IWMI
International Water Management Institute

CGIAR
IWMI is a CGIAR Research Center

Building a water-secure future

Annual Report 2021

Photo: Martin Seemungal / IWMI

Innovative water solutions for sustainable development

Food · Climate · Growth

Message from the Board Chair and Director General

Roberto Lenton
CHAIR, BOARD OF GOVERNORS

Mark Smith
DIRECTOR GENERAL

We cannot help but look back at 2021 and see that the challenges of building water security and delivering on Goal 6 of the United Nations Sustainable Development Goals (SDGs) are becoming only more urgent. The demands on IWMI and CGIAR to do more – to use our research-for-development to deliver impact at scale and with speed – are only growing, and our responsibility to ally with partners to meet that demand is only deepening.

It is abundantly clear that the threat of water insecurity, and the dangers it holds for people, economies and ecosystems, is coming into increasingly sharp focus. Changing risks of extreme precipitation, destructive floods, drought and aridification are apparent across many parts of the world, and not just from global datasets and the scientific literature, or the reports of the Intergovernmental Panel on Climate Change, but in bold-faced media headlines and urgent appeals for action and investment.

It is encouraging that, in spite of the alarm bells ringing for water security, IWMI has made successful steps forward in ensuring it is able to better support responses in the communities and countries where the Institute works, and better contribute to the partnerships that are critical to transforming water systems.

At the global level, at the United Nations Climate Change Conference of the Parties (COP26) in Glasgow, Scotland, in November 2021, IWMI joined more than 30 partners at the first-ever Water and Climate Pavilion to communicate a clear and urgent message to climate negotiators, partners across sectors, investors, businesses and funders: *Transforming water systems to build water security is central to climate action and must serve as the foundation for a climate-resilient future.*

With this message resonating in Glasgow and with stakeholders at national, regional and global levels – and in preparation for the United Nations Water Conference to be held in March 2023 – the challenges motivating the IWMI Board of Governors and staff are clear: How do we deliver water security for the most vulnerable people? How do we use action on water security to adapt to climate change, build food system resilience, and advance gender equality and inclusion? How do we come together across nations, sectors, partnerships – and, indeed, research domains – to build water security as the climate changes?

As this report demonstrates, IWMI makes a unique contribution to meeting these challenges. As the world's only international organization dedicated to conducting research on water management, IWMI's work builds on a rich, almost 40-year legacy of research, innovation and learning. In 2021, we marked the end of the IWMI-led CGIAR Research Program on Water, Land and Ecosystems (WLE), and showcased results that will guide water-sensitive, sustainable economic development for years to come, and help to create a more climate-resilient and environmentally secure future for communities around the world.

IWMI's Strategy 2019-2023 has proved to be a vital guide to the Institute's organizational development in the challenging and rapidly evolving global context we face. In 2021, we launched a series of new partnerships and projects, while continuing to develop IWMI's contributions to the ongoing reform of CGIAR. This reform – known as One CGIAR – is deepening the integration of governance and management across the CGIAR system, while broadening CGIAR's mission to embrace science and innovation to advance the transformation of food, land, and water systems and support climate action. Amidst such change, we ended the year on a growth footing — financially stable with a growing bilateral portfolio and strongly positioned in the emerging new cross-CGIAR Research Initiatives.

With the support of our Board of Governors, we took steps to ensure that IWMI's vision for a water-secure world became more firmly embedded within the mission of One CGIAR as its transformation evolves. In doing so, our goal is to promote synergies across CGIAR and coordination of CGIAR's water-related research and programming in the years ahead.

Alongside our contributions to One CGIAR, we are putting in place stronger, more strategic partnerships that we hope will strengthen the global institutional architecture for water. We are exploring a strategic

alliance with the Global Water Partnership to use our clear complementarities to create joint programs to advance SDG 6 and the vision we share of a water-secure world. We also put in place the foundations for a new partnership platform, the 'Alliance for a Water-Secure World', with the goal of catalyzing investments in major new programs and partnerships for water security.

As we reflect on 2021, we are deeply thankful to our staff, partners, IWMI's host government in Sri Lanka and our host communities around the world for their shared commitment and solidarity in weathering and navigating yet another year of the Covid-19 pandemic. While vaccines played a vital role in keeping the virus at bay, it was our collective endurance, resilience and resolve that made possible the progress and results featured in this report.

We recognize that IWMI's many achievements in 2021 reflect extraordinary effort across the Institute, and we are enormously grateful to all IWMI staff for the exceptional hard work and dedication that made this possible.

We invite you to learn more about our work in this annual report, which profiles some of IWMI's most impactful projects and shines a spotlight on our global engagement. As you will see, our vision for — and our determination to achieve — a water-secure world remains resolute and unchanged.

Roberto Lenton
CHAIR, BOARD OF GOVERNORS

Mark Smith
DIRECTOR GENERAL

Photo: Hamish John Appleby / IWMI

Global relevance

Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report

Photo: Dakshina Murthy / IWMI

Dr. Aditi Mukherji, Principal Researcher, IWMI, was a Coordinating Lead Author of the Water Chapter of Working Group I of the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6). She was also part of the core writing team of the AR6 Synthesis Report. In 2021, IWMI hosted a webinar to present the findings of the IPCC AR6 Working Group 1 Report, and to discuss the implications of the latest climate change findings on Asia and Africa, where IWMI has been developing and implementing water management solutions to improve climate resilience. IWMI contributions to the IPCC reports are crucial to translating climate science into effective, comprehensive policy. Working Group II's Water Chapter was released in early 2022.

United Nations Food Systems Summit (UNFSS)

Photo: Barbara van Rijn / IWMI

As part of the UNFSS preparatory process, IWMI and the CGIAR Research Program on Water, Land and Ecosystems (WLE) led regional (in Southern Africa and Central Asia) and national (in Pakistan and Egypt) Independent Dialogues, and participated in pre-Summit events centered around the links between water and food. These dialogues helped identify local challenges and solutions to ensure a sustainable water supply to local and regional food systems. The dialogues focused on ways to sustainably transform food systems, while promoting inclusion and equity within the water-energy-food (WEF) nexus, and protecting ecosystems. Insights from these Independent Dialogues fed into the UN-Water-led global dialogue titled *Water: The game changer for food systems* and helped shape the UNFSS agenda.

First-ever Water Pavilion at COP26

Photo: Hamish John Appleby / IWMI

In Glasgow, IWMI was proud to be a core partner in the Water and Climate Pavilion, alongside 31 other organizations working on water-related issues. IWMI researchers were involved in 40 sessions at COP26, engaging audiences as speakers, panelists and moderators to ensure water systems science was put forward in local, regional and global climate agendas. IWMI and partners remain committed to meeting the world's growing demand for water-based climate solutions.

Engagement in the United Nations Global Compact

Photo: Nabin Baral / IWMI

After having signed the United Nations Global Compact (UNGC) in 2019, IWMI renewed its commitment to the UNGC's Ten Principles with a statement of communication on engagement. Internally, IWMI's Sustainability team is dedicated to creating a comprehensive sustainability strategy with the goal of reducing the environmental footprint of the Institute's operations. Data collection efforts are already informing our planning process, but IWMI operations will continue to align with the Paris Agreement's goal of limiting global temperature rise to 1.5°C.

The report on youth inclusion in agriculture by FAO's high-level panel of experts

Photo: Andrew Reckers / IWMI

IWMI's Indika Arulingam contributed, as a Team Member, to a report on the engagement and employment of youth in agriculture and food systems, which was compiled by the Food and Agriculture Organization of the United Nations (FAO) Committee on World Food Security's high-level panel of experts. IWMI recognizes the role of youth as agents of change in food, water and energy systems. Through our researcher's work on this report, IWMI is building on its legacy of research on ways to position youth as agents of change in the field of sustainable development.

IWMI at a glance in 2021

Website

141k Website visitors

23 Videos

55 Blog posts

21k Publication downloads

Social media

98.3k engagements

3.4 Million impressions

17% Growth in social media followers

Publications

34 IWMI reports

02 Books

21 Book chapters

103 Journal articles

74.7% of all journal articles are Open Access

77 Open Access journal articles

Projects and partnerships

105 Partnerships

197 Active projects

74 New projects

Global staff

Gender balance

147 Male
113 Female
Total 260

31 Nationalities

167 in Asia
87 in Africa
6 in Europe/North America

Photo: Hamish John Appleby / IWMI

Major trends shaping IWMI's strategic and operational context in 2021

Water, Food and Ecosystems

In 2021, hunger hit an all-time high. The United Nations reports that last year, 193 million people in 53 countries were at an 'acute' risk of hunger. This figure shows a jump of almost 40 million compared to 2020.

Conflicts in the Democratic Republic of the Congo, Yemen, Afghanistan, Ethiopia, Sudan, Syria, Nigeria and, more recently, Ukraine have led to further food price increases. Climate change and the Covid-19 pandemic have also exacerbated the situation. Nonetheless, water-smart agricultural solutions are being developed and scaled up globally, and efforts to put water at the forefront of environmental research, policy and action are growing.

Biodiversity loss remains acute. Extinction rates are 100 to 1,000 times higher than they have been over the past tens of millions of years. In 2021, Earth Overshoot Day happened on July 29, almost a month earlier than the year before, which was strongly influenced by the pandemic. However, smart water practices such as accounting for environmental flow requirements and nature-based solutions contribute to protecting critical ecosystems. Today, a great majority of development interventions adopt sustainable strategies for our ecosystems.

Water, Climate Change and Resilience

According to the most recent IPCC report, 3.5 billion people are highly vulnerable to the impacts of climate change. Every year, the number of people affected by flooding increases by half a million, and over three billion suffer severe water shortages. Water risks are intensifying around the world, and as climate change tightens its grip, rising temperatures are promoting the spread of diseases in crops and livestock. Unless immediate and bold action is taken, the impacts of climate change are set to worsen. Water scarcity and less reliable rainfall patterns could spark conflict, provoke migration waves and trigger famine in many regions of the world.

