

2015 Annual Report



A water-secure world

Front cover image: Shaoyu Liu / IWMI

International Water Management Institute (IWMI). 2016. *IWMI Annual report 2015*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 28p. doi: 10.5337/2016.208

ISSN 1017-5954

Copyright © 2016, by IWMI. All rights reserved. IWMI encourages the use of its material provided that the organization is acknowledged and kept informed in all such instances

CONTENTS

03	Facts and figures
04	Putting water at the heart of sustainable development <i>A joint message from our Board Chair and Director General</i>
	10 feature stories
06	Innovative flood management approach tested for the first time in India
08	Indian farmers begin harvesting sunshine
10	Meeting investigates the role of migration in increasing women farmers
12	When is a wetland not a wetland?
14	Large dams put a million sub-Saharan Africans at risk from malaria annually
16	Flood maps guide emergency response in South Asia
18	Finding the brass in the muck
20	IWMI's new eye in the sky
22	Myanmar: Finding the best ways to manage scarce water resources
24	New book examines the potential impacts of climate change on agriculture
26	Statement of financial position
27	Principal investment partners
28	Wastewater efforts recognized
28	Celebrating 30 years of water management



Pic: Faseeh Shams / IWMI

STAFF NUMBERS AS AT DECEMBER 31, 2015

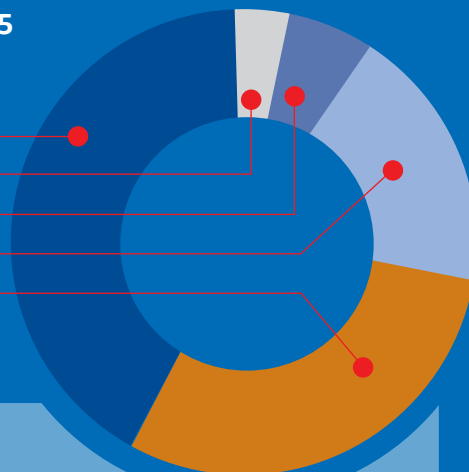


MEDIA ARTICLES PUBLISHED IN 2015



PUBLICATIONS FOR 2015

244	Total number of publications
104	Journal papers
11	Books
19	IWMI reports
41	Book chapters
69	Other



SOCIAL MEDIA STATISTICS FOR 2015



50%

Increase in Twitter followers with around 276 new followers per month



44%

Increase in LIKES for a total of 9,190 LIKES with 234 new LIKES per month



41%

Increase in LinkedIn followers with around 131 per month



**41,878
VIEWS**

On SlideShare of presentations by IWMI scientists

PROJECTS FOR 2015

Total active projects as at December 31, 2015:

148

IN 51 COUNTRIES



PUTTING WATER AT THE HEART OF SUSTAINABLE DEVELOPMENT

A joint message from our Board Chair and Director General



The year 2015 has been a momentous year for international development. Not only did the 193 member states of the United Nations adopt the Sustainable Development Goals (SDGs) in New York in September, but 195 countries adopted the first-ever universal, legally binding global climate deal in Paris 3 months later.

For all the diplomatic progress, however, the extent of the global challenges we face has remained clearly evident. Droughts triggered or exacerbated by an El Niño event in the Pacific Ocean affected many parts of Africa and Asia. Flooding in Chennai brought one of India's biggest cities to a standstill. Also, endless bouts of winter rain submerged many parts of the UK, showing that developed countries, too, are vulnerable to extreme weather events. Meanwhile, a new crisis unfolded in Europe, as unprecedented numbers of migrants sought to reach the safety of its shores.

So, the international agreements, while welcome, come not a moment too soon. The need to take action on climate change and embrace sustainable development is now urgent. It is at these critical junctures that we believe that the International Water Management Institute's (IWMI's) science can have the greatest effect. Our research on water management solutions is already assisting thousands afflicted by extreme water variability, and is helping to build the resilience of climate-affected communities.



Pic: Sharad Maharjan / IWMI

Take flooding for instance. IWMI's initiatives on satellite-verified flood insurance for smallholder farmers are now being field-tested in northeast India. In the same region, a pilot scheme for testing the approach referred to as 'Underground Taming of Floods for Irrigation' (UTFI) is also under way.

A further highlight of the year was the launch of the 'Solar Power as a Remunerative Crop' (SPaRC) pilot project in Gujarat, India. In a bid to persuade India's farmers (who irrigate with solar pumps) not to over-exploit groundwater with their 'free power', the SPaRC project uses smart subsidies to encourage producers to sell excess power to the national grid through a bespoke cooperative arrangement. More solar-powered irrigation is good news for climate mitigation, and it also has huge potential to boost incomes in areas of India where power supplies are erratic or nonexistent. SPaRC is designed to ensure that this new technology doesn't lead to the unsustainable depletion of aquifers.

Elsewhere, our newest office in Yangon, Myanmar, was just starting out in 2015. Our establishment in Myanmar was heralded by the publication of the first-ever comprehensive overview of agricultural water management in the country's dry zone. Based on an initial scoping study conducted in 2013, this work underpins a major new research program for Myanmar as the country emerges from years of isolation. This timely study has given us an opportunity to make a real contribution to policy development for sustainable water use in the new democracy, and together with partners we hope to build a thriving in-country research program.

