



International Water
Management Institute



CGIAR
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Research Center

Water systems underpin food security

Annual Report 2022





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Innovative water solutions for sustainable development

Food • Climate • Growth

Message from the Board Chair and the Director General



Roberto Lenton
CHAIR, BOARD OF GOVERNORS



Mark Smith
DIRECTOR GENERAL

The year 2022 offered a glimpse into a future of heightening pressures on water security. In response to these challenges, IWMI sought a range of innovative water-smart solutions, benefitting communities, national economies and river basins. Our researchers worked closely with the governments of countries most impacted by extreme weather events to support their disaster responses, in addition to helping them plan for future risks. As we look ahead, IWMI is taking on a more proactive role in ensuring that we make a stronger contribution to supporting policy change and implementation, and to using evidence from research to help shape the global water agenda.



As we reflect upon the events of the past year, it is clear that 2022 offered a glimpse into a future of heightening pressures on water security.

The Horn of Africa's prolonged drought and the Pakistan floods, which inundated millions of hectares of farmland and destroyed over two million homes, served as stark reminders of water's central role in climate change. The Ukraine-Russia war in Europe also laid bare the interconnections among water, food and conflict. Each such event makes the urgency of solutions for water management and risks only more evident.

The [Sixth Assessment Report](#) of the Intergovernmental Panel on Climate Change (IPCC) was another wake-up call, stressing that each degree of global warming intensifies challenges to climate, food and water security. Climate change is unequivocally causing widespread and rapid changes to the Earth's hydrological cycle, leading to more droughts, floods, heat waves and wildfires. These shifts detrimentally impact freshwater availability, food production, biodiversity and livelihoods, and lead to a cascade of other profound consequences that fall disproportionately upon vulnerable communities.

The IPCC report aligned with findings from other publications such as [The State of the World's Land and Water Resources](#) by the Food and Agriculture Organization of the United Nations (FAO) and the [Dasgupta Review of The Economics of Biodiversity](#), which were published in 2021. Both publications highlighted that food, land and water systems are at breaking point, with only a narrow margin for reversing trends in resource deterioration and biodiversity loss. It is abundantly clear – because of the dependence on nature of food, land and water systems and, in turn, our economy – that if we fail to value our natural resources and restore biodiversity, we risk economic loss and breakdown.

In response to these challenges, IWMI seeks a range of innovative water-smart solutions, a selection of which is

described in this report. In 2022, our research benefitted communities, national economies and river basins. Our researchers worked closely with the governments of countries most impacted by extreme weather events to support their disaster responses, in addition to helping them plan for future risks. Moreover, our solar innovation scaling tools and inclusive financing mechanisms allowed thousands of farmers to take the reins of their irrigation systems in Asia. Our projects also tapped into the potential of reusing wastewater to catalyze circular economies and improve food safety, health and livelihoods in Africa and the Middle East. In East and Southern Africa, IWMI found new ways to mobilize private finance for climate-smart food systems innovation. Also, our technologies continue to help smallholder farmers optimize water use and reduce irrigation costs in water-scarce areas.

As we approach the conclusion of our [2019-2023 strategy](#), its benefits are becoming clear. We are using our research-for-development capabilities to contribute knowledge, evidence and innovation to building, with our partners, solutions for the world's most pressing water challenges. As this report showcases, our collaboration with local communities, governments and the private sector has been a cornerstone to achieving impact on water security and development. We have stronger relationships with our host nations and have forged strategic partnerships with local organizations, both within and beyond the water community.

Our strategy has also proved invaluable in guiding our contributions to [CGIAR](#) and the development of the [CGIAR Research Initiatives](#), which were launched in 2022 to provide systemic and integrated solutions to the pressing need to transform food, land and water systems. IWMI's active involvement in 22 of the 32 initiatives reflects the growing investment by CGIAR in water systems science, and CGIAR's deepening commitment to help solve the world's most pressing challenges to water security.