Awareness of the role of water in climate change impacts and solutions is growing, and the ever-increasing number of climate adaptation and mitigation responses is encouraging. However, the scaling of water management innovations and technologies is urgently needed in the most vulnerable regions of the world. Water data fragmentation continues to slow us down, and research-policy-action gaps have yet to be fully bridged. Fortunately, IWMI research and innovation are fueling a growing number of disaster risk reduction and climate adaptation and mitigation projects, a step in the right direction towards a climate-, food-, energy- and water-secure world.

Water, Growth and Inclusion

Smallholder farmers produce at least one third of the global food supply. However, in developing countries, 80% of these farmers live in water-scarce regions, despite being the main source of food production.

In 2021, the Covid-19 pandemic disrupted food distribution channels, led to layoffs, restricted physical access to food markets, slowed transport, and diminished the capacity of institutions that support social safety nets for food security. Inclusion strategies are now a growing focus of development solutions, and gender empowerment is becoming more urgent in development solutions worldwide.

Despite the global mobility limits which resulted from the Covid-19 pandemic, the 2021 World Migration Report revealed a dramatic increase in internal displacement due to disasters, conflict and violence. Although remittances dropped slightly in 2020, the number of international migrants continued to increase the following year, especially in Europe and Asia. Migration continues to be a major factor in development and change.

Water Data Science and Digital Innovation

Almost half of the world's population still has no access to the internet. This digital divide predominantly impacts women, rural populations and vulnerable communities living in developing regions of the world, where fewer than one in five people are connected to a mobile or internet network.

Knowledge gaps, including the lack of data on water services, and the fragmentation of water science data, are slowing the implementation of comprehensive policy solutions. Nevertheless, new initiatives to render data and the internet more accessible have reached unprecedented numbers.

Stories of change

Photo: Muhammad Usman Ghani / IWMI

Water, Food and Ecosystems

Photo: Hamish John Appleby / IWMI

BIG PICTURE STORY

Connecting producers to markets with farmer-led irrigation development: Harnessing the power of water and energy for food

The benefits of solar-based irrigation have long been recognized in countries where there is low access to the power grid. Once assessments of groundwater conditions show that increased irrigation can be achieved in a sustainable manner, next steps involve getting the right technologies to the right clients. This is often complicated by weak supply chains, high costs and a poor understanding of local market needs. IWMI is working to better scale the use of solar-based irrigation and as a result help strengthen food security and climate change resilience.

A recent IWMI study suggests that solar photovoltaic pumps offer an economically and environmentally sustainable alternative to fossil fuel pumps. Private sector companies are eager to capitalize on this potential by expanding the market for small-scale solar-based irrigation. For these companies, serving small-scale irrigators, who have traditionally been perceived as high risk, can be profitable if the right business models are applied. However, the use of solar-based irrigation remains limited. IWMI and partners are working on new approaches to expand farmers' access to solar-based irrigation that are appropriate in cost and scale.

Unlocking Ghana's irrigation potential

With the abundance of sunshine in Ghana, solar-based irrigation offers smallholder farmers a promising alternative – but only if they can afford the initial investment. IWMI and its private sector partners co-developed and evaluated three possible business models that could address how farmers in Ghana's Northern Region can cope with the high upfront costs of buying a pump.

Photo: Barbara van Rijn / IWMI

In the first model, farmers purchase solar-powered pumps to access water for irrigation and other needs such as livestock watering, home gardening and domestic uses. Farmers can also sell water to neighbors. To make the pumps more affordable for this model of outright purchase, Pumptech Limited, a distributor of solar pumps manufactured by the German company LORENTZ, offers a pay-as-you-own credit scheme. This allows farmers to use the equipment while making regular payments until the total cost of the pump is paid off. Payments may be monthly, quarterly or scheduled around harvest times when cash flow is highest.

The second model is an alternative to individual ownership – a shared model where a group of farmers jointly own a solar-based irrigation system. Group members share the costs and risks as well as the benefits. For the model to work, the group must be cohesive, with clear rules on water-sharing mechanisms, maintenance responsibility, financial management and conflict resolution.

Under a third model, the solar system is owned, operated and maintained by a supplier or other third party. With the help of low-cost loans, partial grants and other financial incentives, entrepreneurs own and operate solar systems that provide irrigation water services to farmers for a fee. Entrepreneurs then use the fees from water sales to repay the loan.

Market knowledge is powering Africa's solar irrigation sector

Data-driven tools are helping solar irrigation companies target their products and services to the right people, in the right way.

Making innovative water management and irrigation technologies available to farmers on a massive scale is crucial if we are to meet growing food demands and respond to climate change impacts. However, scaling efforts often fall short because they do not sufficiently consider the factors that determine whether a farmer will adopt these technologies. Solar irrigation companies can target their products and services by identifying and segmenting customer groups.

IWMI has been working to customize solar suitability maps to enable companies to identify where their marketing efforts should be directed. These maps pinpoint areas where smallholder farmers can invest in solar irrigation without depleting water resources. IWMI has refined the mapping framework to produce an online interactive tool for all of Africa.

IWMI has been working with solar manufacturing and distribution companies to demonstrate how the maps and tools can be customized and incorporated into companies' sales zoning and marketing strategies. One of these companies, PEG Africa, used the maps to identify areas with the highest potential for its pumps, based on water resource type and depth, and adapted its marketing strategy to focus on these areas. In Mali, IWMI has been initiating customized solar mapping with other companies.

Photo: Tom van Cakenberghe / IWMI

A new toolkit assists in systemic, adaptive scaling of farmer-led irrigation

Efforts to scale solar irrigation can often fall short because they do not sufficiently consider the complex realities of 'softer elements' such as people, supply chains, markets, policies and power relations.

In collaboration with the Feed the Future Innovation Lab for Small-Scale Irrigation (ILSSI) and the Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) projects, IWMI developed a toolkit to operationalize agricultural innovation scaling processes as an integral part of a systemic and adaptive approach to innovation.

The toolkit includes tools for enabling environment analysis, solar suitability mapping, engaging and matching to form the scaling partnership, market segmentation, client assessment, demand-supply linkages, multi-stakeholder dialogues, and private-sector-driven capacity development.

Aimed at implementers and private sector entities, the toolkit guides users in designing and facilitating partnerships and investments in scaling solar-based irrigation. For example, the enabling environment analysis tool guides a series of structured steps that lead to a clear understanding of the sets of policies, informal institutions, support services and other conditions that are important for irrigation systems. Based on a list of suggested questions, the analysis produces a country-specific report containing the information necessary to make recommendations for policy, successful scaling programs, and alternative scenarios to scale water solutions.

The tool was developed in tandem with the World Bank publication titled *The Farmer-led Irrigation Development Guide: A What, Why and How-to for Intervention Design*. Farmer-led irrigation development (FLID) – in which farmers take the lead in establishing, managing and improving irrigated agriculture – is widespread, but FLID growth is constrained and inclusion is limited. There is significant potential for interventions to catalyze FLID processes, and thereby transform food and water security and promote sustainable livelihoods. Solar irrigation could be a possible game-changer in FLID, and now with IWMI's new toolkit, implementors can be deployed in a faster and smarter way.

Photo: Muhammad Usman Ghani / IWMI

OUTCOME STORY

Measuring environmental flows at global and regional scales

It's all about balance and trade-offs. Natural ecosystems need water to survive and thrive, but people are dependent on ecosystems and water for agriculture, drinking and many other purposes. When water resources are limited, how do you make these resources available to communities while protecting biodiversity and the environment at the same time?

IWMI is pioneering new approaches to determining environmental flows (e-flows). E-flows are the quantity, timing and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems. E-flows seek to strike a balance between water resources development and the protection of freshwater-dependent ecosystems. They tell us how much water we can use and how much we need to leave in the ecosystems.

The Global Environmental Flow Information System

Recognizing the importance of e-flows, the United Nations created Indicator 6.4.2 of the Sustainable Development Goals (SDGs) to track how much freshwater is being withdrawn by all economic activities, compared to the total renewable freshwater resources available. Indicator 6.4.2 is a measure of water stress at national level. It takes into account e-flow requirements as a measure of how much water should be left in ecosystems.

IWMI developed an online, publicly available, interactive tool called the 'Global Environmental Flow Information System (GEFIS)'. The Food and Agriculture Organization of the United Nations (FAO) adopted GEFIS as the official global tool so that countries can insert the e-flow estimations into the water stress formula within the framework of the SDG.

In 2021, IWMI and FAO published a guideline on how to make use of GEFIS for SDG reporting. IWMI has now drafted two more reports which will substantially

assist FAO in their use of GEFIS for SDG reporting. One report provides guidance on the measurement of the Environmental Management Class, making e-flows locally reflective of environmental conditions, while the other report deals with the contribution of groundwater to e-flows.

From global to regional

GEFIS is a valuable tool at a global level, but needs to be paired with tools that take into consideration local nuances and accurately incorporate local ecological conditions, making the estimation of e-flows much more meaningful.

As part of the Resilient Waters project, funded by the United States Agency for International Development (USAID), IWMI is working with partners in the Limpopo River Basin of Southern Africa to provide the necessary data to secure e-flows. The project is helping to provide a framework that will enable communities and ecosystems become more resilient to changes in streamflow.

The rural communities of the Limpopo River Basin are highly vulnerable to any adverse impacts caused by climate change and excessive upstream water use. The basin has a high diversity of endemic and unique aquatic biota and important ecosystem processes that help to support more than 14 million people who live in the basin and depend on its resources. The water resources of the basin are limited and overused.

IWMI scientists and partners conducted a risk assessment for the basin using the PROBFLO method, a holistic e-flow assessment tool that incorporates regional-scale ecological risk assessment methods in a robust, tested approach to determine e-flows with high confidence. It helps scientists evaluate the social and ecological consequences of altered flows at multiple spatial scales.

The IWMI team described the relationship between river flows and the river ecosystem, and quantified the flows necessary to keep the ecosystem in its present or better condition. The study found that the percentages of total water required to protect e-flows vary considerably, ranging from 49% in some of the smaller upstream tributaries to only 16% in the lower reaches of the river.

The IWMI team also highlighted the risk to ecosystem services provided by the basin when flows are altered. If e-flows were implemented, the condition of the river would be significantly improved, even though the overall e-flow is substantially less than the total present-day flow. Timing is key as e-flows can contribute to flows during the dry season when, at present, the river stops flowing in many places due to upstream abstractions. As a result, the risks to users of the ecosystem would be reduced in many parts of the basin. Local vulnerable communities would benefit from e-flows and be more resilient to climate shocks.