IWMI celebrated its 30th anniversary in 2015, with highlights including a touring exhibition on our contribution to water management in Sri Lanka. This was launched at a gala reception in Colombo. Our other offices around Africa and Asia held their own celebrations. In Ghana, the anniversary was marked with the opening of IWMI's new regional office for Africa in Accra, demonstrating our commitment to the region. Our offices in Delhi, Addis Ababa, Vientiane and Pretoria also reached out to local partners and stakeholders to say a big thank you for all the support they have given IWMI over the years.

It has been a year of consolidation and change for the CGIAR Research Programs (CRPs). IWMI is now a partner in five CRPs, and leads the CRP on Water, Land and Ecosystems (WLE). Building

Donald Blackmore, left,
and Jeremy Bird



on a strong research portfolio, WLE directed its attention to four focal regions. It refined its mandate to include new aspects of sustainable intensification that are applicable across the CRP portfolio and will contribute to countries' initiatives to achieve the SDGs. The enhanced emphasis includes improved soil management and exploration of the rural-urban interface; the new interface of global resource challenges where agriculture, demography and development are interacting in new ways on an unprecedented scale.

Managing waste is a growing issue in urban and peri-urban areas. In response, we have developed a dynamic new program to roll out and scale up our work on resource recovery and reuse. There are early signs that this work has the potential to be a game changer in urban waste management. In Ghana, for instance, IWMI initiatives have contributed to the establishment of a new privately run co-composting facility in Techiman, which will annually transform 5,000 m³ of fecal sludge and 300 tons of organic solid waste into the safe, pelletized compost *Fortifer*. A new plant at Koumbi City will similarly convert organic waste into fuel briquettes. In Kumasi, in partnership with the local authority, wastewater is being used to support African catfish aquaculture. Proceeds from the business will be fed back into waste treatment.

A lack of access to water for agriculture often drives migration to urban areas. IWMI research in South Asia is unpicking the complex relationships between underperforming agriculture, inequitable land tenure and rapid development to better understand why modern patterns of labor migration seem to mire so many in perpetual poverty, and to examine whether improved access to irrigation could break this cycle.

This kind of crosscutting research has long been one of IWMI's strengths and will enable us to make significant contributions to fulfilling the SDGs. Our research-for-development agenda directly supports nearly all the SDGs, but we are also involved in the equally important business of target setting for water-related goals. We are working nationally and globally to define targets that are realistic but capable of delivering sustainable economic progress.

The global financial position for research funding has been challenging right across CGIAR throughout the past year. This has led us to review our skill base, and prioritize core activities and regions. Inevitably, this has caused some disruption, but leaves us in a stronger and more focused position to take advantage of future opportunities.

Looking ahead, we continue to see a vital role for our world-class research. The year 2017 will mark 10 years since the publication of IWMI's landmark report *Water for Food, Water for Life*, otherwise known as the *Comprehensive Assessment of Water Management in Agriculture*. We will be marking the anniversary with special events and publications, but most of all with a renewed commitment to sustainable and equitable development to benefit all humanity.

A handwritten signature in black ink, appearing to read 'D. Blackmore'.

Donald Blackmore
Chair, Board of Governors, IWMI

A handwritten signature in black ink, appearing to read 'J. Bird'.

Jeremy Bird
Director General, IWMI



Pic: Prashanth Vishwanathan / IWMI

“The team suggested diverting excess water from a canal fed by the flood-prone Pilakhar River, a minor tributary of the Ganga, to a village pond”

INNOVATIVE FLOOD MANAGEMENT APPROACH TESTED FOR THE FIRST TIME IN INDIA



Since September 2015, IWMI scientists have been testing a new method for managing floods while overcoming water scarcity. The approach, referred to as ‘Underground Taming of Floods for Irrigation’ (UTFI) (pronounced ‘utify’), involves using surplus floodwaters to recharge underground aquifers during the monsoon season, and then pumping the water to irrigate crops during the dry season. The pilot is being conducted in Uttar Pradesh, India. India is one of five Asian countries where IWMI has explored the potential to implement UTFI.

A detailed site assessment revealed the village of Jiwai Jadid in Rampur District as a suitable location for the pilot. Groundwater is being over-exploited across much of the district, while the wider Ganga River Basin suffers from regular floods. Many farmers grow thirsty crops, such as poplar trees, sugarcane and paddy rice, primarily pumping water from tube wells and boreholes to irrigate them. Groundwater levels have dropped substantially as a result.

The team suggested diverting excess water from a canal fed by the flood-prone Pilakhar River, a minor tributary of the Ganga, to a village pond. After gaining the support of the community, work began. It took 3 months to set up the site, so that floodwater could be transferred to the pond. In the latter part of the 2015 monsoon season, water was successfully transported from the canal to the underlying aquifer via recharge wells sunk in the base of the pond. During this process, water is first pre-treated through a desilting chamber to remove excess sediment and help it flow swiftly below the ground.

