Water Matters

News of IWMI Research in Sri Lanka

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This year is IWMI's 25th Anniversary. From its previous role in irrigation management to its current mandate to improve the management of land and water resources for food, livelihoods and the environment, IWMI has come a long way. This issue of Water Matters celebrates 25 years of IWMI's research with partners in Sri Lanka. It highlights some of the key concepts, tools and studies IWMI has produced and also looks ahead at some of the pressing issues that will be the basis for new research in Sri Lanka.

IWMI Celebrating 25 years 1985-2010

IWMI
International Water Management Institute

Twenty-Five Years of Research: Looking Back, Looking Ahead…

Twenty-five years ago, IWMI was set up in Sri Lanka as the International Irrigation Management Institute (IIMI). IIMI began its formal operations on May 31, 1984, by establishing headquarters at the Digana Village, 15 kilometers (km) east of Kandy, and near the Victoria Reservoir in the Central Hills. In January 1985, legislation to formally establish IIMI as an international organization with legal status, was ratified by the Parliament of Sri Lanka. Since, then the Sri Lankan Government has been represented on the Board of Governors of the Institute through the Secretary to the Ministry of Irrigation.

IIMI's initial mandate was to improve irrigation system management and much of the work was in the form of technical assistance. Initially, IIMI worked in five countries - Sri Lanka, Pakistan, Indonesia, Nepal and the Philippines. In Sri Lanka, Irrigation Management Transfer (IMT) and Participatory Irrigation Management (PIM) were high on IIMI's research agenda. IIMI worked very closely with the Sri Lanka Irrigation Department and the Mahaweli Authority of Sri Lanka (MASL) on some key projects in Mahaweli System H, the Devahua scheme and in the Uda Walawe and Kirindi Oya schemes.

In 1991, IIMI became a member of a group of research centers, supported by governments, private foundations and international and regional organizations collectively known as the Consultative Group on International Agricultural Research (CGIAR)[1]. By joining the CGIAR system, IIMI widened its mandate. With a new mandate to "contribute to food security and poverty eradication by fostering the sustainable increases in the productivity of water through the management of irrigation and other water uses in the river basin", the Institute changed its name to the "International Water Management Institute (IWMI). IWMI's headquarters also moved from Digana in Kandy to Colombo.

Today, IWMI has a staff of about 360 people and offices in 12 countries across Asia and Africa. It is a front line opinion leader in the world water debate.

It is a pity that we Sri Lankans hosting such a world-class 'knowledge source' are not using it fully. It is true that we have inherited a rich history of water resources utilization from our ancestors and are undoubtedly proud of it.

However, one cannot live in the past. We learn lessons from the past and move forward. In this information age, knowledge is fast becoming the "capital" replacing money. We need to harness this knowledge, learn from world experiences and move forward from where we are.

Sri Lanka is blessed with water. However, a slight delay or increase in rain causes droughts and floods in the country. How can we reduce these vulnerabilities? How can we realize the dream of our Great King Parakramabahu, and use each and every raindrop productively for the people of this country?

Water is scarce in the "Dry Zone" during a certain time of the year. History says our ancestors made these regions more prosperous by constructing small tanks. Since then many of these tanks have fallen into disuse, though the concept of retaining water in small ponds is still relevant. We need to modify this system to suit today's needs and capabilities. Similarly, modifications are needed in our agricultural systems as a whole (agriculture uses 85% of Sri Lanka's freshwater withdrawals). Let us, generate, borrow and apply new knowledge suitable for the current context and make these regions flourish once again!

Countries with rainfall less than what we receive in dry locations, like Hambantota or Mannar, are agriculturally prosperous, and export agricultural products. There are huge markets around us waiting to be tapped. We have plenty to offer. Proper management of land and water resources will not only help to prosper our rural areas but it will also make the country more self-reliant and economically more sustainable. Making these decisons based on sound scientific research will be important. This is where IWMI can contribute and help.

Dr. Herath Manthrithilake
Head, Sri Lanka Program

[1] The Consultative Group on International Agricultural Research (CGIAR), established in 1971, is a strategic partnership of countries working towards food security, hunger and poverty alleviation in the world. It consists of 15 international research centers of which IWMI is one.