Researchers acknowledge that there are socioeconomic costs associated with the implementation of e-flows in the Limpopo River Basin. However, the multiple benefits, and the long-term costs of operating the system in an unsustainable state, will outweigh any immediate costs of protecting the ecosystem.

Water, Climate Change and Resilience

Photo: Pierre Restoul / IWMI

BIG PICTURE STORY

Strengthening resilience in the face of future droughts

Droughts are a natural part of the water cycle and, across time, have always challenged human civilization. Since humans first started recording climate trends, drastic drops in precipitation levels and arid cycles, which on average last around 300 years, have forced populations to move or adapt. However, today, the rising frequency, severity and unpredictability of droughts are impacting food and nutrition security for one in three people around the world who are already subjected to water scarcity of some form and therefore even more widely impacted.

The Intergovernmental Panel on Climate Change reports, with high confidence, that the likelihood of drought is projected to increase in many regions over the 21st century, even with strong climate change mitigation interventions in place. This increase is expected to be even more severe if no action is taken to avert the climate crisis.

It has now been proven that climate change will not only induce more intense drought events, but also make them harder to predict. For decades, scientists have been able to rely on the past as a guide to plan for the future, but that is no longer possible. Scientists are now armed with new technologies such as map-based monitoring and early warning systems to help decision makers take timely action to manage drought.

IWMI's work on drought is based on three pillars of integrated drought risk management centered around interconnected, multidisciplinary and multi-institutional activities. These pillars are (1) developing drought monitoring and early warning systems; (2) conducting impact and vulnerability assessments; and (3) elevating the importance of drought mitigation, preparedness and response.

Each pillar is fundamental in promoting proactive drought management measures. The pillars are dependent on one another and essential to strengthening drought resilience.

Tackling drought in the world's most water-stressed region

The Middle East and North Africa (MENA) region is the driest in the world with only 2% of the planet's renewable water supplies. It is home to 12 of the world's most water-scarce countries. Soaring temperatures and evaporation rates, in addition to decreases in precipitation across the region, are creating extreme challenges to water and food security.

Photo: Pierre Restoul / IWMI

MENAdrought, a project supported by the United States Agency for International Development (USAID), is turning the tide of climate change by creating more resilient communities that can stay one step ahead of the next drought. MENAdrought works with policymakers, water managers and engineers in Jordan, Lebanon and Morocco to develop the training, data, tools and planning skills they need to anticipate, prepare for, and mitigate the worst impacts of drought.

At the heart of the MENAdrought project was the development of an interactive map by IWMI researchers that shows satellite data on rainfall, land surface temperature, soil moisture and vegetation health – all compiled into an enhanced Composite Drought Index (eCDI). The color-coded maps allow decision makers to quickly identify an emerging drought, even before its effects can be seen on the ground. National partners are involved in the entire process, making use of satellite data to direct early mitigation efforts to the areas in greatest need, and helping stave off some of the more severe impacts of drought. For example, partners in Morocco are able to review monthly drought maps which are produced within eight days of the new month. These maps are publicly available to universities and policymakers. In Jordan, the government also uses maps to track drought and make payments to the farmers affected, while in Lebanon, the Ministry of Energy and Water works with MENAdrought to forecast droughts and better plan its responses.

Early warning systems are key

Like the MENA region, Afghanistan also suffers from unpredictable water scarcity. In 2018, the worst drought in a decade prompted the Government of Afghanistan to launch its Early Warning, Early Finance and Early Action Project.

IWMI's expertise contributed to the development of the Afghanistan Drought Early Warning Decision Support (AF-DEWS) Tool, a robust system for monitoring the weather and other relevant factors that are needed to predict drought as quickly as possible. IWMI also helped to build institutional capacity in Afghanistan. Now, when the AF-DEWS models predict a water shortage, managers and others know what to do and how to do it. Since the AF-DEWS tool was adopted by the Afghanistan Drought Early Warning Committee, over 50 bulletins have been issued during droughts. Plans to further scale the use of AF-DEWS are being designed in coordination with the Afghanistan Drought Early Warning Committee, Afghan ministries and donors.

Photo: Andrew Reckers / IWMI

The AF-DEWS tool has been online since 2020, providing weekly updates of rainfall and temperature forecasts for a four-week period. In addition to forecasts, drought indicators are also given for specific locations, so that steps can be taken to minimize risks.

Mapping drought in South Asia

With the incidence of severe drought on the rise, governments must provide faster and better-targeted resilience-building and relief measures. By using satellite images and remote measures of ground vegetation to assess the extent of the drought, IWMI developed the South Asia Drought Monitoring System (SADMS), an index that integrates information on vegetation, soil moisture and temperature. In 2020, IWMI received the Geospatial World Excellence Award 2020 for its development of SADMS.

SADMS provides a weekly map of drought conditions in South Asia. Numerous drought indices, including the Integrated Drought Severity Index, Standardized Precipitation Index and Soil Moisture Index, have been developed to provide advanced drought monitoring and assessment information. In tandem, these indices not only paint an accurate picture of any particular drought episode, but also provide invaluable content for decision-making and application.

The satellite data underpinning SADMS is used to identify conditions of various stages of drought and levels of soil moisture. The system has three components: monitoring and forecasting; vulnerability and impact assessment; and mitigation and response planning through drought contingency plans.

The vulnerability and impact assessment component of SADMS helps authorities to assess risks and vulnerability before droughts occur.

IWMI and the Indian Council of Agricultural Research (ICAR) have shared these weekly drought maps with agricultural extension services and state authorities. These maps assist with the preparation of drought contingency plans which help farmers manage drought risks and access insurance payouts.

Photo: E.L.S.K.E.. Photography / IWMI

Toward proactive drought management

IWMI's work in the MENA region, Afghanistan and South Asia paves the way to improved drought monitoring in other parts of the world struggling with water scarcity. Drought is now becoming an important part of national and regional development planning in many drought-affected regions, and is being recognized as a chronic problem rather than a series of ad hoc emergencies. IWMI's work is vital because proactive drought management to help nations deal with the devastating impacts of drought and build resilience is less expensive than crisis-led responses, it helps prevent these debilitating damages and casualties from happening, and because accurate forecasting models at scale are essential for better planning and preparedness.

Photo: Samurdhi Ranasinghe / IWMI

OUTCOME STORY

Promoting inclusion through weather index insurance for all

Natural disasters such as floods and droughts are not selective in who they target. However, it is the marginalized and vulnerable people who suffer the most when natural disasters decimate their livelihoods. These disasters are now occurring with increasing frequency, so IWMI has been working to make Weather Index Insurance (WII) broadly available among affected farmers in Sri Lanka to ensure they are properly compensated in the event of losses.

In theory, WII can increase the ability of vulnerable farmers to recover financially from climate shocks with the compensation they receive, enabling them to resume cultivation in the following season. Using mainly satellite images to help predict damage and assess losses, WII facilitates faster compensation payouts to farmers by avoiding time-consuming verification of the damage caused at field level. This can result in low transaction costs and allow WII to be more affordable for smallholder farmers. When bundled with agricultural inputs and crop/climate advisory services, such as weekly rainfall forecasts and advisory on crop management practices, WII can expand the potential reach of insurance coverage to remote areas previously considered uninsurable.

However, in practice, WII programs struggle to attract the people most in need of protection, particularly marginalized women and men. Reaching remote and diverse communities with technically complex index insurance products is an enormous challenge.

Social and cultural divisions, combined with illiteracy and the lack of information and awareness about WII and its benefits, mean that small and marginal farmers that need support the most are often the first to be left out of WII schemes. These challenges can be compounded if the resources and time required to explain the complicated technicalities of WII to farmers and assist them to meet the eligibility criteria are not available. If those who need WII the most are not enlisted, existing inequalities will be

reinforced and opportunities to promote pro-poor and gender-sensitive development will be missed.

Bundling WII for greater reach

There are other vulnerable and socially underprivileged groups in Sri Lanka that have not benefitted from WII. Traditional norms favor men's privileges, resulting in additional constraints to women's equitable access to land and capital. These challenges are in fact similar across much of the developing world.

Sri Lankan farmers emphasized that before adopting WII packages, they need to be able to assess the costs and benefits based on understanding how key elements of the product work. This highlights the importance of investing in awareness raising through a combination of print, verbal and visual tools that make complex products understandable to stakeholders with low levels of literacy.

IWMI researchers assessed the effectiveness of WII bundled with real-time climate and agronomic advisory services provided to farmers in Sri Lanka via mobile phones. The study concluded that partnering with local organizations can be a cost-effective way of gaining the social science skills and local networks needed to engage with target communities. Such partners can bring prior knowledge of community structures and political economies, and the requisite skill sets and trust of people to the process.

Developing a framework toward inclusion

In response to the need to address the challenges posed by complex social contexts to include the most vulnerable farmers, IWMI has developed a framework which provides a road map that allows different stakeholders involved in all stages of developing and implementing WII schemes to address issues of inclusion in a systematic way. This framework takes a process-oriented approach that ensures actions supporting inclusion and equity run through the entire process of WII design, implementation and post-implementation. It further recognizes that inclusion and equity considerations should dictate who is involved in WII design and implementation.

Deeper challenges that undermine adoption of the framework

IWMI held dialogues on actions to improve inclusion in WII with government representatives, insurers, practitioners, academics and civil society representatives mainly within the South Asia region. The dialogues and IWMI's fieldwork highlighted that meaningful actions to enhance social inclusion will have to overcome several structural and system barriers.

Government policy and rules now need to be developed that can clarify the potential multiple policy objectives of WII and set standards (e.g., equity) to be met by future WII programs.

IWMI remains committed to moving this agenda forward and has closely collaborated with other CGIAR Research Centers. A community of CGIAR scientists will provide advice to the CGIAR Research Initiatives that have WII components. This will help ensure the initiatives address the nuances in WII that will set examples of how more inclusion of the particularly vulnerable can be created in these programs.