This water will be available to farmers for pumping during the dry season. The team is working towards ensuring that, over the long term, the local community will be able to maintain, or even intensify, crop production and reduce downstream flooding. Agricultural worker Ram Das was quoted in *The Hindu* as stating that the water level in nearby wells had risen, and the project was looking promising.

IWMI scientists are assessing how well the pilot project performs to see how the approach might be scaled up. They have prepared maps showing other locations where UTFI might have potential within the Ganga River Basin, as well as in other regions. “This



Pic: Prashanth Vishwanathan / IWMI

is an exciting concept that has never really been tested before, and which directly benefits local and wider communities,” said Paul Pavelic, Principal Researcher – Hydrogeology at IWMI, who leads the Institute’s research on UTFI. “Putting UTFI into practice will save on the large funds spent each year on flood relief and restoration efforts, and on subsidies for groundwater extraction during the dry season.”



Pic: Prashanth Vishwanathan / IWMI

“Gujarat is one of India’s sunniest states, receiving 3,000 hours of sunshine a year. However, extended hot, dry spells and increasingly unpredictable rainfall are making farming a challenge”

INDIAN FARMERS BEGIN HARVESTING SUNSHINE



In June, an IWMI-led pilot project, funded by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), helped one pioneering Indian farmer to profit from sunshine. When wheat and banana farmer Ramanbhai Parmar of Anand District, Gujarat, had finished irrigating his crops, he began selling energy produced by the solar panels powering his water pump back to the grid. The first local farmer to profit in this way, he received INR 7,500 (around USD 110) for 1,500 kWh of electricity produced over 4 months, as part of the Solar Power as a Remunerative Crop (SPaRC) initiative.

Gujarat is one of India's sunniest states, receiving 3,000 hours of sunshine a year. However, extended hot, dry spells and increasingly unpredictable rainfall are making farming a challenge. Many farmers have begun taking advantage of subsidized energy to pump groundwater to irrigate their crops, often taking more than they need. With solar pumps becoming increasingly popular for their green credentials and 'free' energy, there was a concern that unrestrained pumping would soon deplete groundwater resources.

This is where SPaRC came in. The scientists hoped that giving farmers the option to sell excess electricity generated by their solar panels would encourage them to use only the water they needed. The buyback scheme could also protect farm incomes in the event of a crop failing and – if widely adopted – reduce pressure on the state's overburdened electricity board. Had farmer Parmar run his pump instead of selling the excess energy it produced, he would have extracted approximately 8 million liters of groundwater.

"Solar crops are a very exciting example of a 'triple win,'" said Tushaar Shah, Senior Fellow at IWMI. "Farmers, the state and precious groundwater reserves all benefit from a single intervention. We know that India's farmers are extremely responsive to incentives that improve productivity and incomes. By offering them the chance to sell the surplus electricity generated by their solar-powered water pumps, we could make agriculture in the country cleaner and greener."



Pic: Prashanth Vishwanathan / IWMI

On the back of the initial pilot project, IWMI is now helping to develop the world's first solar irrigation cooperative, again with funding from CCAFS. In collaboration with the Government of Gujarat, Gujarat Energy Research and Management Institute (GERMI) and the local electricity distribution company Madhya Gujarat Vij Company Ltd. (MGVCL), a pilot project has been established in Dhundi village, Anand.

The six farmers involved in the project have each installed solar pumps and are connected to a micro-grid, which, in turn, is connected to the national grid at a single metered point. The farmers each contributed 10% of the capital cost of their equipment. The cooperative has begun selling back surplus solar power under a 25-year power purchase agreement with MGVCL at INR 4.63/kWh. Two further pilots are planned for Bihar and North Gujarat.



Pic: Fraser Sugden / IWMI

“ To explore the impacts that migration is having on livelihoods, rural development and water resources, the IWMI-led CGIAR Research Program on Water, Land and Ecosystems (WLE) convened the major policy dialogue ‘Migration matters: Male out-migration and the feminization of agriculture’ in 2015 ”

MEETING INVESTIGATES THE ROLE OF MIGRATION IN INCREASING WOMEN FARMERS



Around 214 million international and 740 million internal labor migrants exist worldwide, according to the Food and Agriculture Organization of the United Nations (FAO). Asia is at the forefront of this migration trend; as climate change and economic development make farming-based livelihoods less viable, men are increasingly leaving rural areas to seek better employment opportunities elsewhere. With women usually left behind to run farms, agriculture is becoming 'feminized'. The increased workloads these women face, and their limited access to capital and resources, hinder their ability to farm productively. However, agricultural output needs to be increasing to support the world's rising population.

To explore the impacts that migration is having on livelihoods, rural development and water resources, the IWMI-led CGIAR Research Program on Water, Land and Ecosystems (WLE) convened the major policy dialogue 'Migration matters: Male out-migration and the feminization of agriculture' in 2015. During the period November 26-27, 2015, more than 30 participants from India, Nepal, Sri Lanka and Bangladesh attended the meeting in New Delhi, India. The aim of the meeting was to allow stakeholders present to meet each other, share experiences of migration research across different countries, and identify practical solutions to improve women's engagement in agriculture and water management.