The Significance of Sri Lanka's Small Tank Cascade Systems

In 1995, IIMI (as IWMI was then known), with funding from the International Fund for Agricultural Development (IFAD), studied the small tank cascade systems in the Anuradhapura District in the Northwestern Province. In 1996, this study was extended, with assistance from the Mahaweli Authority of Sri Lanka (MASL), to cover the whole of the "Rajarata" area which lies within the Dry Zone of Sri Lanka's North Central Province.

In recent years, there has been considerable interest in understanding small village tank irrigation systems in South Asia. These systems are now considered as one of the oldest human-made ecosystems and historically one of the oldest in engineering design. Village tanks are eco-friendly and ensure groundwater recharge in arid areas. They also benefit all sections of the village community - especially women. Sri Lanka has 18,387 tanks (Ratnatunga 1979), of which some are functioning and some have been abandoned or are in need of repair. Sri Lanka's small tank cascade irrigation systems developed as ultimate stock-type irrigation systems, with long histories which date back to over a thousand years and were the backbone of an ancient hydraulic civilization which flourished in the North Central part of the country.

These small tanks are not randomly located or distributed, but occur as distinct cascades positioned within small watersheds or meso-basins. Although apparently flat, the North Central Province is undulating and the ancient tank builders took advantage of this landscape to make "chains" of small tanks in the valleys. This is what is referred to today as the "small tank cascade system" (Tennakoon 2000). Studies showed that the 9 river basins of the Rajarata area are made up of 50 sub-watersheds and 457 small tank cascades.

The restoration and rehabilitation of small tanks can significantly impact the economic and social welfare of village communities in the Dry Zone.

A cascade of tanks is made up of 4 to 10 individual small tanks with each tank having its own micro-catchment, but where all of the tanks are situated within a single main catchment basin. These basins could vary in extent from 6 to 10 square miles (1 square mile = 2.58998 square kilometers). The small tanks form a series of successive water bodies along small watercourses. The advantage of such a system is that excess water from a reservoir, along with the water used in the command area, is captured by the next downstream tank and is thus continuously reused. This system helps to surmount irregularly distributed rainfall, non-availability of large catchment areas and the difficulty of constructing large reservoirs. It is also an effective means of recycling water (Sakthivadivel et al. 1996).

The surface water that is captured and stored in these small village tanks served multiple purposes apart from irrigation supply for rice cultivation. Water was used for inland fisheries, livestock, groundwater recharge, domestic bathing needs and ecosystem services. The construction of the tanks was carried out by villagers themselves who also developed their own indigenous institutions for maintaining and operating their tanks as common property resources. These institutions were empowered to own and manage the tanks, and to raise income from fisheries and various aquatic plants and reeds growing in the tanks.

The restoration and rehabilitation of these tanks can make a significant contribution to the economic and social welfare of village communities in the Dry Zone. For such a restoration to take place there is a need for social capital and the setting up of institutional support systems. These are two main areas where IWMI can bring in new knowledge and international expertize based on its experiences in the region, like in India, for example, where similar village tank systems have been successfully rehabilitated for the benefit of rural communities.

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Reflections

Remembering 25 Years of Research

Here we bring you the highlights of IWMI's 25 years of research in Sri Lanka, including some key tools and products the Institute developed with partners and information on important projects. We dedicate this section to the many partners we work with in this country, who have provided valuable inputs, worked with us in the field and implemented the recommendations made by IWMI.

1985 - 1990

Specializing in Irrigation Management

The need for an international institute to initiate and promote research in irrigation management became evident when many professionals recognized that the rapid development of irrigation systems - to provide water for emerging new crop varieties - would eventually reach a limit. The need to expand water resources would eventually give way to the need to manage those resources. And so, in 1985, IIMI was established.

Participatory Irrigation Management (PIM)

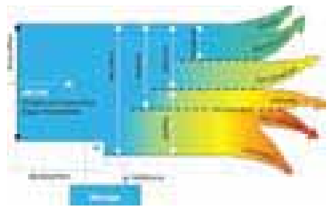
Early work in Sri Lanka was mainly focused on irrigation water management and took root in the Walawe Basin. Here, research concentrated on the behavior of agencies and farmers in relation to water management in the field canal and distributary canals (tertiary canal system level) and the implications of canal rehabilitation on water management.

Groundwater in Hard Rock Areas and Small Tank Cascade Systems

"**Groundwater is the most misunderstood resource. Because wells get recharged easily, they are being dug indiscriminately everywhere**" - *Dr. C. R. Panabokke*.