Water, Growth and Inclusion

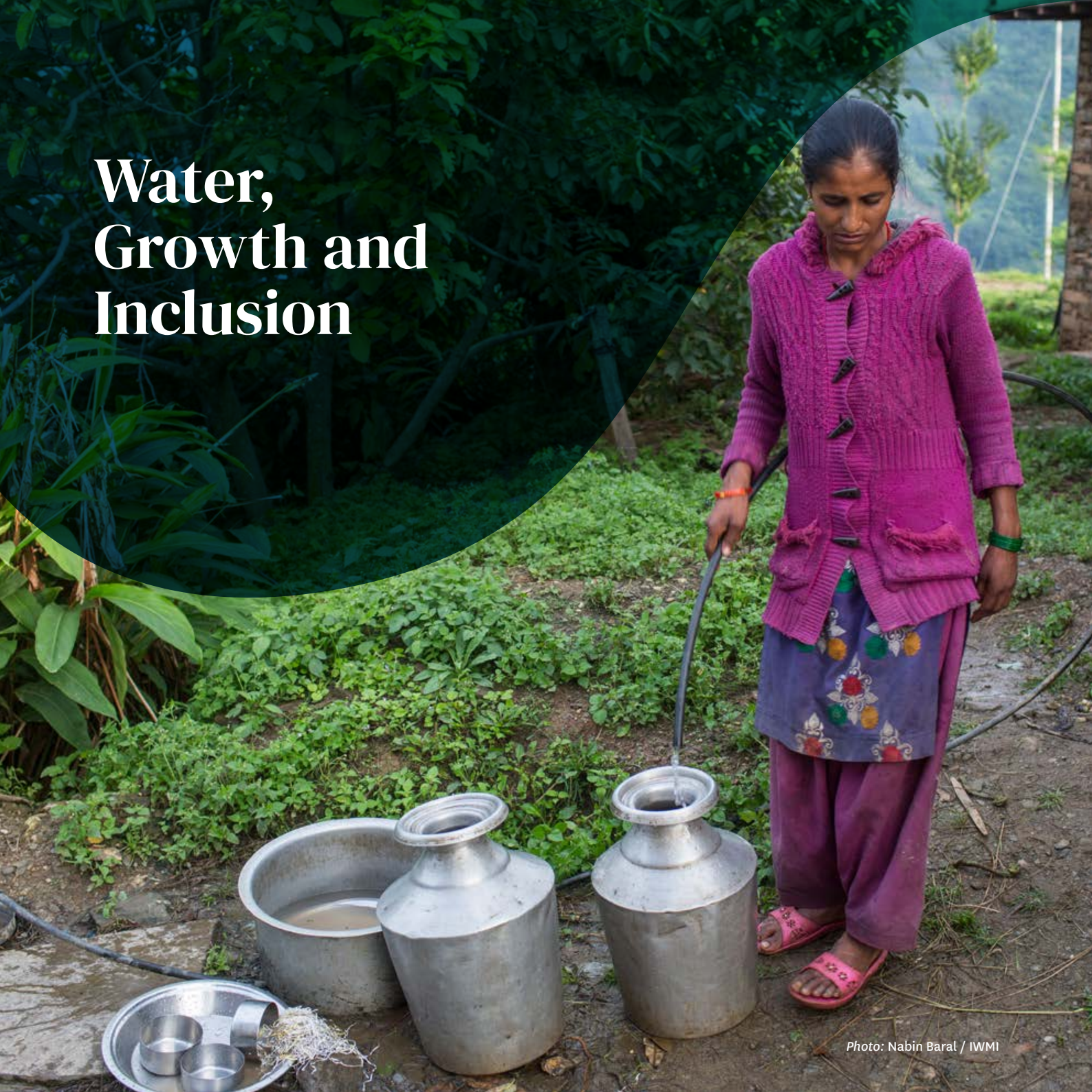


Photo: Nabin Baral / IWMI

BIG PICTURE STORY

Water security without gender equality will not work

For decades, IWMI's research has shown that we will not be able to achieve key development goals unless water systems investments, innovations and interventions support gender equality and social inclusion (GESI), especially in rural areas. As the multiple challenges of food, land and water systems sustainability converge, combining innovation with gender equality is a must to ensure systems deliver key benefits over time.

Building up women's collective decision-making power in Nepal

In a project supported by Water for Women and Australian Aid, IWMI has explored how gender relationships and power dynamics influence the sustainability and functionality of domestic water supply systems in Nepal.

Despite having the responsibility for ensuring household water supply, women usually do not have substantial decision-making power in the design, operation and maintenance of water supply systems.

Nepal has shifted to a decentralized framework of governance and has used a GESI approach to ensure 40% representation of women across federal, district and local governance levels. Nevertheless, IWMI's research in Nepal shows that beyond their representation, much remains to be done to achieve effective engagement of women in water and sanitation governance. Attitudes and mindsets have not changed, and elected male leaders perceive women's representation to be tokenistic. Women who have been elected as representatives are invited to attend meetings, but their voices are rarely heard.

Photo: ICRAF

Research conducted by IWMI in the rural municipality of Gurans in Dailekh district highlighted the challenges to transformative change. It revealed that before women can have greater representation, there must be stronger coalitions and coordination of women leaders to enable a more collective presence, voice and agency.

Building up women's collective power over community water security will play a central role in ensuring future system sustainability and, ultimately, the resilience of rural communities affected by the climate emergency.

Supporting refugees' nutrition in East Africa

More than 2.2 million South Sudanese have fled their homes in recent conflicts and live as refugees in Ethiopia, Sudan, Kenya and Uganda. Many carried seeds, including okra, with them as they escaped their home areas. Okra is a nutritious part of their diets and culturally important in maintaining a sense of food and identity. However, settlements and camps where the refugees find sanctuary are frequently in areas where the soils are poor and water for cultivation is limited.

IWMI and World Agroforestry (ICRAF) are leading a resource recovery and reuse project to support households in the reuse of domestic wastewater on new home gardens in six refugee settlements and their surrounding host communities in Ethiopia, Kenya and Uganda. In the Rhino Camp of northern Uganda, for example, refugee households can generate 14 liters per person per day of greywater, which is sufficient to keep a small okra patch thriving during the dry season.

This project underscores how water reuse has the potential to address the intimately connected issues of gender, food and nutrition in complex refugee situations. With these communities consisting largely of refugee women and children from many cultural backgrounds, our work pays particular attention to ensuring a gender-responsive approach across the project life cycle. Lessons learned on the dynamics of gender integration in displaced and vulnerable communities have resulted in a gender integration approach that can be applied across diverse programs.

Women's roles in wastewater management

IWMI implements the ReWater MENA project in the Middle East and North Africa (MENA) region to support safe water reuse practices that can improve food safety, health and livelihoods. As more farmers rely on water reuse for irrigation, there is an alarming inconsistency in the quality of treated drainage water. The gendered implications of these challenges remain poorly understood.

Gender-based social norms in the MENA region exclude women from water governance, management and decision-making processes. In collaboration with Jordan's Royal Scientific Society, the project conducted focus group discussions in Iraq al-Amir, in the North Jordan Valley. These discussions assessed the attitudes, perceptions, beliefs and experiences of both women and men regarding treated wastewater reuse. During the dialogues, women expressed a clear need and interest to be more effectively engaged in wastewater access, use and decision-making.

Photo: Hamish John Appleby / IWMI

Building on these findings, in Jordan, ReWater MENA is working with partners to improve women's access to essential information, including procedures and protocols for wastewater reuse. The project is exploring new ways of employing women in the water reuse and sanitation sectors. This opens opportunities for women to be part of identifying and deciding on appropriate water reuse options, and ensuring full compliance with reuse rules in order to protect themselves, their households and the environment.

ReWater MENA, with support from the CGIAR GENDER Platform, also conducted research in Kafr El Sheikh, Egypt, to analyze the gender-power dynamics at the tail end of irrigation networks. Focus group discussions and in-depth case studies demonstrated how an increase in women's work in irrigated agriculture enables persistence of patriarchal structures including control over access to resources. The case studies document how landless women use water reuse practices to irrigate fields through sharecropping arrangements. Yet, the women rarely make any profits, are excluded from water decision-making, and are exposed to multiple health risks.

The case studies recommend more inclusive irrigation practices, which put the health, social and well-being of the poorest groups of farmers at the heart of new investments, innovations and interventions. This recommendation aligns with the current national initiative Haya Karima, which recognizes the need to put human well-being, dignity and the rights of Egyptian citizens above all other goals.

IWMI places gender equality and the empowerment of women center stage in transforming lives and livelihoods. We see gender equality and long-term water security as intimately connected – one is not possible without the other. Working closely with local partners, the findings of our research will continue to push for actions that lead to truly gender transformative change.

Photo: Graeme Williams / IWMI

OUTCOME STORY

Hybrid water law for historical justice in South Africa

90% of small users use 10% of the water, while 10% of large users use 90% of the water.

Though apartheid in South Africa officially ended in 1994, vestiges still remain. Despite some post-apartheid water laws, the distribution of water resources remains highly unequal. IWMI is working with partners to identify options that can help decolonize statutory water law through a hybrid approach, finally helping those 90% of small users to get their equitable water share.

Injustices due to the existence of dual, race-based legal systems were painfully visible during apartheid. A tiny minority grabbed the best land and water resources. In 1994, the new democratic state made discrimination illegal, while South Africa's government proposed new water policies and laws to achieve racial and gender justice.

The *National Water Act (NWA) of 1998* strived for a progressive, distributive approach to water but its interpretation and implementation have actually created greater inequalities. Under the NWA, water uses that were lawful under earlier legal regimes could remain as 'Existing Lawful Uses' (ELUs), a clause that powerful white users administratively exploited by hoarding such entitlements. After 1998, anyone wanting new access to water needed to obtain a permit.

The second-class collective ELUs in former homelands have not been elevated yet. Because the needs of small-scale users have not yet been recognized as ELUs, they still have to apply for a permit to legally gain access to water resources. For post-1998 users, the process of getting permits is often costly, lengthy and bureaucratic for small-scale users. These users are then criminalized without a permit. Micro-scale water users are exempted from the obligation to apply for a permit but are then marginalized because exempted uses have a weaker legal standing than permitted water uses.