Fraser Sugden, Senior Researcher - Political Economy and Water Governance, and Interim Head of IWMI's Nepal Office, started the meeting by highlighting the major drivers of migration, which include a reduction in the cultivable land area due to water and labor shortages, industrialization and civil conflict. A clear point emerged from the early sessions: there is no single definitive picture of migration. Rather, rural development is transforming migration in various ways and for many reasons. S.M. Premasiri, Director of Irrigation for the Government of Sri Lanka, cited financial security as the main priority of farmers in the country, with non-farm jobs and foreign employment opportunities often providing better prospects. Here, migrants undertake household work (33%), skilled labor (26%), unskilled labor (24%), mid-level work (15%) and professional work (2%) (2013 figures).



Pic: Sharada Prasad / Flickr

Participants debated the impacts of migration on agriculture and water management; considered the wider implications of migration for human well-being; and identified ways in which people from different demographic groups are affected by migration. Following the wide-ranging discussions, participants split into groups to identify issues within water access and migration, mechanization in agriculture, and policy. A strong conclusion was that the current structure of migration contributes to propagating rural poverty. Participants agreed that addressing this will require an improved status for women, so they gain more control over resources; land tenure reforms, so that farmers get security and collateral; and farming cooperatives that facilitate greater use of technology.

"The workshop proved to be an outstanding opportunity to share experiences from across Asia, both in understanding the ecological and economic drivers causing migration, and the impact on those who stay behind," said Sugden. "The focus of research is usually on the migrants themselves. This workshop offered an opportunity to discuss the equally important issues of what happens to those communities that migrants leave behind, and how rural depopulation affects livelihoods and natural resource management." As a follow-up to the meeting, IWMI has developed a network of like-minded scholars, practitioners and policy makers who are committed to taking the migration research agenda forward.



Pic: Kieran Dodds / Panos Pictures

“A snapshot of what a wetland is at a particular point in time holds little value”

WHEN IS A WETLAND NOT A WETLAND?



Wetlands, the most biologically diverse ecosystem on Earth, cover around 12.8 million km² globally. Their economic value – based on the food, freshwater and building materials they provide, along with services such as water treatment, flood protection and erosion control – is estimated to be USD 70 billion per year. Yet, mapping and monitoring wetlands in order to manage their resources is challenging because of their shifting nature.

Wetlands are fundamentally dynamic. They move, change shape, and expand and contract with the seasons, often to varying extents from year to year. A wetland can sometimes be dryland, depending on when it is observed. The surface area of Cambodia's Tonle Sap combined river-lake system, for example, expands by 12,000 km² each year due to the influence of the monsoon on the Mekong River, while the Sudd wetland in South Sudan averages 30,000 km² in extent, but can swell to 130,000 km² during the wet season.

IWMI, in collaboration with McGill University, Canada, has helped to develop a new map of the world's wetlands, using an innovative method for measuring their extent. Generated from satellite images taken over a 12-year period, the high-resolution map distinguishes between permanent and temporary wetlands, and measures patterns of inundation: the extent to which water remains in an area over time. For the first time, users are able to query whether or not an area is a wetland on a scale of probability.

"A snapshot of what a wetland is at a particular point in time holds little value," explained Lisa-Maria Rebelo, Senior Researcher - Remote Sensing and GIS at IWMI, who helped to develop the map. "Data which characterize the dynamic nature of wetlands are crucial for studying large floodplain and wetland ecosystems, and for accurately assessing global freshwater resources. Without them, it is impossible to guide policies related to the wise use of wetlands or to ensure that the ecosystem services wetlands provide are not being compromised."

The dataset underpinning the new map addresses a large information gap, and is already being put to good use. For example, it will inform the Ramsar Convention's analyses on the



Pic: JB Russell / Panos Pictures

State of the world's wetlands and their services to people, and is included as an inventory option among technical guidance provided for SDG indicator 6.6.1 (change in the extent of water-related ecosystems over time).

The dataset also provides essential input to the water accounting framework developed by IWMI, UNESCO-IHE Institute for Water Education, and FAO, through WLE, for assessing hydrological ecosystem services in the Volta, Nile and Mekong river basins.



Pic: Matthew McCartney / IWMI

“Many African countries are currently planning the construction of dams, keen to reap the economic and development benefits that having reliable supplies of water for hydropower, irrigation and domestic use can bring”

LARGE DAMS PUT A MILLION SUB-SAHARAN AFRICANS AT RISK FROM MALARIA ANNUALLY



A study conducted by WLE showed that one million people living near large dams in sub-Saharan Africa (SSA) are at risk of contracting malaria each year, four times more than previously estimated. The findings are particularly important because recent increased aid for water resources development has prompted a new era of dam building in the region. Scientists from IWMI and the University of New England, Australia, estimated that the anticipated construction of 78 major new dams in SSA would lead to 56,000 additional malaria cases each year.

Malaria is transmitted by the *Anopheles* mosquito, which breeds in slow-moving or stagnant water. The shallow puddles that form around the shorelines of dam reservoirs provide the perfect conditions for reproduction. So, building new dams has the potential to increase transmission levels and affect patterns of malaria infection. Small dams, as well as natural ponds, lakes and wetlands, also provide favorable mosquito breeding grounds. In total, around 174 million cases of malaria occur in SSA each year.