IWMI research made a major breakthrough in showing how groundwater occurs in inland valleys and not at random across the landscape. A methodology was developed to estimate the carrying capacity of agro-wells within a cascade system. Dr. C. R. Panabokke and Dr. R. Sakthivadivel contributed extensively to studies on groundwater and the small tank cascade systems.

Water Accounting



IWMI's Water Accounting System helped planners determine the amount of potentially usable water that is available in a river basin, where it is going, who is using it and how productive it is in terms of cost per cubic meter.
In 1998, IWMI performed a comprehensive water balance study in the command area of the Kirindi Oya irrigation scheme in Sri Lanka's dry zone to assess the water use by non-crop vegetation. The assessment was based on surface flow measurement, rainfall data and estimation of crop water requirements. The water balance showed that perennial vegetation consumed 43% of the water available, while crops consumed only 22%.

1990 - 1995

Action Research in the Uda Walawe Right Bank Scheme and Kirindi Oya Basin motivated stakeholders to implement research-based recommendations on water management and crop diversification to improve agricultural performance.

1995 - 2000

Research on Multiple Themes

IWMI researchers began to bridge the gap between agriculture, livelihoods, the environment and health issues in a basin and understand the trade-offs and links, which resulted in a new direction towards thematic research which continues to date.

A Change from Irrigation Management to Water for Food, Livelihoods and Nature

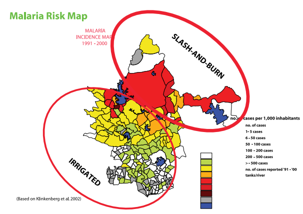
In 1998, IIMI became IWMI under its new mandate of improving the management of water and land resources for food, livelihoods and nature.

2000 - 2010

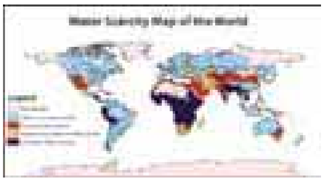
The World Water and Climate Atlas developed by IWMI showed where rainfed agriculture can be expanded, where supplemental irrigation can increase yields and where the majority of poor people live.

Malaria Risk Mapping in the Uda Walawe

IWMI and partners introduced a project to integrate priority public health issues into overall water management in the Uda Walawe Basin. Malaria risk mapping, using GIS remote sensing technology, made it possible to target priority high risk areas with interventions to help control the spread of vectors.



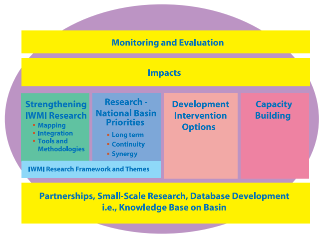
2000 - 2010 (contd.)

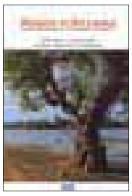


IWMI's Global Water Scarcity Study, carried out by David Seckler, Randolph Barker and Upali Amarasinghe projected water supply and demand across 118 countries and pinpointed water scarcity hot spots by 2025.

The Benchmark Basin Concept

When IWMI introduced the benchmark basin concept in the twenty-first century, the Walawe Basin was one of the four basins selected for benchmarking. IWMI carried out studies within the basin on anicut irrigation schemes, small tank systems, inland fisheries, livestock and irrigation water use, which helped to form a comprehensive picture of water resources management and development in the Walawe Basin.





Malaria in Sri Lanka

This book encompassed 50 years of malaria research. It brought together IWMI research findings and the work of Sri Lankan and international researchers and documented both the successes and failures of control efforts in Sri Lanka, thereby contributing to the global knowledge base on malaria.

Tsunami Relief and Research

In the days following the 2004 tsunami IWMI worked with MapAction, UK, at the Sri Lanka Center for National Operations (CNO) to create GIS maps of affected areas and these were regularly updated. IWMI also carried out a rapid livelihood needs assessment in Hambantota as part of a plan for rehabilitation and recovery. In addition, IWMI provided guidance on groundwater and well cleaning to organizations and communities on the east coast, while assessing the environmental impacts of the tsunami.

PODIUM-IWMI's Global Policy Dialogue Model

IWMI developed PODIUM as an interactive policy planning and scenario analysis tool which explores the trade-offs and future demands on water resources on a national scale. It was intended to foster dialogue and stakeholder participation and provide a basis for multi-sectoral planning and analysis. In Sri Lanka, the model looked at water demand by the various sectors, including agricultural, industrial and domestic uses, and environmental requirements.