The most common point of contention in South Africa regards the monetary value of water entitlements. High-impact users have used ELUs, gained through racist laws, to claim high monetary values when transferring entitlements to this public resource to other users (as water trade) or through surrendering to the government (for compensation).

Moving toward hybrid water law

Now there is a path to ensuring historical justice in South Africa. For countless generations, living customary water rights regimes have governed water rights for millions of small-scale and micro-scale users in Africa's informal rural economies.

Photo: IWMI-South Africa

IWMI is working with South African partners to encourage the use of 'hybrid water law', which is a suite of legal tools that are fit-for-purpose in different contexts across the African continent. Hybrid water law aligns legal tools from statutory law with customary legal systems. It combines state-managed and customarily managed water regulation.

This hybrid approach recognizes that permitting is a useful tool for regulation of high-impact users. However, for all other users, different legal tools are needed. The approach is administratively lean, recognizes customary law and protects the most vulnerable. Instead of being entangled in concerns of getting a permit or not, hybrid law focuses on determining the ultimate goals that communities and states want to achieve through the regulation of precious water resources, and how best these can be realized.

Implementing hybrid law in Inkomati-Usuthu

IWMI is trialing an alternative hybrid approach to achieving historical justice in the Inkomati-Usuthu Water Management Area (IWMA) in the north-eastern part of South Africa. Like elsewhere in South Africa, powerful users deprive the most vulnerable of water even for basic livelihoods, with just 7% of all those registered using a vast 83% of all registered volumes.

IWMI is collaborating with the Water Research Commission (WRC) and the water authorities concerned – the Department of Water and Sanitation at national level and the decentralized Inkomati-Usuthu Catchment Management Agency (IUCMA) – to develop an implementation plan for the Inkomati Catchment.

The project team is piloting different tools for legal recognition, protection and prioritization of collectively-held water resources in former homelands vis-à-vis upstream and downstream users. The team is also exploring a reserve for core minimum volumes to meet constitutional rights to water and food, and administrative justice in permitting. As part of the effective curtailment of high-impact users, WRC, IWMI and IUCMA are also assessing realistic crop water requirements, so that water allocations are based on factual use instead of total land areas, whether cultivated or not.

With these changes ongoing, finally one of apartheid's major injustices can be redressed enabling a fairer rights regime for smallholder farmers in South Africa.

Water Data Science and Digital Innovation

Photo: Maheder Haileselassie / IWMI

Photo: Sanjiv de Silva / IWMI

BIG PICTURE STORY

Digital innovation allows farmers to improve productivity – a focus on irrigation

Climate change will exacerbate the scarcity of and competition for water. As rainfall declines and temperatures rise, the availability of water becomes uncertain. Because agriculture can be water-intensive, irrigation is often our best bet to offset these uncertainties, and feed the growing global population. However, to ensure the sustainable use of water resources for irrigation, researchers and practitioners must be very clever about how they develop novel irrigation systems of the future to meet the needs of farmers.

IWMI is pioneering digital innovation tools that can leapfrog existing technologies and have the potential to be game changers. These tools will play a key role in the transition to irrigation systems that are productive and profitable while being resilient and well adapted to climate change. The tools capitalize on new technologies and big data to sustainably manage both the supply of and demand for water resources. Tools developed in public-private partnerships will give farmers, water planners and managers more efficient ways to manage water resources and build resilience to climate change.

Sensing the right amount of water

Farmers in Amhara, Ethiopia, have access to water via the Koga Irrigation Scheme, but that water has not been used efficiently. IWMI is providing smallholder farmers with tools that allow them to assess whether their crops should be irrigated or not.

WaPOR is the Food and Agriculture Organization of the United Nations (FAO) portal to monitor **Water P**roductivity through **O**pen access of **R**emotely sensed derived data. WaPOR assists countries in monitoring water productivity,

identifying water productivity gaps, proposing solutions to reduce these gaps and contributing to a sustainable increase in agricultural production. IWMI scientists are working with partners to build their capacity in the use of WaPOR data. WaPOR uses satellite data to monitor agricultural water productivity at different scales. This database provides the information necessary to generate solutions to local challenges linked to water and land productivity as well as water demand management.

At the farm level in Ethiopia, and with the support of partners and donors, IWMI scientists are drawing on WaPOR data to work with farmers, national researchers and private companies in the introduction of low-cost sensors to improve irrigation scheduling and use water more efficiently while improving productivity of the land.

One such tool is the Wetting Front Detector (WFD), which is an ingenious plastic tube that tells the farmer when sufficient water has accumulated in the root zone by pushing up a flag. By installing these at different depths, farmers can monitor irrigation flow until the soil has been sufficiently wetted.

Another tool, the Chameleon Soil Water Sensor, connects via wires to a soil moisture sensor installed at different depths. It translates a plant's uptake of water into a simple color. The colors blue, green and red correspond to very wet, moist and dry, respectively.

IWMI worked with farmers and national researchers in Koga to assess the efficiency of WFDs and Chameleon Sensors in the field. The results were very promising. According to key farmers, they reduced their water consumption by 35%, which helped extend the irrigation cycle from the local storage reservoirs. The decrease in irrigation water did not mean a smaller harvest. In fact, wheat yield increased from 10% to 20% according to farmers' estimates.

The farmers noted that improved water demand management resulted in a faster rotation among water users in the same group, and resulted in a decline in water-related conflicts. The water saved was used to extend the area under cultivation within the blocks, and to also reduce water deliveries from main scheme operations to night storages.

Connecting solar irrigation pumps to data platforms

IWMI research has indicated that there is untapped and sustainable groundwater potential in many regions of Africa. However, use of that water must be monitored to ensure that recharge is managed and the resource is sustainable.

Solar irrigation pumps (SIPs) offer a sustainable solution to groundwater extraction. However, with near zero operational costs, it is easy for irrigators to overuse the scarce water resources. IWMI researchers are investigating the land that is most suitable for solar irrigation, and how SIPs will impact groundwater resources and the connected water, agricultural, energy and environmental systems.

IWMI has developed the Solar Irrigation Information System, a prototype platform that uses near real-time data from Futurepump, a private sector provider of solar pumps equipped with data loggers which measure the amount of energy used. The data derived from individual pumps allow managers to aggregate data to identify different patterns of use in real time. This helps future design, needs and operations of pumps to support design teams. The data also provide information on rates of abstraction of shallow groundwater reserves, which ultimately allows us to identify when and how much water is being abstracted and if this is sustainable, or how it could be better managed in relation to rainfall recharge.

Photo: Maheder Haileselassie / IWMI

Farmers can use the resulting data to better understand where they can sustainably use solar irrigation, and policymakers can use it to better manage groundwater resources.

Maintaining irrigation systems

Around 40% of the world's food is produced using irrigation. Yet, many irrigation schemes seem to follow a Build-Neglect-Rehabilitate cycle, which overlooks maintenance and infrastructure needs.

IWMI developed an irrigation asset tool called Systematic Asset Management Software (SAMS). SAMS is an open-source and user-friendly application which captures irrigation infrastructure investments in a database and tracks performance and predicts when maintenance is needed. This innovative process will enable stakeholders to audit investments and keep track of maintenance.

IWMI started a new project in 2020 titled 'Targeting investments in medium- to large-scale irrigation schemes'. Under this project, IWMI is furthering the development of SAMS to use remote sensing to digitally manage irrigation infrastructure and assess irrigation performance. The project is developing integrated tools that enhance the manager's capacity to carry out a quick assessment and make an investment decision that will increase the performance of irrigation schemes.

Irrigation is only one of the ways in which practitioners, researchers and decision makers can engage in sustainable water management practices. Nevertheless, in many places, its potential remains untapped.

CGIAR Research Program on Water, Land and Ecosystems

Photo: Metro Media / IWMI

BIG PICTURE STORY

Celebrating the legacy of the CGIAR Research Program on Water, Land and Ecosystems

At the end of 2021, IWMI celebrated the successful conclusion of the CGIAR Research Program on Water, Land and Ecosystems (WLE) which it led since launch of the program in 2012. WLE was a global research-for-development program connecting partners to deliver sustainable agricultural solutions, strengthen ecosystem health, and create resilient water, land and food systems. During the program's 10-year journey, WLE worked in 60 countries, with more than 300 partners, and completed over 200 projects that directly benefitted millions of lives and improved environmental health across the Global South.

Photo: IWMI-Tashkent

Innovations with a long-lasting impact

WLE's legacy lies with the practical and science-driven innovations that countries and farming communities can adopt to address development challenges and transition to more productive, sustainable and resilient food systems. These examples are just a part of the significant legacy that WLE is leaving for CGIAR and the wider world of research for development.

WLE developed affordable and inclusive index-based flood insurance for flood-prone farmers. The insurance uses flood modelling data to estimate flood depths and duration, and satellite data to help assess flood damage. The approach removes the need to verify claims via field visits, speeds up the payment of compensation from insurers and helps ensure that premiums remain affordable. Another innovation is a bundled insurance product that provides compensation along with improved seed varieties of drought-tolerant wheat or flood-resistant rice, agricultural inputs such as fertilizers, and information on appropriate agronomic practices.

Solar irrigation pumps have received significant attention during the past decade. They are a more affordable, reliable and climate-smart alternative to conventional

Photo: Hamish John Appleby / IWMI

diesel pumps. Efforts to increase uptake are not sufficiently 'pro-poor' and instead favor well-connected farmers with the means to invest in these solar pumps. With the help of IWMI, WLE researchers developed and refined farmer-centric business models that incentivize efficient water use and enhance smallholder access to the benefits of solar-powered irrigation without exacerbating groundwater depletion.

Farmers are struggling with depleted soils, water shortages and climate uncertainty. At the same time, urban areas are becoming vast sinks for organic waste. The way forward is to mimic natural cycles by adopting the model of a circular economy – processing organic food waste, wastewater and human excreta to extract energy, nutrients, organic matter and water for agricultural use. WLE identified opportunities for resource, recovery and reuse using numerous technical and institutional solutions. Recognizing that many of these solutions remain inaccessible to small-scale entrepreneurs and other stakeholders, WLE innovated a business model approach tailored to these groups that can drive circular economies.