The scientists mapped the locations of 1,268 existing and 78 planned dams against the malaria stability index, which shows areas having no malaria, stable malaria or unstable (seasonal) malaria. They then used the Malaria Atlas Project (MAP) and WorldPop databases to determine the malaria infection rate at different distances from reservoirs. They found that a total of 15 million people living within 5 km of dam reservoirs are at risk of contracting the disease, and that 1.1 million malaria cases are linked to the presence of large dams each year.

Many African countries are currently planning the construction of dams, keen to reap the economic and development benefits that having reliable supplies of water for hydropower, irrigation and domestic use can bring. However, the report makes clear for the first time the extent to which malaria negatively affects those living nearby, and shows that these impacts are currently not being sufficiently offset by dam developers. Potential actions for mitigating the increased risk of malaria include designing and managing dam reservoirs to reduce mosquito breeding, introducing larvae-eating fish and distributing bed nets.



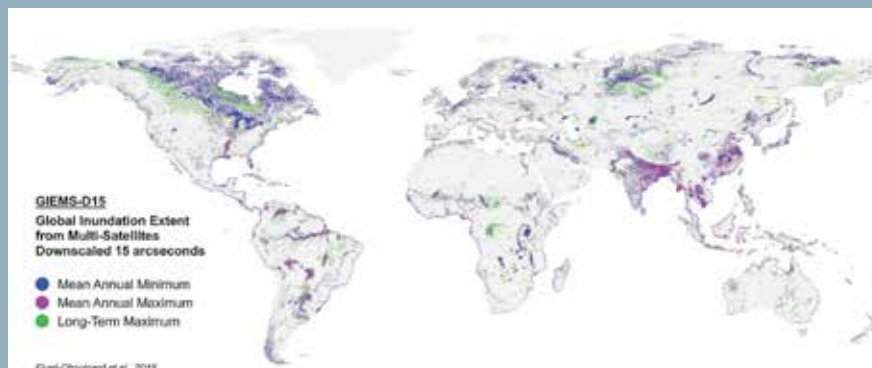
Pic: Steve McCurrach / IWMI

IWMI scientists Jonathan Lautze, Matthew McCartney and Luxon Nhamo (from the Institute's Pretoria [South Africa] and Vientiane [Lao PDR] offices) collaborated on the study with biologists Solomon Kibret and Glenn Wilson from the University of New England, Australia. Following the publication of a peer-reviewed paper in the September 2015 issue of *Malaria Journal*, the report's findings were further publicized by the *Washington Post*, *CNN.com*, *BBC*, *Reuters*, *Voice of America (VOA)*, *SciDev.Net*, *The Guardian* (Nigeria), *United Press International*, *Serious Science*, *Kenya's Business Daily*, *OutbreakNewsToday.com* and others.



Pic: STRDEL / Stringer

“The maps showed the flooding situation in real time, using cloud-free satellite images provided by the Japan Aerospace Exploration Agency (JAXA)”



FLOOD MAPS GUIDE EMERGENCY RESPONSE IN SOUTH ASIA



IWMI, in partnership with Sentinel Asia, activated its emergency response disaster charter twice during 2015. Led by the Asia-Pacific Regional Space Agency Forum (APRSAF), Sentinel Asia is an initiative through which organizations in the region use remote sensing (RS) and web-geographic information system (GIS) technologies to assist with disaster management. IWMI, which is a member of the Sentinel Asia Joint Project Team, provided flood mapping in October to its host Sri Lanka when exceptional rainfall inundated the Southern Province. Three months later, IWMI experts helped to prepare emergency response maps to aid relief and rescue operations in Chennai, India, following widespread flooding of the city and surrounding areas.

Continuous heavy rainfall from mid-September in the southern parts of Sri Lanka resulted in floods and landslides that caused eight deaths and injured nine people. In total, 7,300 people across four districts were affected by the adverse weather, and more than 600 properties were damaged. IWMI responded to a request for assistance from the Sri Lankan Disaster Management Centre (DMC), within the Ministry of Disaster Management (MoDM). For the first time, the Institute worked in collaboration with MoDM and the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER) to prepare maps of the affected areas.

The maps showed the flooding situation in real time, using cloud-free satellite images provided by the Japan Aerospace Exploration Agency (JAXA). The accumulated rainfall was calculated to be around two to three times higher than that during the same period in 2014. The Relief and Emergency Unit of DMC used the maps to make rapid impact assessments and to guide their response to the disaster. This information was shared with other relevant authorities to aid their decision making. IWMI staff later accompanied DMC on a field mission to the affected districts to evaluate the scale of the flooding and assess its impact on paddy fields. This information was used to develop a situation report.

