on surface water for irrigation requirements but this is insufficient during dry periods. Areas with shallow aquifers and fractured hard rock in this region (Panabokke 2002) were found to be suitable for shallow, large diameter wells known as "agro-wells." With the introduction of these agro-wells, not only has the area under agriculture expanded but in some areas cropping intensity has also increased by 200% (Pathmarajah 2002). The government's subsidies, along with economic gains, have led to a proliferation of agro-wells in the dry zone of the country (Karunaratne and Pathmarajah 2002) which has raised concerns about overexploitation of groundwater extractions (Panabokke 1998).

Shallow aquifers are very vulnerable to high extraction rates. With thousands of shallow wells scattered over a large area, it is physically impractical to study their cumulative impact on groundwater in the region. While efforts have been made to identify the number of existing shallow wells, data has been extrapolated from a smaller study area. The first step in managing groundwater in these shallow aquifers is to develop a robust inventory of existing shallow wells. With the availability of high resolution, multispectral imagery, it is possible to use remote sensing and geographic information system (GIS) techniques to identify and georeference these shallow wells.

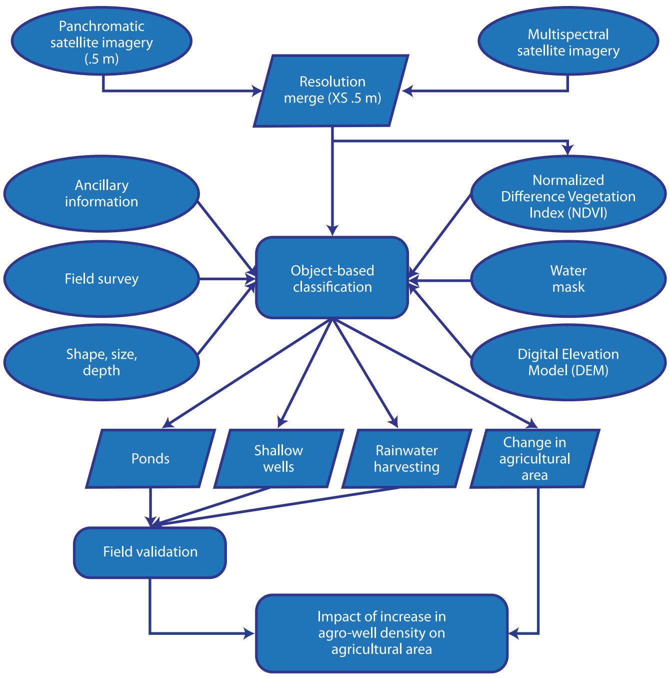

Diagram showing the mapping and classification process for agro-wells.
Source: Created by Aditya Sood, Postdoctoral Fellow – Hydrological Modeling, IWMI.

IWMI is developing a methodology to identify and georeference shallow wells (especially those used for agricultural purposes), by using high resolution, multispectral imagery, in the shallow coastal aquifers of Kalpitiya. This technique will be applied later to the Jaffna and Anuradhapura regions of Sri Lanka. Interestingly, all these three regions have different aquifer characteristics. Hand-dug shallow wells have been used for a long time in the Jaffna and Kalpitiya aquifers, whereas the agro-wells in the central hard rock region of the country, which are often mechanically dug, have become common only since the 1980s owing to government subsides. For purposes of this study, a 30 to 50 square kilometer (km^2) area will be selected from each region.

The best way to mark current agro-wells and to track changes will be through the use of high resolution satellite images. These images will show how much and where the density of these wells has increased over time. By applying object-based classification techniques and using other information from field surveys and literature, specific characteristics of wells will be identified and separated from pond and rainwater harvesting structures. The final results will be validated by field visits. To assess the impacts of an increased number of agro-wells on the total agricultural area and production, satellite images from the past 5 years will be acquired, processed and analyzed. Data related to production will be obtained from the corresponding agricultural statistics.