Top-down approaches to restore increasingly depleted soils and water resources have had limited success because of a mismatch between the landscapes and recommended solutions, a lack of monitoring and maintenance and, crucially, poor adoption by communities lacking training or institutional support. WLE-supported work to restore degraded landscapes focused on understanding and engaging communities to obtain their buy-in. By demonstrating the potential economic benefits to communities, and securing their agreement and material contribution, restoration activities have been successfully implemented. These activities include landscape restoration and water harvesting practices; contour bunds to conserve water and reduce soil erosion; rehabilitation of traditional water tanks; mechanized micro-water harvesting packages; and weirs to capture nutrients and improve agricultural productivity.

Poor soil health is a major cause of decline in agricultural productivity in sub-Saharan Africa. However, interventions aimed at improving soil condition are hindered by a limited

knowledge about soil health and degradation. In the last decade, however, WLE-supported advances in technology to measure soil properties transformed the possibilities for ecosystem evaluation. Soil spectroscopy, which uses an infrared light on samples to accurately assess properties such as soil carbon, nitrogen and pH levels, allows scientists to generate data on entire landscapes. The technology now enables ecosystem health evaluation on a massive scale, paving the way for better targeting of land restoration and more sustainable agriculture.

Technological innovations for irrigation – whether they are solar-powered groundwater pumps or 'smart sticks' to measure water use – often do not 'trickle down' through target groups. WLE research on many fronts has advanced understanding of the constraints that smallholder farmers face in irrigating their holdings. WLE helped advance small-scale irrigation in sub-Saharan Africa by providing research and management tools that improve understanding of how best to support farmers. WLE-supported work consolidated evidence on the multiple productivity, profitability, gender and nutrition benefits arising from small-scale irrigation.

Science-driven solutions for the future

WLE released a series of legacy knowledge products, which demonstrate the scale of WLE's research for development over the past 10 years. These products were developed to influence future research, planning, policies and investments. They are available on a WLE science-driven solutions platform and include innovations in nature-based solutions for climate-smart development, productivity and resilience for thriving communities, and landscape approaches for restoration, sustainable land use and livelihoods. The 26 summaries and eight legacy products have linkages to approximately 100 detailed knowledge sources, including multimedia content.

Investing in agri-food systems innovations

WLE launched the Commission on Sustainable Agriculture Intensification (CoSAI) in 2020. CoSAI investigates the current level of investment in agri-food systems innovations and explores how to overcome constraints to more rapid development and uptake of innovations. CoSAI published a baseline study of the current level of investment in agri-food systems innovations in the Global South. Only 7% of current funding for agri-food systems innovations had explicit environmental objectives, and less than 50% of this had explicit social objectives. CoSAI also co-published an innovation investment gap study. This study estimated a global investment gap of just over USD 15 billion per year by 2030 to meet the target of Goal 2 (zero hunger) of the United Nations Sustainable Development Goals (SDGs) and make progress toward other targets.

WLE's legacy remains with CGIAR

WLE's research is also instrumental in the transition to One CGIAR – a new partnership that integrates CGIAR's knowledge, assets and global presence. The knowledge and experience that WLE gained will help ensure that CGIAR innovations are deployed faster and applied over a larger scale at a reduced cost. Food, land and water systems are integral to the CGIAR mission, and WLE research influenced the development of several CGIAR Research Initiatives, including NEXUS Gains, Agroecology, MITIGATE+ and Nature-Positive Solutions.

While WLE has ended, it is clear that its impact will continue to resonate and help strengthen our collective response to the climate crisis and the needs of climate-vulnerable communities across the Global South.

Major awards

Photo: World Food Forum

IWMI's Nafn Amdar and Arif Anwar were awarded the World Food Forum Transformative Research – Innovation Lab Award in line with IWMI's work carried out under the Water Innovation Technologies (WIT) project in Jordan.

This award recognizes researchers and aspiring researchers who are committed to transforming agri-food systems. Eight finalists were selected from over 80 entrants for their pioneering approaches and potential to create a better food future for all.

WORLD FOOD FORUM
POWERED BY GLOBAL YOUTH

Key events

Virtual World Water Week 2021

The year 2021 saw another virtual World Water Week (#WWWeek) due to continued Covid-19 restrictions. With the theme of World Water Week emphasizing climate and resilience, IWMI played a significant role at the conference, taking part in around 30 sessions during the period August 23-27, 2021, either as convenor or co-convenor. IWMI staff members from around the world engaged as moderators, speakers and panelists.

COP26: United Nations Climate Change Conference of the Parties 2021

COP26 was held in Glasgow, Scotland, during the period October 31–November 13, 2021. The main aim of IWMI's participation in the conference was to communicate an urgent and clear message to climate negotiators: Transforming water systems to build water security is central to climate action and must serve as the foundation for a climate-resilient future. As a global leader in identifying, refining and implementing innovative water-based climate solutions, IWMI used COP26 as a platform to engage with not only negotiators and policymakers, but also with current and prospective partners, media outlets, donors and other key stakeholders in the water and climate arenas. IWMI staff led, co-led, or participated in around 40 events throughout COP26, with our participation anchored by daily programming at the first-ever Water and Climate Pavilion, of which IWMI is a core partner.

Water, Extremes and Climate Change webinar

IWMI hosted a webinar titled Water, Extremes and Climate Change on August 20, 2021, to discuss the findings from the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6) of Working Group I. Two lead authors of IPCC presented findings from their round of the IPCC Assessment: Prof. Friederike Otto, Associate Director, Environmental Change Institute, University of Oxford, UK, and Dr Krishnan Raghavan, who specializes in climate modelling. They were joined by a panel of water experts to explore the implications of the latest climate change findings for regions including Asia and Africa. The webinar was facilitated by IWMI's Dr Aditi Mukherji, a Coordinating Lead Author of the Water Chapter of Working Group I of IPCC's AR6.

IPCC is the United Nations body for assessing the science related to climate change and publishes reports at intervals of seven years. The Sixth Assessment Cycle consists of three IPCC Working Group Reports, three Special Reports and a Synthesis Report. The contributions from the three Working Groups were released between 2021 and 2022, starting with the release of the Working Group I Report in early August 2021.

CGIAR @ Climate Adaptation Summit 2021

As a CGIAR Research Center, IWMI took part in a range of sessions at the Climate Adaptation Summit (CAS) in 2021. IWMI researchers highlighted the importance of water in accelerating adaptation action during several sessions. CGIAR also launched its 2030 Research and Innovation Strategy at this summit.

United Nations Food Systems Summit 2021: Water Dialogue

Ahead of the United Nations Food Systems Summit 2021, a global water dialogue explored the fundamental interconnections between food systems and water systems, and their relation to other areas that are essential to achieving the Sustainable Development Goals. At the event titled 'Water: The Game Changer for Food systems', it was concluded with consensus that water has unmatched utility to support the necessary transformation of food systems. Participants, including six senior IWMI experts, agreed that water plays a critical role in future proofing food systems against climate shocks and pandemics. This will make food systems more inclusive and healthier, which will help to end hunger and malnutrition, and safeguard the health of our planet.

Solar Irrigation for Agricultural Resillience (SoLAR) - Webinar Week

The IWMI-led Solar Irrigation for Agricultural Resilience (SoLAR) project, funded by the Swiss Agency for Development and Cooperation (SDC), organized a series of six webinars during the period February 1-5, 2021. The SoLAR project aims to generate knowledge to sustainably manage water, energy and climate interlinkages through the promotion of solar irrigation pumps (SIPs). The goal of the project is to contribute to climate-resilient, gender-equitable and socially inclusive agrarian livelihoods in Bangladesh, India, Nepal and Pakistan by supporting government efforts to promote solar irrigation. The six-part SDC-IWMI webinar series explored some of the big questions around energy transition and SIPs in four South Asian countries. The webinars were open to the public and gathered speakers from all four countries as well as those from outside the region.

Pakistan Water Week 2021

The Ministry of Science and Technology, through the Pakistan Council of Research in Water Resources (PCRWR), in collaboration with IWMI's office in Pakistan and the CGIAR Research Program on Water, Land and Ecosystems (WLE), organized the Pakistan Water Week 2021 International Conference. The conference was held in Islamabad, Pakistan, during the period December 6-9, 2021, with the theme 'Needs for Sustainable Water Management in a Climate Crisis for Indus Basin'. This was the first-ever event of its kind in Pakistan, and brought together academics, government officials, nongovernmental organizations, and policy experts from home and abroad to discuss the water related problems facing the country today.