In 2022, our work was carried out against the backdrop of landmark events that emphasized the growing urgency of water security in the face of multiple interconnected crises. Our contributions to the Water and Climate Pavilion and the Food and Agriculture Pavilion at the United Nations (UN) Climate Change Conference of the Parties (COP27) in Sharm El-Sheikh, Egypt, allowed us to advocate, at the highest levels, for the crucial role of water systems science in climate adaptation and mitigation. We collaborated directly with key negotiators to put evidence into use in the negotiations, and contributed alongside a coalition of partners to advocate successfully for the inclusion of water systems in the Sharm El-Sheikh Implementation Plan that was agreed at COP27.

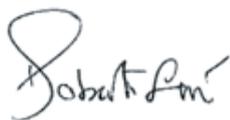
At the [Dushanbe Water Conference in Tajikistan](#), which took stock of progress achieved in the UN [Water Action Decade](#), 2018-2028, we laid the foundations of IWMI's contributions to the [UN 2023 Water Conference](#), planned for March 2023 and the first UN intergovernmental conference on water since 1977.

In Dushanbe, IWMI launched the Transformative Futures for Water Security Initiative (TFWS), a dialogue co-hosted

by young scientific and water leaders and with partners from the Global South, to identify high-ambition missions for collective action on water security ahead of the UN 2023 Water Conference. TFWS emerged as a way to create alignment and convergence of knowledge and research, policy, business and on-the-ground implementation. In 2022, the initiative held the first of eight Regional Dialogues, paving the way for collaborative efforts and to address the critical challenges facing water security worldwide.

As we look ahead, IWMI is taking on a more proactive role in ensuring that we make a stronger contribution to supporting policy change and implementation, and to using evidence from research to help shape the global water agenda. By harnessing the collective expertise and commitment of individuals, institutions and governments worldwide, we aim to build a sustainable future that prioritizes water resilience and transforms water systems to adapt to the era of rapid global change the world is now experiencing.

Through partnership, innovation and transformative change, we can create a resilient and water-secure world.



Roberto Lenton
CHAIR, BOARD OF GOVERNORS



Mark Smith
DIRECTOR GENERAL



Global engagement



Transformative Futures for Water Security regional dialogues

Photo: Kgothatso Mophosho / IWMI

The [Transformative Futures for Water Security](#) initiative emerged as IWMI's contribution to the United Nations 2023 Water Conference, which aims to shape global water management and policy through the Water Action Agenda. Over the past year, TFWS convened over 1,000 representatives from the private sector, water user and advocacy groups, research institutes, political entities and youth networks to identify critical gaps and opportunities in water research, policy and action. These represented 55 countries and 400 organizations. Through a unique process that included eight South-South regional dialogues and a global conference held in Cape Town, South Africa, eight high-ambition missions emerged, around which new TFWS stakeholders have rallied. The initiative uses a bottom-up approach, with youth acting as co-guardians of the process. The missions were part of IWMI's commitment to the Water Action Agenda, aiming to catalyze and deliver innovation and action to strengthen water security.



United Nations Climate Change Conference of the Parties (COP27)

Photo: Faseeh Shams / IWMI

The [27th United Nations Climate Change Conference](#) was held in Sharm El-Sheikh, Egypt, on November 6–18, 2022. It was the second consecutive Conference of the Parties (COP) to feature a Water and Climate Pavilion, which encouraged a focus on the links between water and climate change, and discussions on climate-resilient water management and solutions. During the event, IWMI collaborated with several organizations with the aim of encouraging policymakers to prioritize water as a critical resource impacted by climate change. These discussions were successful, as described by Vidhisha Samarasekara (Strategic Program Director – Water, Climate Change and Resilience, IWMI) in her op-ed for *Scientific American* titled [How Water Finally Became a Climate Change Priority](#). She explained how the [international agreement](#) that resulted from the COP27 negotiations “solidified the idea that water is a valuable resource that can help society become more resilient to the impacts of climate change” – a huge win for global water security.



