WaterMatters

News of IWMI Research in Sri Lanka

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EDITORIAL

WATER MATTERS MAY, 2012

Ripples on Water

I spent an interesting evening at the Open Air Theatre in Viharamahadevi Park in March, watching the launch of the '*Ripples on Water*' campaign. The International Water Management Institute (IWMI) took an innovative approach in raising awareness on water issues with this campaign, which creatively combines art, science and development in a manner that engages audiences to understand the importance of managing water better.

This was the first phase of the campaign, which was launched with a light show and contemporary water dance performance by Sri Lankan contemporary dance company, nATANDA. '*Ripples on Water*' aims at putting water on the global agenda by taking the campaign to many other countries around the world.

Many people believe that there's plenty of water in Sri Lanka and so there's no real problem. But the facts speak for themselves. Droughts have been responsible for a third of all crop losses over the past three decades. Even today, over 85% of rural households and a quarter of urban households lack access to clean water. Although this country does have water, it is distributed unevenly and seasonally. As the economy improves, more stress is being placed on water resources and reserves. Better water management could, for instance, double irrigation efficiency, and reviving the tank system will give more farmers access to water and also provide valuable water for wildlife and the environment.

This is where the importance of research comes in, in identifying these areas of concern and in suggesting sustainable intensification of use.

Several articles in this issue of *Water Matters* also highlight this need for sustainable intensification of use in view of the major challenges that the exploitation of groundwater presents. '*Counting farm wells in northern Sri Lanka*', speaks about tracking the increasing number of wells that are pumping groundwater, which could be one way of keeping track of overexploitation. The critical issue of sustaining groundwater quality in Jaffna, as researched by Sutharsiny Arasalingam, is addressed in *Assessing salinity levels to help protect Jaffna's water* which advocates that steps should be taken to increase rainwater recharge to underground resources and to conserve freshwater use. The work carried out by Madar Samad et al., explained in *Wells and cells invigorate village agriculture*, outlines an interesting instance of how new technology woke up a sleeping tank community to the vast possibilities that productively harnessed groundwater brings, but cautions that active interventions by the authorities is necessary to avoid access disparities and ensure security of production.

It may perhaps be archaic to talk about old, traditional weather forecasting when the modern world has moved on to weather satellites. However, in many countries, particularly developing countries, modern weather forecasts are either wrong, post-fact or have no use to farmers, and cannot be utilized when planning for their cropping seasons. The opinion piece on traditional weather forecasting states that natural indicators are best suited in such instances as they can predict and provide valuable information for food production. Ranjith Ariyaratne, Benchmark Basin Coordinator at IWMI, asserts that this knowledge, gained over millennia, should be passed on to new generations through school curricula. The article, *Urban agriculture gets policy-level support in Sri Lanka's Western Province*, makes a vital point that home gardens in urban/peri-urban areas could be the means to growing the much-needed food to feed rapidly expanding urban populations, the success of which has already convinced policymakers to address its potential.

On a final note, IWMI is pleased to support the South Asia Regional Center for Rainwater Harvesting (SARCRH), whose office is located at the premises of the headquarters of IWMI in Colombo. South Asia will undoubtedly benefit from the work carried out by this regional office in alleviating the region's water woes.

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Front cover photograph: Wayside sales outlet at Gampaha supported by the IWMI-RUAF Urban Agriculture Program (Photo credit: Kannan Arunasalam)

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Wells and cells invigorate village agriculture

Farmer-led initiatives in water management can catalyze rural development

Walk into the house of Mr. Amarapala in Galenbindunuwewa, a small village close to Medawachchiya, and you are met by an extraordinary sight: a carpet of shiny purple onions. House-brick stepping stones peek out of the onion layer to allow the family to hop in and out. Mr. Amarapala is a farmer with less than half a hectare of land area. But by using groundwater, pumped from a newly-dug open well, he has successfully been able to boost his production of onions and other high-value vegetables. He now has so much surplus that he has nowhere to store it other than on the floor of his house. How did this happen?