In Chennai, 30,000 people were evacuated after flooding left them stranded. Homes and public buildings were inundated and roads were made impassable. During November, IWMI provided



Pic: STR / Stringer

flood situation maps using Sentinel-1 satellite data from the European Space Agency (ESA). As the situation escalated, IWMI produced emergency response maps using Advanced Land Observing Satellite-2 (ALOS-2) and Phased Array type L-band Synthetic Aperture Radar-2 (PALSAR-2) in collaboration with JAXA and in association with the Indian Space Research Organisation (ISRO). The maps were made available to the Chief Secretary, Government of Tamil Nadu, India's National Disaster Response Force (NDRF), and international agencies, including the United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA), Reliefweb and UN-SPIDER.

IWMI is now developing a new drought monitoring system, which is based on similar technology. Early trials of the system in India indicate that it has the potential to detect emerging droughts before water shortages become critical.



Pic: Nana Kofi Acquah / IWMI

“ The time is ripe to turn wastewater into an economic asset. More than half of the world’s population already lives in cities and this is set to rise further ”

FINDING THE BRASS IN THE MUCK



As World Water Day drew attention to the increasing pressures on the world's freshwater resources, IWMI sought to highlight the value of wastewater. Developed countries have long treated wastewater to make it safe for reuse, but this has not been an option for many poorer developing nations. In these countries, wastewater frequently pollutes waterways. With freshwater at a premium, many urban and peri-urban farmers now use wastewater to irrigate crops, some without knowing, others more deliberately. This can present a risk to human health from contamination.

Pay Drechsel, leader of IWMI's research theme on Resource Recovery, Water Quality and Health, was among the editors of the book *Wastewater: Economic Asset in an Urbanizing World*, which aimed to demonstrate that wastewater does not have to be an environmental burden. The 14 chapters show that wastewater, being rich in nutrients and a good potential source of energy, could be valuable for planners seeking to make cities more sustainable. However, for that to happen in the developing world, the processes involved need to be financially sound.

The time is ripe to turn wastewater into an economic asset. More than half of the world's population already lives in cities and this is set to rise further. Increasing demand for food, feed, fiber and fuel is placing ever more pressure on limited freshwater supplies. Also, treating wastewater is cheaper than creating new reservoirs, and less energy-intensive and polluting than desalination or making long-distance transfers.

Wastewater can also play a role in closing the so-called rural-urban nutrient loop. Currently, nutrients primarily drawn from the soil in rural areas become stored in crops, which are mostly consumed in cities. In developing countries, the resulting human waste is often dumped in waterways, cesspits and septic tanks. Reclaiming carbon, nitrogen, potassium and phosphorus could enable cities to produce their own organic fertilizer, which could then be used to grow crops. This would particularly benefit the rapidly expanding urban and peri-urban agriculture sector.



Pic: IWMI

IWMI's dedicated Resource Recovery and Reuse (RRR) program is already exploring ways of profitably converting fecal sludge into pelletized fertilizer, for example, in Ghana and Sri Lanka. The hope is that this approach could be emulated across other parts of the developing world. "Wastewater is only waste if we look at it that way," said Drechsel. "There are proven methods for transforming what we currently consider as waste into safe products that are environmentally and socially valuable. The final piece in the puzzle is finding ways to make these products economically valuable."



Pic: IWMI

“The drone is currently being used to help health planners monitor the spread of chronic kidney disease of unknown etiology (CKDu), which has been linked to contaminated well water”

IWMI'S NEW EYE IN THE SKY



Assessing the health of crops, observing flooded areas and analyzing water use on farms will all be made easier thanks to IWMI's latest acquisition: a drone. The unmanned aerial vehicle, a Swiss-made Electronic Bee or eBee, caused quite a buzz during test flights over Anuradhapura in northern Sri Lanka. "When we got the first pictures back from the drone, we were delighted," said Salman Siddiqui, Senior Manager of IWMI's GIS, RS and Data Management Unit. "The detail and clarity were spectacular."

The eBee carries a 16-megapixel camera, which takes images with a resolution of up to 3 cm. For comparison, this is significantly better than the 50-cm resolution of Google Earth images. The photographs can be stitched together (in the same way as satellite images) to produce a digital surface or elevation model in virtual 3D. However, unlike with satellite images, cloud cover is not an issue, as the drone flies below any clouds. Also, whereas satellite images can only be recaptured every 15 or so days, IWMI's scientists can dictate the frequency at which they gather images using the eBee.

Operating the drone is simple. Ahead of each flight, the researchers program in mission details, such as the area to cover, resolution and other flight parameters. The drone then takes off, flies and lands automatically, using a built-in artificial intelligence module and Global Positioning System (GPS). Each flight can last 45 minutes on a single charge, depending on the wind speed and altitude. Sensors keep the vehicle stable in flight, even if the wind changes, and help it to avoid other flying objects, such as birds and helicopters. If it starts to rain or the GPS signal is lost or contact with the base is broken, the drone returns to its starting location.

The first task for IWMI's drone was to develop a high-resolution digital elevation model of Badulla, the capital city of Uva Province. The Survey Department of Sri Lanka needed the model to help develop a disaster mitigation plan for the city. Using conventional techniques, it might have taken longer than a year to survey the area. However, IWMI's drone team was able to survey the entire 10-km² area in just 3 days. During this time, the drone made 14 flights and shot 4,600 high-resolution images, with an average spatial resolution of 4 cm.