Contributions to CGIAR Research Programs

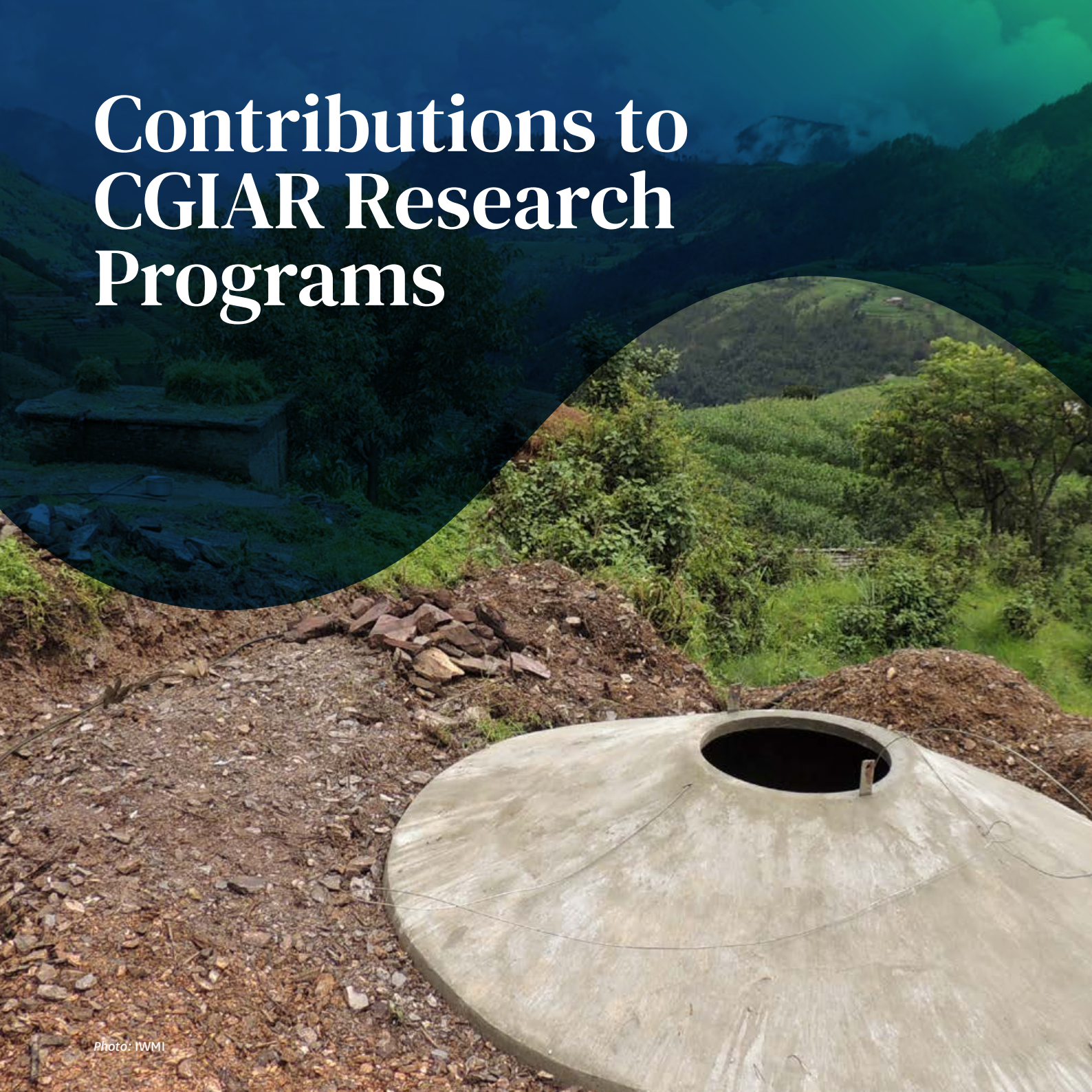


Photo: IWMI

Fish Agri-Food Systems (FISH)

IWMI's collaboration with the CGIAR Research Programs on Fish Agri-Food Systems (FISH) and Water, Land and Ecosystems (WLE), as well as bilateral projects, has delivered significant research outputs and evidenced policy impact, particularly on integrated agroecological farming and fish in irrigation systems.

- IWMI, together with WorldFish and the Food and Agriculture Organization of the United Nations (FAO), published guidelines on increasing the benefits and sustainability of irrigation through the integration of fisheries. As part of the outreach activities, a session was organized at World Water Week 2021 in conjunction with the International Commission on Irrigation and Drainage (ICID). A paper discussing how fisheries can contribute to irrigation modernization was also produced.

- IWMI developed a paper and associated policy brief on the need to manage social complexities in technical water investments to ensure inclusive, sustainable outcomes are achieved.

- A paper on rice-fish transformation in southeast Asia was published and a decision support system for scaling and targeting investment in rice-fish systems was developed. Rice-fish systems were promoted via a brief and a session at World Water Week 2021. In addition, a database of rice-fish innovations was created and a theory of change for a rice-fish program in Cambodia was developed in collaboration with Australian Centre for International Agricultural Research (ACIAR).

- The study findings provided inputs to the paper titled Promoting youth engagement and employment in agriculture and food systems by the High Level Panel of Experts on Food Security and Nutrition (HLPE).

- The work on landscape transformation identified consumption patterns and diet gaps and the differences between different states/regions across Myanmar. The research also identified water and carbon footprints as well as nutritional profiles for selected production pathways. Scenario analyses of changing agricultural production were used to create a database of altered water use patterns and greenhouse gas emissions, associated with a switch from rice cultivation to more nutritious food production.

- IWMI contributed to the establishment of the Inland Fisheries Alliance (IFA), which promotes sustainable inland fisheries and has contributed to increased awareness of inland fisheries at the United Nations Food Systems Summit and elsewhere. Both IWMI and WorldFish are represented on the IFA steering committee.

Climate Change, Agriculture and Food Security (CCAFS)

IWMI continued to contribute to the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) through index-based flood insurance programs and the scaling up of climate-smart technologies:

- The project titled Scaling-up Climate-Smart Agriculture Technologies, Practices and Services was jointly initiated by the Indian Council of Agriculture Research (ICAR), IWMI and CCAFS in 2019. The project aimed to contribute towards the development of a national strategy for synthesizing cumulative knowledge, experiences and learnings of ICAR, CCAFS and CGIAR Centers' programs in scaling out climate-resilient agricultural practices and technologies.

  - As an outcome of the project, in 2021, a district-level climate adaptation plan for resilient farming in Beed district (Maharashtra) was prepared. The process consisted of characterization of climatic risks followed by identification and prioritization of climate-smart agriculture (CSA) technologies and

practices, and identification of opportunities for scaling up through the convergence of government policies and programs. A participatory approach involving stakeholders from agricultural research institutions, district line departments, Krishi Vigyan Kendras (KVKs) (Farm Science Centers), and the private sector, and farmers was used for identifying and prioritizing the area-specific climate-smart interventions.

- The convergence of resources from relevant government schemes/projects for mobilizing funds for prioritized CSA technologies has been proposed. The report titled Scaling Out Climate-Smart Agriculture for Resilient Farming in Beed district of Maharashtra also outlines the institutional arrangement required for effective implementation of climate adaptation plans.

- A web-based survey tool on Technology characterization and suitability mapping for climate-smart agriculture was developed for capturing district-level basic data, technology characterization, and suitability mapping for implementing technologies for the cultivation of major crops, livestock and fisheries. Subject matter specialists of district KVKs contributed to the collection of district-level data. In this survey, feedback was received from all over India and included responses from more than 720+ participants for crops, 330+ for livestock and 170+ for fisheries. The information collected is being used to prioritize CSA technologies for selected districts/states and agroclimatic zones. Some results for the prioritization and convergence of CSA water management interventions were presented during the 26th United Nations Climate Change Conference of the Parties (COP26) which was held in 2021.

- IWMI and CCAFS developed innovative solutions for tackling climate shocks such as floods and drought under the umbrella of bundled insurance solutions to promote comprehensive risk mitigation plans and the rapid dissemination of climate information services to smallholder farmers.

- IWMI and partners conducted pilot trials in India and Sri Lanka to promote innovative bundled solutions among vulnerable smallholder farmers in order to transform agricultural risk management. The main objective of the pilots has been to provide Bundled Solutions of Index Insurance with Climate Information and Seed Systems to manage Agricultural Risks (BICSA).

- BICSA was tested in five districts of Sri Lanka (Ampara, Anuradhapura, Kurunegala, Monaragala and Vavuniya), with the aim of providing access to climate-resilient seeds, agro-climate advisories and weather index insurance to thousands of farmers during the *Yala* and *Maha*. The weather index insurance product, developed in close collaboration with Sanasa General Insurance Company Limited, uses satellite-derived rainfall data.

Policies, Institutions, and Markets (PIM)

- IWMI contributed to the CGIAR Research Program on Policies, Institutions, and Markets (PIM) through engagement in the project titled Migration and Gender Dynamics in Irrigation Governance in Nepal. The project aimed to understand the gendered dynamics in the structure and functioning of Water Users' Associations (WUAs) in farmer-managed and agency-managed irrigation systems, as an outcome of male migration and other socioeconomic changes, focusing particularly on changes (if any) in women's membership and leadership roles (previously held by men) in the governance of WUAs. The project also aimed to understand whether caste, ethnicity and wealth affect women's participation in irrigation labor and in WUAs. In October 2021, IWMI participated in the Cultivating Equality Conference and co-presented on Migration and gender dynamics in irrigation governance in Nepal.

- In May 2021, Diana Suhardiman participated in the IASC 2021 Water Commons Virtual Conference and presented in the following sessions:

- Aspirations undone: Hydropower and the (re) shaping of livelihood pathways in Northern Laos.
- Scalar politics, power struggles and institutional emergence in Daw Lar Lake, Myanmar.

Agriculture for Nutrition and Health (A4NH)

Since the CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) joined the CGIAR Antimicrobial Resistance (AMR) Hub, IWMI has continued to collaborate with CGIAR Research Centers to help integrate and channel research and development efforts.

- IWMI contributed to the technical review of a study on AMR risks from crop production carried out by the London School of Hygiene and Tropical Medicine (LSHTM).
- IWMI participated in a virtual workshop organized by WorldFish and the University of Waterloo to explore how selected interventions will mitigate AMR under uncertain future conditions.
- IWMI was represented in the management team of the CGIAR AMR Hub.
- IWMI presented AMR work in a webinar titled Wastewater and Emerging Pollutants: Unfolding A Toxic Story organized by the United Nations Environment Programme (UNEP) and the Global Wastewater Initiative.
- IWMI represented A4NH in two AMR sessions at World Water Week 2021 and contributed to the discussion coordinated by the Stockholm International Water Institute (SIWI) and other international partners.
- IWMI contributed to a journal article titled Increased antimicrobial use during COVID-19: The risks of advancing the threat of antimicrobial resistance.

CGIAR Research Support Platforms

GENDER Platform

IWMI continued to collaborate with the CGIAR GENDER Platform – Generating Evidence and New Directions for Equitable Results – to integrate with the Platform's activities through knowledge products, tools and events:

- IWMI/WLE researchers co-authored the GENDER Platform evidence explainer titled 'A feminist political ecology approach to better manage land, water and forests'.
- In October 2021, several IWMI/WLE researchers contributed to the Cultivating Equality Conference organized by the GENDER Platform and Wageningen University, Netherlands.
- IWMI was one of four recipients that was awarded a grant under the Platform's Methods Module for the research project titled 'Doing science with society' led by Deepa Joshi. This research project will pilot and validate a bold socio-technical innovation that integrates a feminist political economy lens with a transdisciplinary, ethnographic, digital tool called SenseMaker.