Much of the rural population around Anuradhapura and Medawachchiya, in the heart of Sri Lanka's dry zone, are dependent on small tank irrigation for their livelihoods. Every village usually has one or two tanks that are part of a larger cascade. Traditionally, the tank system sustained not only a sizeable area of paddy, but also provided water for domestic needs, livestock and fishing. Water seeping from the tank also supported home gardens by keeping the soil moist. Community members cooperated with each other to ensure that there was a fair share of water for all.

Then in the 1980s things began to change. The wide availability of cheap diesel and petrol pumps gave farmers a new option. They could now sink their own wells and pump groundwater. This meant that they could get as much water as they wanted, whenever they wanted. More profitable vegetables could then be grown on a much wider area of land. New road links to Sri Lanka's urban centers also opened up new markets, turning subsistence farmers into commercial market gardeners.

A further innovation accelerated the transformation: mobile phones. As farmers got connected, they could check the market process on a daily basis and carefully choose when to sell to wholesalers to maximize their profits. Sales to wholesalers in the area rocketed from 5% of total output in the 1990s to around 85% today.

Photo Credit: Madar Samad/IWMI

Cultivating capsicum – availability of cheap pumps enable farmers to grow more profitable vegetables on a much wider area of land.

Photo Credit: Kannan Arunasalam

Mobile phones give rural growers leverage over middlemen and wholesalers.

The combined effects were remarkable. From the late 1990s, the number of wells in Galenbindunuwewa village increased by 93%, to around 117 today. Farm incomes have also risen, on average, by two and half times.

All of this has been good news for local people. School enrolments have increased. Housing and health are also improving. So far, there has been no serious depletion of groundwater as regular rainfall has consistently recharged local aquifers.

However, there is a catch: the benefits of this groundwater boom have not been shared equally. Essentially, access to land has meant access to water. As a result, the landless and more marginalized members of the community have not benefitted to the same degree as more wealthy farmers. There has also been increased encroachment on state land and enclosure of common property, depriving poorer households of easy access to shared land.

The revival of traditional practices and customs are often proposed as a solution to contemporary problems of agriculture under small tank systems. The case study, conducted by Madar Samad, K. Jinapala and B. R. Ariyaratne, argues that such an uncritical approach is too simplistic. The present conditions in the villages are markedly different from their historical setting. The experience of Galenbindunuwewa demonstrates that there is enough water in Sri Lanka to grow all the food needed to meet growing demand. But unless we take an equitable overview of water, land, technology and infrastructure, we may not be able to guarantee food security for all of the island's people.

First, it clearly demonstrates just what a valuable resource groundwater is. Provided underground aquifers are used sustainably, they have the potential to support a substantial expansion of agriculture. Overexploitation of aquifers can, of course, create huge problems. However, as long as a balanced and locally tailored approach is taken, groundwater can be a lasting farm-based solution to crop irrigation.

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Second, an important lesson is that simple inexpensive technologies can make a huge difference to rural farmers. Without mobile phones, farmers had little leverage over middle agents and wholesalers. Now the balance has become fairer. It's worth noting that the effective combination of groundwater use and mobile technology was an innovation that came from the farmers themselves. Grassroots transformations are often far more sustainable than top–down, centrally planned interventions.

Third, we need to revisit our onion floor. It is an all too familiar demonstration of what can happen when agriculture is made more productive, but no proper storage or processing facilities are available. Here, of course, the central government can play a critical role in developing the infrastructure needed to store, process and transport food.

It also raises some important issues for the future food security of Sri Lanka and other parts of South Asia. Food security, after all, is not simply the ability to grow enough food. It is also about ensuring that all members of society have access to affordable nutritional value. It is a challenge we would do well to remember.

Photo Credit: CC image by Sriganesh Lokanathan/LIRNE Asia on Flickr

Traders at the Dambulla market.

IWMI hosts SARCRH office

Photo Credit: Ministry of WS&D

Minister of Water Supply & Drainage (WS&D) cuts the ceremonial ribbon at the inauguration of the SARCRH office.

The South Asia Rainwater Catchment Systems Association (SARCSA) set up its South Asia Regional Center for Rainwater Harvesting (SARCRH) on the premises of the headquarters of the International Water Management Institute (IWMI) in November, 2011. Hon. Dinesh Gunawardena, Minister for Water Supply & Drainage, was the chief guest at the inauguration.