Pic: Neil Palmer / IWMI

The drone is currently being used to help health planners monitor the spread of chronic kidney disease of unknown etiology (CKDu), which has been linked to contaminated well water. Meanwhile, a planned future initiative involves mapping freshwater springs in the watersheds of Nepal using a small thermal sensor. The watersheds in question have dense canopy cover, which makes it difficult to use standard optical sensors to locate springs. A drone-mounted thermal sensor can see through the vegetation and locate the waterways, which are colder than the surrounding earth.



Pic: Matthew McCartney / IWMI

“With Myanmar opening up at an unprecedented rate, government agencies need evidence-based research to help them make important decisions regarding national strategies of donor investments”

MYANMAR: FINDING THE BEST WAYS TO MANAGE SCARCE WATER RESOURCES

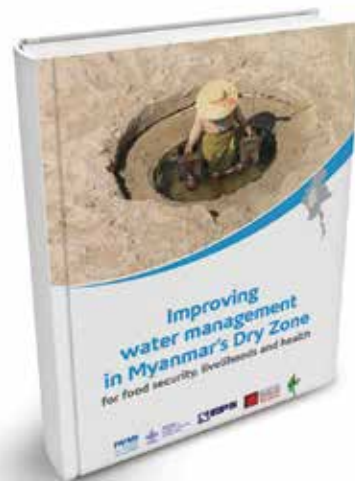


Myanmar's central Dry Zone covers more than 75,000 km², an area roughly equivalent to the size of Ireland. Its 10 million people include many of the country's poorest. Agriculture, primarily rainfed, is the predominant livelihood among the rural population. However, farmers face challenging conditions, as the Dry Zone is the most water-stressed part of the country. Seasonal water scarcity is very common. Dry spells, droughts, early retreat of the monsoon, flooding and cyclones have all had an impact on farming in the Dry Zone in recent years.

To identify how food security and livelihoods might be improved across the Dry Zone, IWMI, together with National Engineering and Planning Services (NEPS) and Myanmar Marketing Research and Development (MMRD) Research Services, conducted a rapid assessment of water use. This involved: assessing surface water and groundwater resources; considering availability, uses, patterns, trends and variability; a community-level survey, exploring water availability, access and management for people of different livelihoods; and analysis of current irrigation.

The findings and recommendations from this assessment were presented in the report *Improving water management in Myanmar's Dry Zone for food security, livelihoods and health*. Some of the main messages to emerge from the assessment are that managing water variability is key to improving livelihoods in the Dry Zone; groundwater is a critical but limited resource; farmers are increasingly pumping water from surface and subsurface sources to try and overcome the vagaries of rainfall and shortfalls in existing formal irrigation schemes; and supporting small-scale agriculture is essential.

With Myanmar opening up at an unprecedented rate, government agencies need evidence-based research to help them make important decisions regarding national strategies of donor investments. This new report is already attracting interest and will provide a firm foundation for future research in the country.



Pic: Matthew McCartney / IWMI



Pic: Nana Kofi Acquah / IWMI

“ We wanted to provide advice for agriculture and irrigation planners, decision makers, researchers and students ”

NEW BOOK EXAMINES THE POTENTIAL IMPACTS OF CLIMATE CHANGE ON AGRICULTURE



As 195 countries adopted the first-ever universal, legally binding global climate deal in December 2015, IWMI published a book examining the impacts of future climate shifts on water use in agriculture. Published by CABI, *Climate change and agricultural water management in developing countries* was edited by IWMI's Chu Thai Hoanh (Emeritus Scientist), Vladimir Smakhtin (leader for IWMI's research theme on Water Availability, Risk and Resilience) and Robyn Johnston (IWMI's Myanmar Representative), and included contributions from 10 IWMI researchers, along with 35 collaborators from 15 external organizations.

With 70% of freshwater resources used in farming, and demand for food expected to double over the next 50 years, the impacts of climate change on rainfall, river flows and groundwater levels will translate into impacts on agricultural production. The book analyzed the projected impacts of climate change on water used for agriculture at a global level, assessed in detail the effects on farming in particular countries and regions, and examined existing water management options for adapting to those changes. It also considered the impact of sea-level rise on agriculture.

"We wanted to provide advice for agriculture and irrigation planners, decision makers, researchers and students," said Hoanh. "So, in addition to global overviews, we included case studies showing detailed crop water requirements and agricultural adaptation options, such as water-saving techniques and groundwater exploitation. Findings and conclusions from the studies presented in the book may help to identify potential actions to take and subjects for further research."

The book showed that the amount of land suitable for farming is set to decrease, with some models predicting the area currently deemed highly suitable for crops likely to shrink by a fifth. Terrain classified as 'marginally suitable' or 'moderately suitable' for agriculture is forecast to expand. "By the 2050s, the area of land subject to increasing water stress is projected to be more than double that with decreasing water stress," explained Smakhtin. "In particular, the frequency of short droughts is likely to increase in presently dry regions."



Pic: Neil Palmer / IWMI

The authors found that, overall, the negative impacts of future climate change on freshwater resources are likely to outweigh the benefits, with the world's poorest people likely to feel the impacts most keenly unless action is taken. However, the book presented some cause for optimism. Although warmer temperatures are likely to demand more water for irrigation, and competition for water from industrial and domestic uses is set to increase, improving agricultural water management and liberalizing the global food trade should enable us to meet future food demands.