Once a framework for identifying the wells is developed, this can be used to study trends in the annual increase of the number of shallow wells in a specific region. The georeferencing of wells will also help in future groundwater modeling exercises in the region.

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Hydro-geochemical Mapping of Jaffna's Aquifer Systems in Sri Lanka

Herath Manthritillake

The Jaffna peninsula has four identified aquifers, namely Chunnakam, Vadamaratchi, Thanmaratchi and Kayts. This study will include hydro-geochemical mapping of the Chunnakam aquifer and the development of a comprehensive GIS-based dataset for groundwater characteristics and land use in the same aquifer area. IWMI, together with academics from the Jaffna and Peradeniya universities and researchers from the Institute of Fundamental Studies, will assess the water quality and geochemistry of the Chunnakam aquifer system in the postwar era and also map groundwater recharge areas in the same system while estimating the recharge. Researchers will also identify chemical and pathogen sources in the groundwater and make all information obtained easily accessible for future use by land and water users.

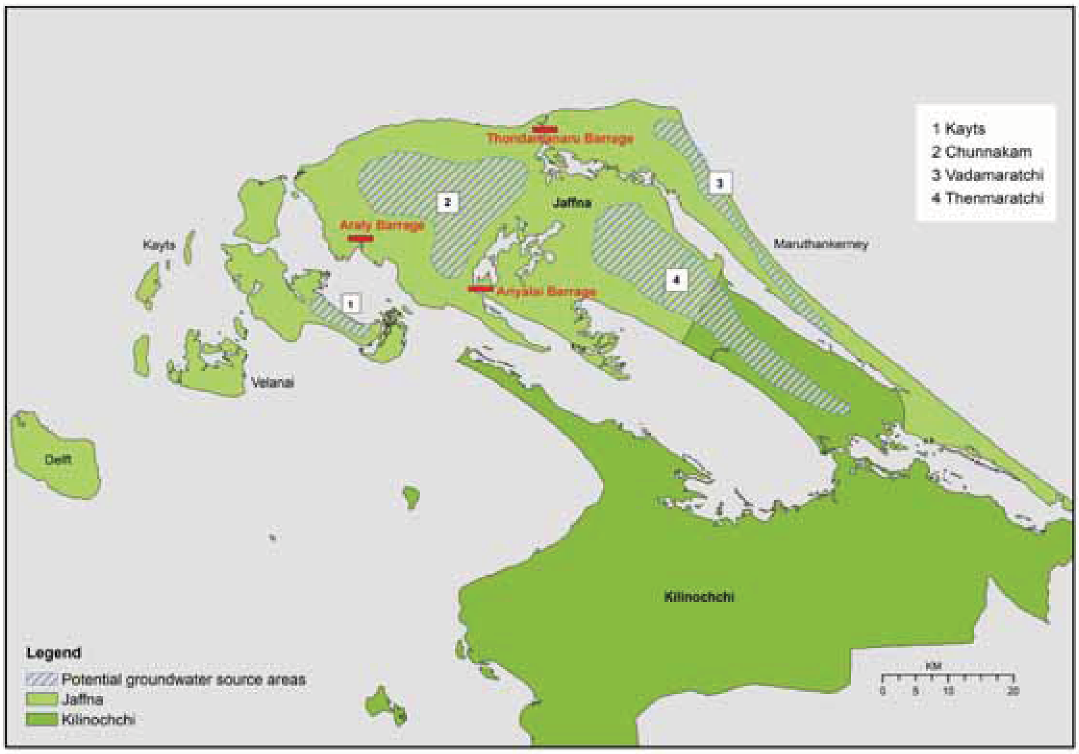
At least 60 wells will be sampled for water quality analysis from Chunnakam. The general parameters for analysis will be electrical conductivity, (EC), pH values, nutrients (nitrate, nitrite, ammonia, phosphate), cations (sodium, magnesium, calcium, potassium, iron, manganese), anions (sulphate, fluoride, chloride, bicarbonate, carbonate), heavy metals (As, Cd, Pb) and harmful pathogen counts.