The setting up of the secretariat was a result of a memorandum of understanding (MoU) signed with IWMI, to support the rainwater harvesting technology and activities of SARCSA in the South Asian region.

In September 2006, the Sri Lanka Government hosted a regional forum on "Rain Water Harvesting," attended by ministers from nations of the South Asian Association for Regional Cooperation (SAARC) who are responsible for water-related matters, and it was decided to establish a SARCRH secretariat in Sri Lanka. This decision was ratified by a declaration at the 15th SAARC summit held in Colombo in 2008, which emphasized the need to build capacity and promote research on rainwater harvesting to combat future water scarcity predicted in the region.

Rainwater harvesting in Sri Lanka has increased substantially during recent years, with an estimated 30,000 systems now in operation island-wide. The technology has proved to be a boon to rural people, particularly for domestic water supplies in water-scarce situations.

Sri Lanka has a National Policy on Rain Water Harvesting, in support of rainwater harvesting technologies for providing water to the people.

Photo Credit: Ministry of WS&D

Lighting of the traditional oil lamp at the opening ceremony.

Urban agriculture gets policy-level support in Sri Lanka's Western Province

Success of an urban farming partnership supported by researchers (from IWMI) has led to the first ever inclusion of urban agriculture in the development strategy of the Western Province

Squeezed between the houses, roads and shops of Sri Lanka's urban sprawls, poor families have long grown their own food on small plots. These 'micro-farms' play an important role: providing cheap, fresh produce to poor and middle-income households. This makes an invaluable contribution to better nutrition and family health. The proximity of vegetable gardens to highly populated areas also has a further benefit: enterprising growers play an important role in recycling organic waste for use as plant fertilizer.

Photo Credit: Kannan Arunasalam

An enterprising anthuriam grower.

But few urban farmers manage to grow enough to be able to profitably sell a surplus. Productivity of urban plots is often low. A shortage of land tends to constrain further expansion. Unlike rural farmers, urban growers enjoy few support services such as those provided by micro-credit agencies and marketing cooperatives. City councils and other state institutions often fail to recognize the importance of urban gardening, or to develop policies to support it.

Photo Credit: Kannan Arunasalam

Some growers have diversified to making chutneys, pickles and pastes.

The city of Gampaha in Sri Lanka's Western Province was typical in this regard. It is one of the country's fastest growing urban centers, and poverty levels are rising. Many hundreds of households grow produce inside the city boundaries, but little attempt was made to increase production or to market surpluses of food.

To improve matters, the Resource Centres on Urban Agriculture and Food Security (RUAF), a South Asian network of nongovernmental organizations (NGOs), in partnership with researchers from IWMI, introduced the '*From Seed to Table*' (FStT) program to the Gampaha District to improve the livelihoods of the urban poor and other marginalized smallholder farmers. The hope was that ultimately a city-wide strategy could be developed to support urban farming systems. The international NGO, Practical Action, provided technical assistance on the ground.

Photo Credit: Kannan Arunasalam

A family works in their home garden.

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Opinion:

Local cultivators know this country's climate

Traditional forecasting is still practicable and should be taught at a young age

B. R. Ariyaratne, H. Manthrithilake and K. Jinapala

Photo Credit: CC image by Totally Reasonable on Flickr

Wasp combs hang from tree branches, the sides of rocks and buildings. Prior to impending cyclones or heavy rains, they move from these open areas to covered places like inside caves or sheltered sides of rocks.

We were on a field trip to the scrub jungles of Siyambalanduwa in the Moneragala District and encountered Karunadasa, a farmer. His family had been cultivating paddy near the Karakolagaspitiya Wewa, a small village tank, for generations. His weather-beaten face creased with concentration as he was busy preparing his land for sowing.

"We must hurry," he explained, "the divul trees are heavy with fruit, so the rains will be upon us soon, to replenish the tank."

Like many farmers, Karunadasa follows in the footsteps of his ancestors by observing nature carefully and fine-tuning his crop calendar by interpreting natural phenomena. He sows and harvests guided by the changing patterns of flowering and fruit-bearing trees, changes in the behavior of animals, and wind and cloud formations.

Agriculture in Sri Lanka dates back over three millennia and, over this long period, two distinct seasons for cultivation have been developed. This understanding and utilization of nature created a rich civilization, underpinned by an indigenous knowledge system that helped inform important agricultural decisions.