INTERNATIONAL WATER MANAGEMENT INSTITUTE

Statement of Financial Position As at December 31, 2015

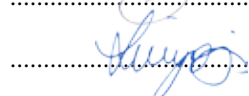
(In US Dollars '000)

	Notes	2015	2014
ASSETS			
Current Assets			
Cash and Cash Equivalents	2	26,427	44,600
Investments	3	4,848	155
Accounts Receivable:			
Donors (net of allowance of \$ 181 thousand in 2015; \$ 47 thousand in 2014)	4	3,871	3,981
Employees	5	299	393
Other CGIAR Centers	6	440	97
Others (net of allowance of \$ 0 in 2015; \$ 42 thousand in 2014)	7	1,644	1,063
Prepaid Expenses	8	260	328
Inventories	9	26	29
Total Current Assets		37,815	50,646
Non-Current Assets			
Property, Plant and Equipment	10	2,808	2,457
Total Non-Current Assets		2,808	2,457
TOTAL ASSETS		40,623	53,103
LIABILITIES AND NET ASSETS			
Current Liabilities			
Accounts Payable:			
Donors	11	14,914	20,806
Employees	12	1,089	1,255
Other CGIAR Centers	13	2,245	3,182
Others	14	3,089	3,801
Accruals		302	434
Total Current Liabilities		21,639	29,478
Non-Current Liabilities			
Accounts Payable:			
Employees	15	3,565	3,750
Total Non-Current Liabilities		3,565	3,750
Total Liabilities		25,204	33,228
Net Assets			
Unrestricted			
Designated		3,996	8,388
Undesignated		11,423	11,487
Total Net Assets		15,419	19,875
TOTAL LIABILITIES AND NET ASSETS		40,623	53,103

These financial statements were approved on 9th May 2016



..... Director General



..... Corporate Services Director

PRINCIPAL INVESTMENT PARTNERS

- African Development Bank (AfDB)
- Asian Development Bank (ADB)
- Australian Centre for International Agricultural Research (ACIAR)
- Bill & Melinda Gates Foundation
- Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ) (Federal Ministry for Economic Cooperation and Development), Germany
- CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)
- CGIAR Research Program on Water, Land and Ecosystems (WLE)
- Department for International Development, UK (DFID)
- Department of Foreign Affairs and Trade, Australian Government (DFAT)
- Directorate-General for International Cooperation, Government of the Netherlands (DGIS)
- European Commission (EC)
- Food and Agriculture Organization of the United Nations (FAO)
- Global Water Partnership (GWP)
- Government of India
- Government of Japan
- International Food Policy Research Institute (IFPRI)
- International Fund for Agricultural Development (IFAD)
- Rockefeller Foundation
- Sir Dorabji Tata Trust and Sir Ratan Tata Trust
- Swiss Agency for Development and Cooperation (SDC)
- United Nations Environment Programme (UNEP)
- United States Agency for International Development (USAID)
- Water Research Commission, Government of South Africa (WRC)
- World Bank

IWMI thanks all its investors for their financial support and contribution to its research in 2015, and the Institute looks forward to further strengthening its partnerships in the future.

WASTEWATER EFFORTS RECOGNIZED

Pay Drechsel, leader for IWMI's research theme on Resource Recovery, Water Quality and Health, won the International Water Association (IWA) 2015 Development Award for Research. The award recognized Pay's long track record in research, which has helped to identify ways in which farmers can safely use wastewater for irrigation. In many low- and middle-income countries that have little capacity for wastewater treatment, the use of wastewater for irrigation is widespread. The award was presented at IWA's Water and Development Congress and Exhibition in Amman, Jordan, in October. Ger Bergkamp, Executive Director of IWA, hailed Pay as "an example to the water community in each corner of the globe."



Pic: ABS Network



CELEBRATING 30 YEARS OF WATER MANAGEMENT

To celebrate its 30th anniversary, IWMI launched the touring exhibition *Water in Sri Lanka* in April at a cocktail reception held at the Light House Galley, Colombo. The exhibition, which showcased IWMI's efforts to resolve Sri Lanka's water resource challenges, toured the country during the year. IWMI's regional offices in Addis Ababa (Ethiopia), Accra (Ghana), Delhi (India) and Pretoria (South Africa) also held events to celebrate the anniversary. Meanwhile, a new publication, *Founding of IWMI in Sri Lanka*, told the story of the Institute's early years.



Pic: Samurdhi Ranasinghe / IWMI



IWMI headquarters

127 Sunil Mawatha

Pelawatte

Battaramulla

Colombo

Sri Lanka

Mailing Address

PO Box 2075

Colombo

Sri Lanka

Tel: +94 11 2880000, 2784080

Fax: +94 11 2786854

Email: iwmi@cgiar.org

www.iwmi.org



IWMI is a
member of
the CGIAR
Consortium
and leads
the:



RESEARCH
PROGRAM ON
Water, Land and
Ecosystems

ISSN 1017-5954