Photo: Hamish John Appleby / IWMI

Photo: IWMI

Financials

IWMI reported an increase on its total grant revenue in the financial year 2021 of more than 25% with a total revenue of USD 31.13 million and achieved a surplus of USD 0.48 million. IWMI received an unmodified audit opinion on its 2021 annual financial statements and 21 project audits were carried out during the financial year to comply with grant agreements. In December 2021, the System Council approved the first group of 19 CGIAR Initiatives to launch from January 2022 and the 2022-2024 Portfolio and Designated Financing Plan.

The Institute continues to review its policies, procedures and processes to further strengthen internal controls. IWMI is currently working with other CGIAR centers on the One CGIAR transition. Once the new One CGIAR transition is completed, all CGIAR centers, including IWMI, will have a further improved internal control system. The Institute also ensures that it strictly follows the clauses in the grant agreements and in compliance with donor regulatory requirements.

Statement of Financial Position

As of December 31, 2021 and 2020 (in US Dollars '000)

	2021	2020
Current assets	22,056	25,310
Non-current assets	3,530	3,042
Total Assets	**25,586**	**28,352**
Current liabilities	11,542	14,865
Non-current liabilities	2,276	2,194
Total Liabilities	**13,818**	**17,059**
Designated net assets	2,871	2,729
Undesignated net assets	8,897	8,564
Total Net Assets	**11,768**	**11,293**
Total Liabilities and Net Assets	**25,586**	**28,352**

Statement of Activities and Other Comprehensive Income

For the years ended December 31, 2021 and 2020 (in US Dollars '000)

	2021	2020
CGIAR Trust Fund (Windows 1 & 2)	15,746	10,085
CGIAR Trust Fund (Window 3)	923	1,686
Bilateral	14,103	12,476
Total Grant Income	30,772	24,247
Other revenue and gains	362	590
Total Revenue	**31,134**	**24,837**
Research expenses	28,719	22,092
General and administration expenses	3,113	2,755
Total Expenses and Losses	**31,832**	**24,847**
Operating Deficit for the Year	**(698)**	**(10)**
Financial income & disposal gains	868	674
Other comprehensive income / (loss)	305	(369)
Total Comprehensive Surplus for the Year	**475**	**295**

Expenses by Function

For the years ended December 31, 2021 and 2020 (in US Dollars '000)

	2021	2020
Personnel costs	13,137	12,896
CGIAR collaboration expenses	6,393	3,877
Non-CGIAR collaboration expenses	1,404	1,362
Supplies and services	9,828	6,026
Travel	368	239
Depreciation / Amortization	406	193
Cost sharing percentage	296	254
Total Expenses and Losses	**31,832**	**24,847**

Principal investment partners

IWMI research receives support from Funders contributing to the CGIAR Trust Fund as well as grants from various organizations.

We gratefully acknowledge their support for our collaborative efforts to achieve water security across the developing world.

- African Development Bank (AfDB)
- Asian Development Bank (ADB)
- Asian Infrastructure Investment Bank (AIIB)
- Australian Centre for International Agricultural Research (ACIAR)
- Bill & Melinda Gates Foundation
- Bundesministerium fur wirtschaftliche Zusammenarbeit und Entwicklung (BMZ) (Federal Ministry for Economic Cooperation and Development), Germany
- CGIAR Trust Fund
- Danish International Development Agency (Danida)
- Department of Agriculture, Forestry and Fisheries (DAFF), South Africa
- Department of Foreign Affairs and Trade (DFAT), Australian Government
- Economic and Social Research Council (ESRC), United Kingdom
- European Bank for Reconstruction and Development (EBRD)
- European Commission (EC)
- Food and Agriculture Organization of the United Nations (FAO)
- Foreign, Commonwealth & Development Office (FCDO), United Kingdom
- Government of Karnataka, India
- Government of the Netherlands
- Green Climate Fund (GCF)
- Helmsley Charitable Trust
- International Development Research Centre (IDRC)
- International Fund for Agricultural Development (IFAD)
- International Science and Technology Center (ISTC)
- ITC Limited, India
- Livelihoods and Food Security Fund (LIFT), Myanmar
- Mekong River Commission (MRC)
- Millennium Challenge Corporation (MCC), USA
- Ministry of Agriculture and Farmers Welfare, India
- Ministry of Agriculture and Rural Affairs, China
- Ministry of Agriculture, Forestry and Fisheries (MAFF), Japan
- Norwegian Institute of Bioeconomy Research/Norsk institutt for bioøkonomi (NIBIO), Norway
- Sir Dorabji Tata Trust and Sir Ratan Tata Trust
- Swedish International Development Cooperation Agency (Sida), Sweden
- Swiss Agency for Development and Cooperation (SDC), Switzerland
- United Kingdom Research and Innovation (UKRI)
- United Nations Children's Fund (UNICEF)
- United Nations Environment Programme (UNEP)
- United States Agency for International Development (USAID)
- United States Department of State
- Water Research Commission (WRC), South Africa
- World Bank

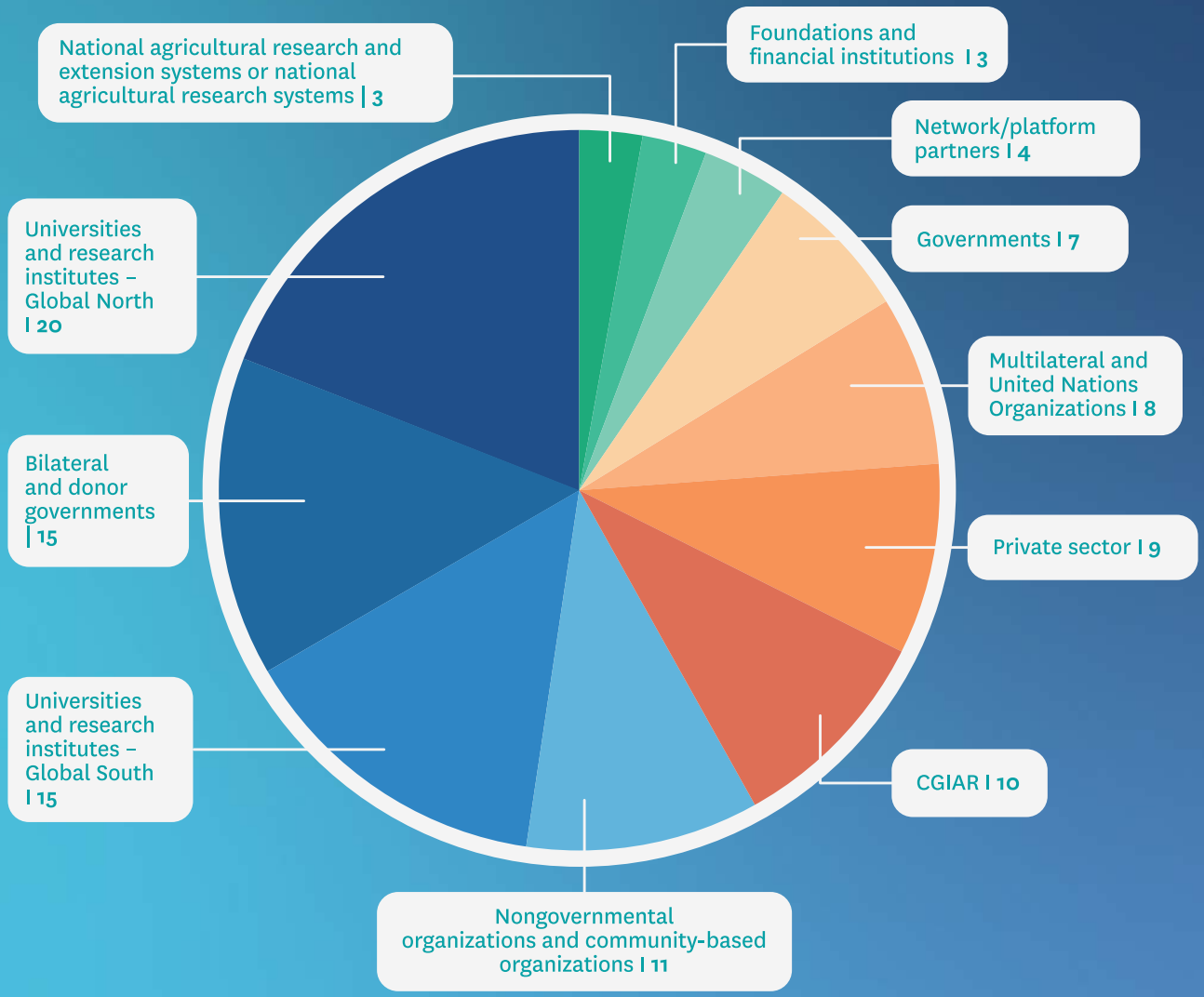
HOST COUNTRIES: Sri Lanka, Egypt, Ethiopia, Ghana, India, Italy, Laos, Myanmar, Nepal, Pakistan, South Africa, United States of America and Uzbekistan

Partnerships

Our priority is to deliver research and knowledge services to, and through, partnerships.

Over decades of experience in research for development, IWMI has learned that no one achieves impact at scale by acting alone. Research contributions to innovation systems are only possible through partnerships. IWMI prioritizes partnerships that put in place the relationships needed to link research to local change and innovation, and to policy and institutional change at national, regional and global levels.

IWMI uses its unique and extensive field-based presence of water scientists, its long-term partnerships with governments, researchers, nongovernmental organizations, the private sector and development practitioners, as well as its membership in CGIAR, to identify key partners and prioritize cooperation with coalitions at local, basin and national levels.


National agricultural research and extension systems or national agricultural research systems | 3
Foundations and financial institutions | 3
Network/platform partners | 4
Governments | 7
Universities and research institutes – Global North | 20
Multilateral and United Nations Organizations | 8
Bilateral and donor governments | 15
Private sector | 9
Universities and research institutes – Global South | 15
CGIAR | 10
Nongovernmental organizations and community-based organizations | 11

Board of Governors

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Professor Emeritus, University of Nebraska, Lincoln

Chemutai Murgor, Kenya
(Vice Chair, IWMI Board of Governors)
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Standard Chartered Bank Kenya Limited

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Audit Committee Chair, WaterAid

* CGIAR Board Member
** Active Observer

Photo: IWMI

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Front cover photograph: Muhammad Usman Ghani / IWMI
(Woman washing her daughter's face in a rainwater pond, Pakistan)

Our locations

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CGIAR
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