Modern science has brought in new technologies: sophisticated weather stations, computers and forecasting models. More and more people now have access to this knowledge. New mobile phones can give even the most isolated farmers the very latest satellite weather data, often tailored to specific regions. The old-fashioned forecasting done by folk is in decline. But are we losing something valuable here? Apart from the difficulty of guaranteeing countrywide mobile connections, and problems with presenting information in easily understood formats, there are other downsides to this digital data boom.

Photo Credit: CC image by J. Michael Rowland on Flickr

When rain is imminent the cloud color changes from ash to dark ash and the clouds settle in the center or lower sky.

Traditional knowledge not only connects us to our heritage, but it enables us to understand our environment more completely. Many spectacular scientific discoveries have been made by observant amateurs whose intimate knowledge of their local environments gives them the edge over university-based academics. If we could tap into this extraordinary resource of curious cultivators, who knows what we might learn?

Photo Credit: Dominique Perera/IWMI

The Cassia tree in full flower during June-July foretells a long dry period ahead.

Sri Lanka's agricultural history and climatic pattern

A first step would be to talk to rural folk to collect as much indigenous knowledge about our plants and animals as possible. This is urgent. Younger farmers are already losing these precious insights. We could then try to match this data with our scientific knowledge of the climate to see how it corresponds.

Photo Credit: CC image by Christina Xu on Flickr

The mango tree is very sensitive to climate variations.

We believe that this knowledge base should be revitalized starting with the very young, who can be taught to observe these natural phenomena in their surroundings and to use them to their advantage. Both physical and biological indicators have been used to describe and predict the climate. For instance, the full moon, the color and position of clouds, the direction of the wind gauged by cloud movements, all foretold monsoonal air flows. Night temperatures, their degree, season and duration of occurrence also predicted the incidence of rain.

Plant and animal indices are the biological indicators. The growth patterns of plants, the shedding of leaves, flowering and fruiting during particular times are all indicative of wet and dry weather. The reproductive behavior and locations of the hives of honey bees can foretell dry and wet seasons. Wasps were once used as the barometers for cyclones or heavy rains.

This instruction should begin with children of every age, starting from playschool. At a very young age they can be taught to identify the parts of plants and insects and weather patterns. At higher grades they could learn to review this data and to add some qualitative information based on time frames and measurements of diverse natural activities. This education will equip children to gain an in-depth understanding of the natural world and, who knows, by the time they leave school it may even have inspired them to take up this study as a worthwhile hobby or profession that spans a lifetime.

Photo Credit: CC image by Stefano Pasucci on Flickr

Cultivators expect rain after the full moon, especially after a long dry spell.

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Grassroots enterprise

As a first step, the program got together with the relevant provincial and city authorities to develop a coordinating agency: the 'Urban Green Force'. Project workers then identified team leaders in areas with multiple gardens. A farmers' company was set up to manage micro-loans through a revolving fund and provide expertize in bookkeeping. Using the team leaders as local advocates, over 100 farmer families joined the company hoping to improve their yields and incomes. RUAF provided training on packaging and marketing for products like *polos* and *kos* (two types of fruit common to the area), so that they could be sold on to supermarket wholesalers. Simple roadside shops and stalls, at which company members could sell their produce, were also established. Some members even diversified into making chutneys, pickles and pastes which could be sold at a premium. Women were often the most keen to make the most of the new opportunities.

The poor often have to endure unreliable mains water supply and other options can be equally problematic. There is little room for rainwater storage, for instance, and groundwater can be heavily polluted. Accordingly, IWMI researchers working with RUAF provided advice on how best to use local water resources, including the efficient and safe recycling of domestic wastewater.

"We had been growing vegetables in a very small way, at home, just for our families," says Sudharma, a local grower. "The project helped us to be more enterprising. Joining the farmer company gave us reassurance that we were part of a larger group, so we had the courage to face whatever comes - even failure. Now we are growing extra produce, for sale."

Hospital gardens

The program also introduced the 'home garden' concept to the Gampaha Hospital. Not only did the produce grown benefit patients by improving the nutritional value of meals, but the garden also became an open-air classroom. Staff from the provincial Ministry of Agriculture set up 'crop clinics' and a plant hospital, which functioned as a center for resolving issues related to cropping.