Rainfall in past years and current rainfall will be compared, and the total volumes of groundwater used for domestic purposes, agriculture and other uses will be determined as well. Researchers will study sources of pollution, for example, discharges from agricultural fields, industries and development sites.

Nitrogen budgeting will be carried out in the Chunnakam aquifer. This process indicates how agriculture, human waste and atmospheric deposition contribute to nitrate contamination in groundwater. The amount of nitrates used by plants, retained in the soil and concentrated in groundwater are calculated as there is a threshold for nitrate content. Water from any aquifer that exceeds this threshold is not safe for human consumption. Nitrogen budgeting will be based on air sampling, farmer interviews, evaluation of fertilizer sales in the local markets and identifying of human settlements. This data will help researchers identify the sources of pathogens in the peninsula.

All data that is collected and analyzed will be used with inland hydro-geochemical data to update the hydro-geochemical atlas of Sri Lanka. IWMI hopes to create a GIS-based dataset that will show (a) the location of test wells, shallow wells and tube-well density, (b) a groundwater recharge potential map, (c) a groundwater table, and (d) sources of nitrogen and pathogens. This information would be of immense value to stakeholders who are involved in resolving water-related problems in the main peninsular area. The project is expected to be carried out over a ten-month period.

Main groundwater aquifers in the Jaffna Peninsula.



Source: Created by A. D. Ranjith (GIS/RS Unit, IWMI).

Revisiting the Pioneering Participatory Irrigation Management (PIM) Project in Sri Lanka. What Next?

Ranjith Ariyaratne

The Gal Oya water management project was implemented during 1981 and 1986. It was a pioneering experiment. According to the available publications, sweeping changes were introduced to water management practices with a view to improving productivity in the irrigation system. The Gal Oya Participatory Irrigation Management (PIM) project was focused on changing the management system within an irrigation scheme. This was the most influential experiment carried out in Sri Lanka since 1978, to develop and implement PIM. It had serious policy implications.

The Agrarian Research and Training Institute (ARTI) of Sri Lanka, with the help of Cornell University, USA, implemented the institutional component of this rehabilitation project, which was funded by United States Agency for International Development (USAID) and put into action by the irrigation department. The Gal Oya experiences were widely disseminated by individual researchers attached to the two research institutions, ARTI and Cornell University.

The proposed new study will attempt to document past experiences of the Gal Oya water management project and assess its current situation in order to understand the strategies that are needed for future water management directions.

So far, IWMI with help from the Irrigation Department has collected information through a questionnaire survey carried out with office bearers from 18 farmer organizations and 231 farmers in the area where the original PIM research was carried out. This was in the head, middle and tail end of the Uhana Branch Canal. The data collected on the current situation will be further studied and analyzed to assess the pathways of future development and answer the question "what next?" Data will be analyzed from a sociological/institutional perspective. The results of this survey should be available by mid-2011.

Photo Credit: B. R. Ariyaratne

Weeragoda Tank main canal in the Gal Oya Project

Improving the Sustainability of Impacts of Agricultural Water Management Interventions in Challenging Contexts

K. P. Jinapala

IWMI is working with an IFAD-funded Dry Zone Livelihood Improvement Program (DZLIP) on research that looks at how AWM interventions help to rebuild shattered lives after conflict, natural calamities and other vulnerable situations. This research will help improve project design for challenging contexts. It will also help to increase the effectiveness of rural poverty reduction interventions by the International Fund for Agricultural Development (IFAD).

The project aims to achieve this by combining results from earlier studies and new thinking within IFAD regarding innovative approaches to dealing with the complexities of AWM. A set of concrete case studies in challenging environments will be compiled with suggested new management response capacities for these contexts. Methods developed and used will include new frameworks for assessing institutional contexts and constraints and opportunities for AWM. Projects by IFAD and other investors will provide the case studies. The thinking behind this is that it is necessary to assess the challenges of the existing national and local contexts, and understand the likely direction of change, when designing investment programs.