Assessing Human Impacts and Water Quality in the Bundala RAMSAR Wetland System

The Bundala National Park is Sri Lanka's first RAMSAR site, located downstream of the Kirindi Oya, and hosts a vast population of wildlife and migratory birds. IWMI examined the effects and potential impacts of hydrological changes on waterbirds and their habitats as well as the impacts of agricultural development on water quality.

Investigating the Impacts of Irrigation Development on Poverty Reduction

IWMI investigated the poverty-reducing impacts of irrigation infrastructure development in Sri Lanka and found that poverty was highest in areas without irrigation infrastructure. Interventions such as the development of small tanks and technologies that use raw material and local labor, along with new avenues of income, can help enhance the benefits to rural communities.

The National Wetlands Directory of Sri Lanka developed by IWMI, International Union for the Conservation of Nature (IUCN) and the Central Environmental Authority (CEA) of Sri Lanka, used GIS remote sensing technology to map and identify wetland boundaries and vegetation cover in over 85 wetlands across Sri Lanka. This generated new knowledge on wetland systems.

Maximizing the Benefits and Minimizing the Risks of Wastewater Agriculture

IWMI together with local partners and the Wastewater Agriculture and Sanitation for Poverty Alleviation (WASPA) in Asia project studied the extent of wastewater use in agriculture in the Kurunegala District. The Institute looked at the health impacts on communities while bringing together different stakeholders and developing and testing solutions for sanitation and decentralized wastewater management, and the mitigation of health risks associated with wastewater agriculture.

Establishing Moveable, Vertical Gardens for Internally Displaced Persons (IDPs)

As part of the program by the Resource Centres on Urban Agriculture and Food Security (RUAF), IWMI worked with the Department of Agriculture (DoA) of the Western Province to introduce vegetable cultivation to IDPs in the Vavuniya District through an innovative technology known as 'moveable, vertical gardens.' Training was provided to 25 agriculture and extension officers as well as farmers and schoolchildren.

Impacts of Climate Change on Water Resources and Agriculture in Sri Lanka:

Vulnerability Hot Spots and Options for Adaptation

Nishadi Eriyagama

There is ample evidence to suggest that Sri Lanka's climate has already changed. During the period 1961-1990, the country's mean air temperature increased by 0.016 °C per year (Chandrapala 1996a), and mean annual precipitation decreased by 144 millimeters (mm) (7%) compared to the period 1931-1960 (Chandrapala 1996b; Jayatillake et al. 2005). However, the bigger question of national importance is what Sri Lanka's climate will look like in 50 or 100 years and how prepared the country is to face it. Few studies attempted to project future climate scenarios for Sri Lanka and to identify climate change impacts on agriculture, water resources, the sea level, the plantation sector, the economy and health. Even the studies that have been carried out appear to have contradictory projections, especially with respect to future rainfall.

A recent review by IWMI on the status of climate change research/activities in Sri Lanka suggests that Sri Lanka's mean temperature may increase by about 0.9-4 °C, over the baseline (1961-1990), by the year 2100 with accompanying changes in the quantity and spatial distribution of rainfall. These changes may lead to an increase in the *Maha* (wet) season irrigation water requirement for paddy by 13-23% by 2050 compared to that of 1961-1990 (De Silva et al. 2007). Future projections on coconut yield suggest that production after 2040 may not be sufficient to cater to local consumption (Peiris et al. 2004), and a reduction in the monthly rainfall by 100 mm could reduce productivity by 30-80 kilograms of 'made' tea per hectare (Wijeratne et al. 2007), thus impacting the country's exports.

Agricultural vulnerability hot spots

This study also attempts to identify the country's agricultural vulnerability hot spots, as well as identify existing knowledge gaps. It developed a pilot level Climate Change Vulnerability Index consisting of three subindices (Exposure, Sensitivity and Adaptive Capacity), which was subsequently mapped at a district level. Typically, a complete measure of exposure to future climate change would require consideration of projected changes in climate in each analysis unit. However, given the existing ambiguity in climate change projections for Sri Lanka, this assessment relies on data on exposure to historical climate extremes, since it is likely that this vulnerability will only increase under future climatic conditions.