Policymakers take notice

Impressed by the project, the provincial Minister for Agriculture recommended that it be expanded to other cities and towns. On his advice, the Provincial Council agreed to include urban agriculture in the Western Province's official development strategy for the first time. Now national policymakers are also taking notice.

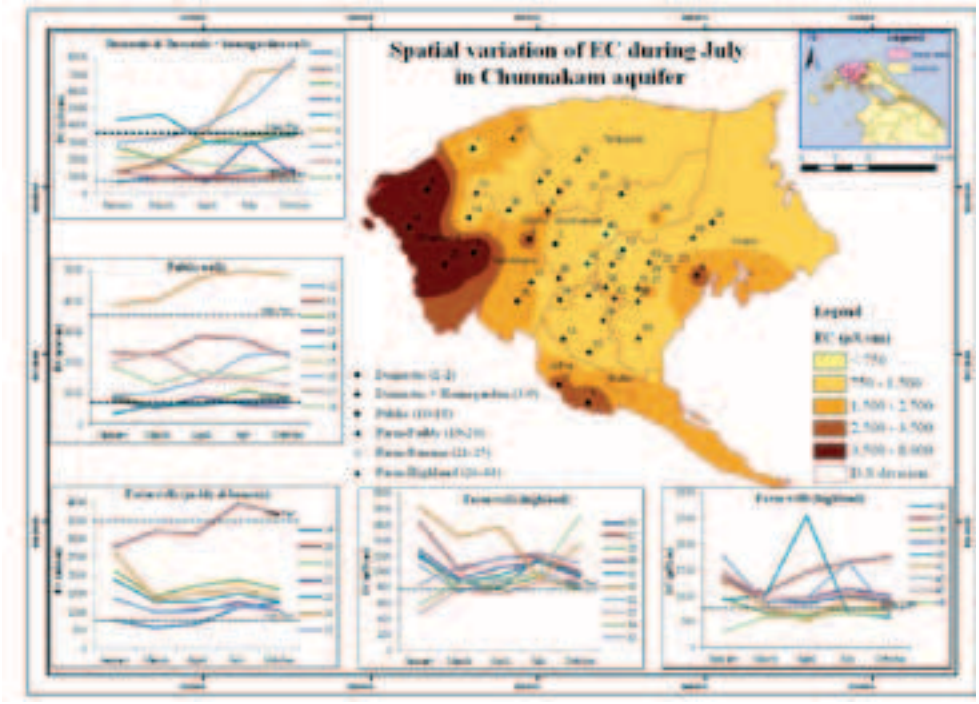
Policies on urban agriculture are now proposed for inclusion in Sri Lanka's national strategy for food production.

Photo Credit: Kannan Arunasalam

The farmer company monthly meeting.

Assessing salinity levels to help protect Jaffna's water

Outside of the rainy season, the population of the Jaffna Peninsula depends almost entirely on underground aquifers for its water. Chunnakam is the main limestone aquifer on the peninsula, and protecting the quality and quantity of water in this resource is, therefore, vital for Jaffna's future. Overexploitation of this freshwater bubble could break the fragile balance between sea saltwater and freshwater from the aquifer.