This project will complement and draw from experiences in other countries in sub-Saharan Africa and Asia where IWMI-led projects - evaluating AWM interventions in different settings and scenarios - are implemented.

Photo Credit: Sanjini de Silva

The IFAD project seeks to improve the livelihoods of poor rural farming communities.

Photo Credit: B. R. Ariyaratne

Farmer consultation in the field to get firsthand information.

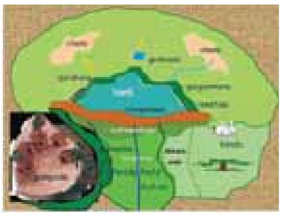
The DZLIP is implemented in different areas of Sri Lanka and IWMI will be collecting data from several sites recovering from challenging situations within project locations in the Anuradhapura and Moneragala districts. After the survey, this data will be analyzed by IWMI.

Results will include context-specific guidance with validated typology and country studies, along with evidence of promising public and private investment opportunities. The project will provide key knowledge and timely support to IFAD programs, and support for informed decision making on investments in AWM interventions. Impact will be achieved through direct interaction with IFAD in the form of consultation and participation in the design and implementation of the project, which will provide input to the processes of IFAD country programs. This is part of a regional project implemented in a few countries in sub-Saharan Africa, and Nepal and Sri Lanka.

Wells, Cells and Markets Invigorate Tank-based Farming Systems in the Dry Zone of Sri Lanka

Madar Samad, K. P. Jinapala and Ranjith Ariyaratne

Farming embedded in traditional practices



Sri Lanka's traditional farming practices were based on a threefold system of land use:

- Rice was grown in the main tank command area under irrigation.
- Non-rice crops were grown in uplands under rainfed conditions.
- Perennial crops were grown in home gardens.

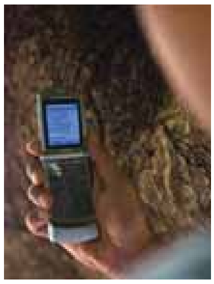
The subdivision and fragmentation of irrigable land, disruptions in the customary techniques of water management, degradation of the catchment area and deterioration of the water conveyance systems resulted in inadequate water supplies to the command area.

As the tank system fell into decline, the economy stagnated. Smallholder farmers had few incentives to change.

Then came the groundwater boom…

Things began to change in 1999. The use of low-cost diesel and petrol pumps ushered in a groundwater boom. The number of wells mushroomed, particularly in the upland areas of the Dry Zone. With low-cost water being available when and where they needed it, smallholder farmers started growing more than just rice. As it has done so elsewhere, groundwater transformed the economy.

Technology linked farmers to markets and commercialized production



Right now another transformation is taking place. Using mobile phones, farmers can directly contact market centers to get the latest prices and negotiate deliveries. By calling or using the short messaging service (sms) facility, farmers can deal directly with buyers in local retail and wholesale markets, or with larger market centers in Colombo, Kandy and Dambulla. Armed with up-to-the-minute information, farmers are managing more efficient production schedules and organizing their own marketing groups.

These innovations have led to greater commercialization of farming in minor tank systems, thereby revitalizing a once stagnant rural economy.

The results of these advances are visible in the substantial improvements in incomes, housing and living standards, school enrollments, health and the status of women.

Not all change has been good: Social equity and environmental concerns

Unfortunately, not all changes have been for the better. There is greater and more visible socioeconomic differentiation than before. Most of the benefits have gone to households who had the capital to invest in the necessary equipment and farm inputs. Perhaps the most alarming development is the increased encroachment on state land and private enclosures of common property. The poor and landless are increasingly marginalized, raising questions of social and economic equity, and growing concerns about the environment.

Photo Credit: B. R. Ariyaratne

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