The maps indicate that typical farming districts such as Nuwara Eliya, Badulla, Moneragala, Ratnapura and Anuradhapura are more sensitive to climate change than the rest of the country due to their heavy reliance on primary agriculture. Coupled with their low infrastructural and socioeconomic assets (or low adaptive capacity), and high level of exposure to historical climate extremes, these areas are the most vulnerable to adverse impacts of climate change (Figure 1).

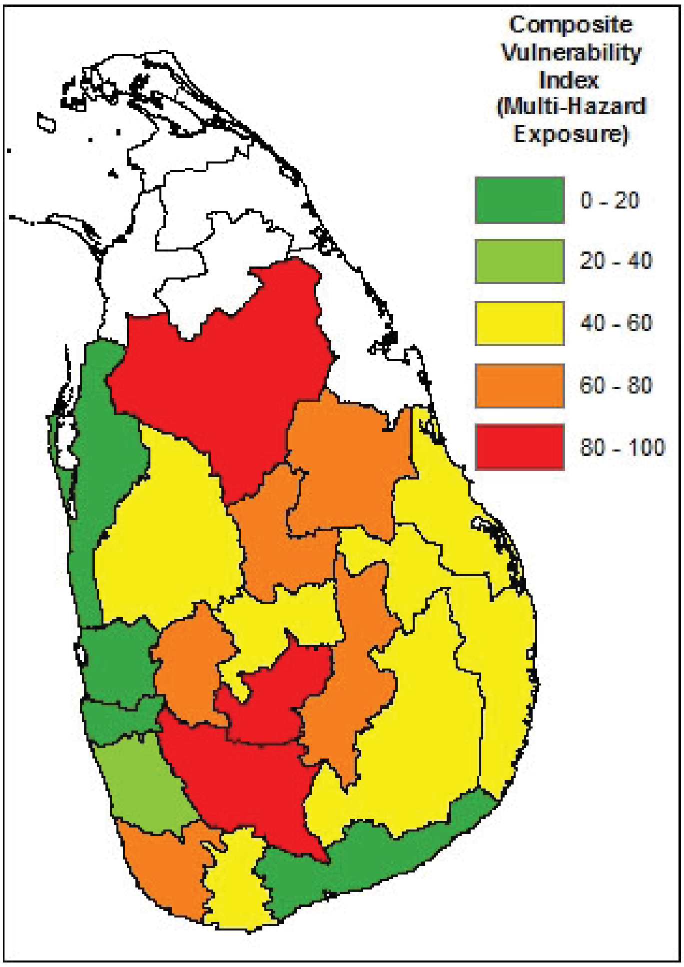


Figure 1. Climate change vulnerability index by district in Sri Lanka, considering each district's exposure to historical climate extremes, sensitivity and adaptive capacity.

Adaptation strategy and options

This study also points out that in the face of an uncertain climate, Sri Lanka needs to concentrate on “smart investments” and “no regrets” adaptation interventions that simultaneously deliver climate resilience and address current development needs. Both, rainwater harvesting, and restoration of the ancient tank system of the country, are two such adaptation options against future challenges in the water resources and agriculture sectors. De Silva et al. (2007) suggest providing rainwater harvesting systems to all households in drought-prone areas, making it a prerequisite to receive drought relief. Development of sustainable groundwater, promotion and adoption of micro-irrigation technologies, wastewater reuse, increasing water use efficiency and change of allocation practices are other adaptation options under consideration in the water resources sector. Studies on crop adaptation are performed mainly by six research institutes in the country conducting research on rice, field crops, horticultural crops, tea, rubber and coconut. The Coast Conservation Department (CCD) is in the process of formulating a Climate Change Action Plan for adapting to sea-level rise. However, equally important is creating awareness among different stakeholders on vulnerabilities, impacts and adaptation options, as well as encouraging farmers to take individual or communal action to prepare for climate change. Apart from the above, reliable and detailed quality controlled climate scenarios and a comprehensive national study on river basin or district scale on the vulnerability of Sri Lanka’s water resources and agriculture sectors to climate change are also urgently needed. This will give a better idea of the risks and benefits of climate change for strategic planning towards adaptation. It is equally important that such a study takes stock of Sri Lanka’s present water resources in the form of a national water resources audit such as the prototype developed by IWMI, which is accessible at: idistest.iwmi.org:8080/slwa/.

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Photo credit : Dominique Perera

Providing rainwater harvesting systems (like the water storage tank pictured here) to households in drought-prone areas can help communities adapt to the challenges of future climate change.

Photo Credit: Sanjini de Silva

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