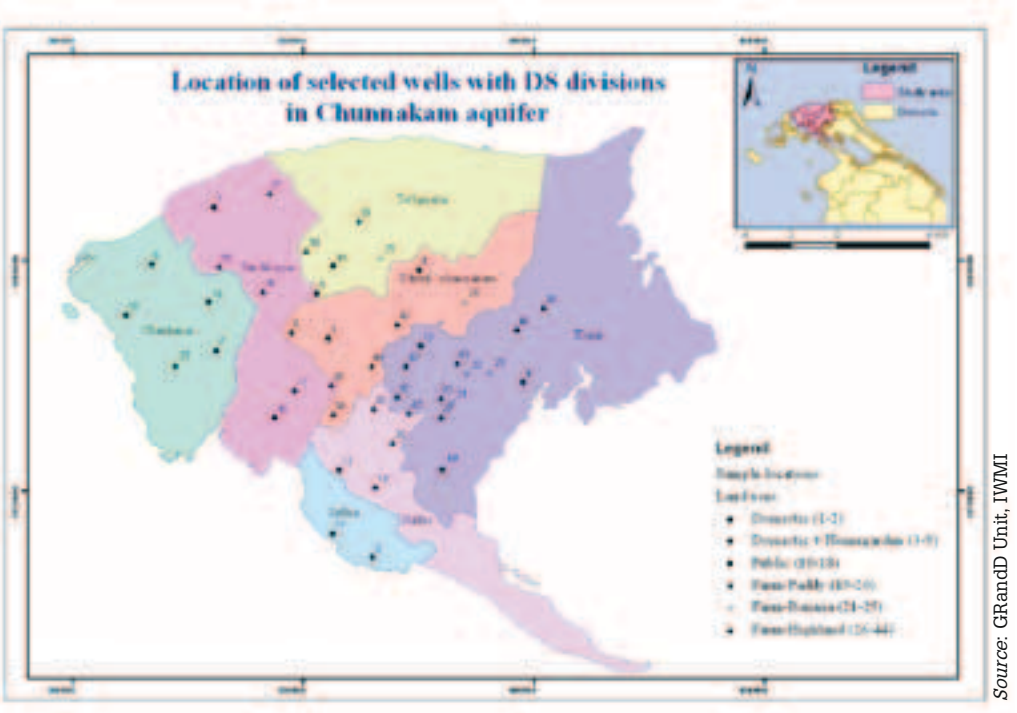


Source: GRandD Unit, IWMI

Distribution pattern of salinity in the Chunnakam aquifer.

"The rocks under the soil of the peninsula are made of limestone which is porous, rather like a hard sponge," says Dr. Herath Manthrithilake, Head of IWMI's Research Program in Sri Lanka. "Overuse of groundwater is likely to result in an imbalance between saltwater and freshwater. Once this happens seawater starts seeping into the lens of freshwater that feeds inland wells and this makes the water in them unusable. Other contaminants are also an issue. It is critical, then, that sustainable, evidence-based water management practices are developed if Jaffna is not to go thirsty."

In recent years, the rise of *geostatistics* has made assessing groundwater quality and distribution far more easy and accurate. Developed originally to help scientists predict the probability of finding valuable minerals in geological formations, geostatistics is now being used to inform many geohydrological investigations. Salinity is one of the many parameters measured in the study, and is measured by assessing the electrical conductivity (EC) of water. As it becomes more salty, the ions in the water increase its ability to conduct electrical signals.



Source: GRandD Unit, IWMI

Distribution of selected wells in the Chunnakam aquifer.

IWMI researchers undertook a study of the Chunnakam aquifer in the Valikamam area to find out if salinity was a growing problem. Sampling also took place at several different times of the year to compare the water quality during the rainy and dry seasons.

Groundwater samples were collected from 44 wells used for a range of different purposes including domestic use, domestic with home gardens, public wells and farm wells. Out of the tested wells, only one public well was found to be above the maximum permitted salt level for drinking water (as set by the Sri Lankan Government) throughout the year. Three wells used for domestic purposes and for home gardens exceeded the maximum permissible level during certain months of the year. All farm wells, except one, were found to be acceptable throughout the year, although there were variations in electrical conductivity over this period. The five wells with severe salinity problems are located near the coastal areas in the Jaffna Peninsula, so their high salinity is likely to have been due to the presence of seawater. Higher salinity was clearly shown to be more common closer to the coast, and decreasing inland.

"The lessons for Jaffna are clear," says Dr. Manthrithilake, "When groundwater is overexploited, saline water encroaches the underground reservoir because recharge from the rainfall is less than the extraction from wells. Hence, steps should be taken to increase the rainwater recharge to the underground resources and conserve the use of freshwater. Increased storage of rainwater above ground would also lessen the demands on the well water."

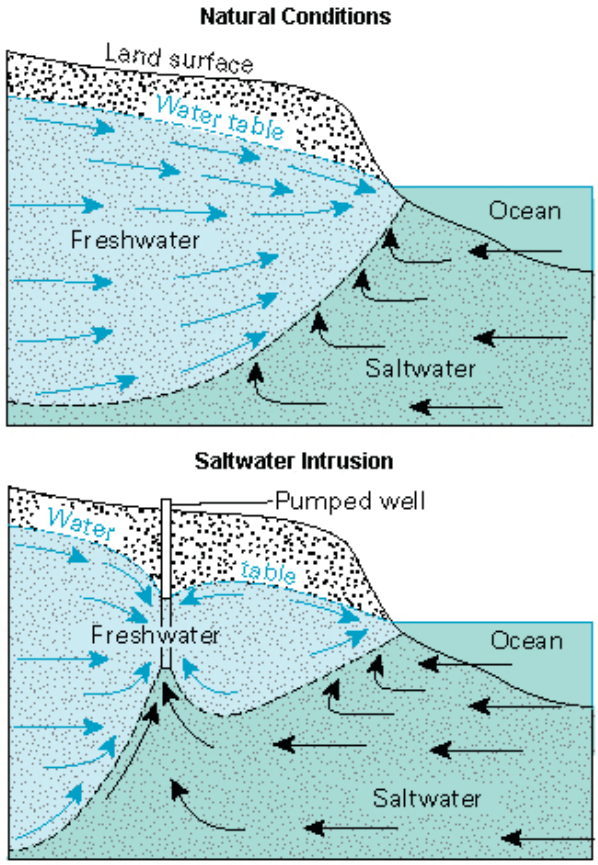


Diagram shows the encroachment of saltwater into an underground freshwater reservoir due to overexploitation of groundwater.

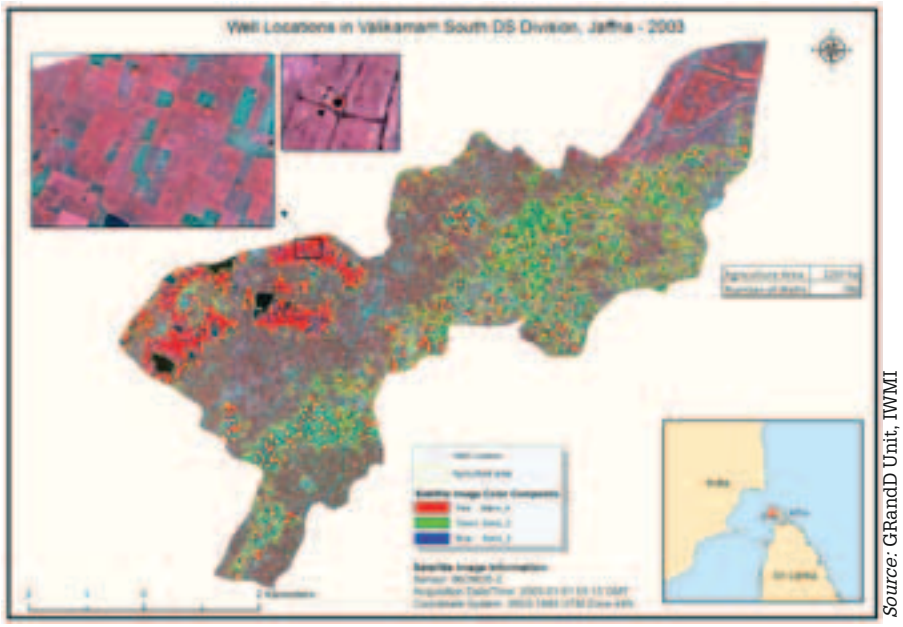
Photo Credit: Sutharsiny Arasalingam

Measuring salinity by assessing the electrical conductivity of water.

Counting farm wells in northern Sri Lanka

Groundwater use is increasing across South Asia at a dramatic rate. Cheap pumps and low energy costs have made extraction of groundwater an attractive proposition to many farmers. However, overexploitation of groundwater resources can create severe environmental problems. In Sri Lanka, wells are proliferating in many areas but nobody really knows just how many there are.

To better understand the potential impacts of this trend, geographic information system (GIS)/remote sensing (RS) experts at IWMI are using remote sensing to analyze changes in the number of wells in northern Sri Lanka. The five-month study focussed on three agricultural areas lying in the dry zone of the country: Kalpitiya in the west, Anuradhapura in the center and Jaffna in the north.



Source: GRandD Unit, IWMI

Agro-well distribution in Valikamam South DS division, 2003.

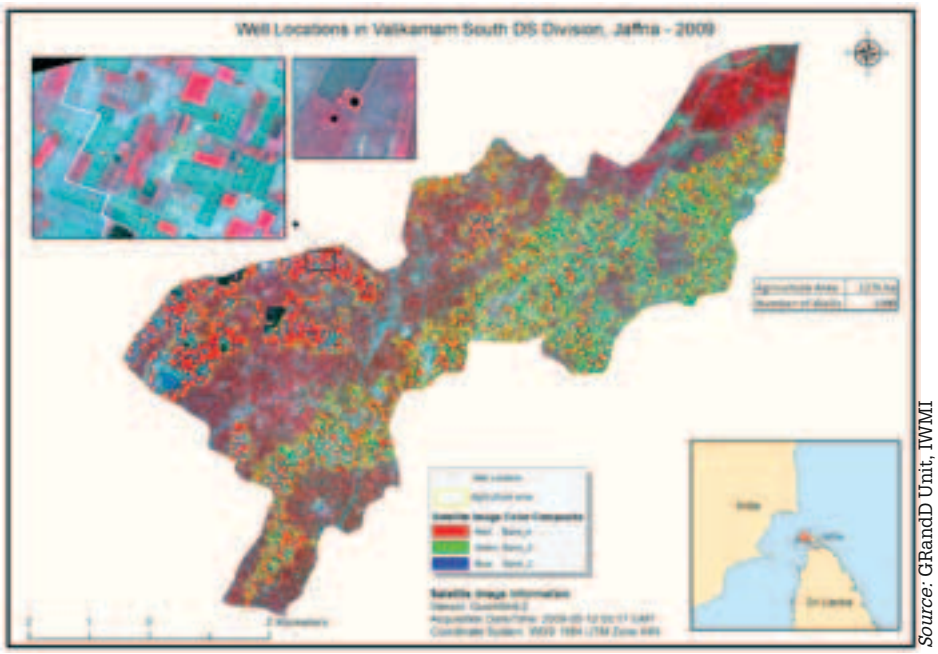
"In the last few years, the number of agricultural wells in these areas has increased drastically," explained Salman Siddiqui, Manager of the GIS/RS/Data Management Unit at IWMI. "However, there wasn't much data available on this because these areas, particularly Jaffna, were affected by the recent civil war. According to a rough estimate, there may be as many as 100,000 wells in Jaffna alone – that is one every 100 meters or so."

"If too many new wells have been dug this could have serious consequences on the quality of groundwater," says Salman. "Lower groundwater levels can lead to increasing problems of salinity as it encourages seawater intrusion. Ultimately, this can permanently damage the shallow freshwater aquifer, which makes the water useless for agriculture or drinking purposes."

The scientists acquired 0.5-m resolution satellite imagery from the IKONOS and QuickBird satellites to home in on one 'Divisional Secretariat' (an administrative subunit) in each district. They then analyzed the satellite images from the years 2003 and 2010 to see how the number of wells has changed over this time in each area.

"We found an increase in the number of wells of just over 37% between 2003 and 2009 in Valikamam South Divisional Secretariat. At the same time, the area used for agriculture only increased by around 6%," says Salman. "Next, we want to clarify the relationships between the number of wells and farm production or yields."

"For instance, there are several possible reasons why the number of wells may be increasing - land fragmentation, new land coming into production and the replacement of old, dried up wells. Similarly, yields may increase if a well provides more regular irrigation or if farmers use better seed, new technology or fertilizer. Rainfall patterns may also make a difference. As we collect more data and understand the picture more completely, we will be better able to sustainably manage groundwater use," says Salman.



Source: GRandD Unit, IWMI

Increase in agro-well distribution and agriculture area in Valikamam South DS division six years later.

Man carries a weighty sack of vegetables in the produce distribution center in Dambulla from where crops from local farmers are loaded daily on trucks and distributed to other parts of the country.

Photo Credit: Carolyn Fry, Consultant to IWMI

The International Water Management Institute (IWMI) is a non-profit research organization with offices in Sri Lanka (headquarters), India, Pakistan, Nepal, Laos, Vietnam, Ghana, Ethiopia, South Africa, Syria and Uzbekistan.

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