Ramsar Convention Conference of the Parties (COP14)

Photo: Hamish John Appleby / IWMI

The [Ramsar Convention Conference of the Parties \(COP14\)](#) was held in Geneva, Switzerland, and Wuhan, China, on November 5–13, 2022, under the theme ‘Wetland Actions for People and Nature’. IWMI participated in the Geneva event with support from the CGIAR Initiative on NEXUS Gains. Delegates from IWMI highlighted the importance of the water–energy–food–ecosystems nexus, and as part of integrated food production systems. As a Ramsar International Organization Partner (IOP), IWMI contributed to side events and panel discussions covering topics such as wetlands as nature-based solutions for food production, wise use of wetlands in South Asia, restoration of mangrove and seagrass ecosystems, and challenges in protecting and conserving Ramsar sites. Along with other IOPs, IWMI called for recognition of the importance of wetlands in the post-2020 Global Biodiversity Framework. Wetlands are hugely important and productive ecosystems which could reduce some of the impacts of climate change, and the multidisciplinary approaches implemented by initiatives such as NEXUS Gains are key to effectively managing these threatened landscapes.



IWMI's global carbon footprint reduction program

Photo: Tanmoy Bhaduri / IWMI

In accordance with the United Nations Global Compact, IWMI is calculating its global carbon footprint from 2020 to 2022. Taking 2019 as its base year, IWMI is working with sustainability consultancy EnKing International to convert operational data from each of its country offices into carbon emissions. This will facilitate the creation of a carbon emissions budgeting process for IWMI. IWMI is also developing its Sustainability Strategy and is working with an external auditor to validate the sustainability and data collection process. Finally, IWMI is supporting fellow CGIAR Research Centers, the International Rice Research Institute and WorldFish, with their enrolment in the United Nations Global Compact, and has briefed other CGIAR centers on the enrollment process.



Sixth Assessment Report of IPCC: Chapter 4 on water

Photo: Amjad Jamal / IWMI

The Sixth Assessment Report from Working Group II of the Intergovernmental Panel on Climate Change (IPCC) was published in March 2022. The report, titled ‘[Climate Change 2022: Impacts, Adaptation and Vulnerability](#),’ features contributions from researchers at IWMI, including Aditi Mukherji, who was a coordinating lead author of Chapter 4. This chapter assesses the impacts of climate change on the hydrological cycle, the risks to humans and the environment, and discusses adaptation efforts. The report acknowledges the disproportionate impacts of water security on vulnerable populations, particularly in the Global South, and urges the development of adaptation policies that incorporate local, Indigenous and technical knowledge for climate resilience.



Kunming–Montreal Global Biodiversity Framework

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

Chris Dickens (Principal Researcher, IWMI) worked with three independent groups that contributed to the inclusion of inland water in the draft targets of the [Kunming–Montreal Global Biodiversity Framework](#) adopted at the United Nations Biodiversity Conference (COP15). Target 2 of the framework now states that by 2030, 30% of the world’s degraded terrestrial, inland water and coastal and marine ecosystems will be under effective restoration and be effectively conserved and managed. Target 3 states that at least 30% of terrestrial, inland water and coastal and marine areas should be effectively conserved and managed. This was a particular objective because inland water was initially omitted from the Targets. Chris contributed to UN-Water’s submission on inland water, drafting the proposal to include environmental flows as one of the Indicators of Target B on “Services Provided by Ecosystems” that will be used to monitor the Targets and Goals. The final selection of Indicators will only be finalized by 2025. IWMI also contributed to scientific and technical background papers that helped formulate and set priorities for the Global Biodiversity Framework, presented by a CGIAR consortium led by the Alliance.

IWMI at a glance



Publications

173 journal articles
144 (83.2%) Open Access
44 book chapters
37 IWMI reports
4 books



Website

307,000 website visitors
24,000 publication downloads
54 blog posts
30 videos



Social media

3.2 million impressions
123,000 engagements
34% growth in social media followers



Global staff

36 nationalities
209 staff in Asia
111 staff in Africa
5 staff in Europe/North America
185 men
140 women } 325 total staff



Projects and partnerships

136 active projects in 2022
51 new projects in 2022
115 partnerships

Major trends shaping IWMI's strategic and operational context in 2022



Water, Food and Ecosystems

Moves to alleviate global hunger unfortunately made minimal progress between 2021 and 2022, persisting well above pre-COVID-19 levels and impacting 9.2% of the global population in 2022, up from 7.9% in 2019. Similarly, the economic recovery noted in 2021 slowed in 2022, largely due to the war in Ukraine. This conflict exacerbated the consequences of escalating prices for food, agricultural inputs and energy, impeding the progress in employment and livelihoods of the most vulnerable communities.

Advances have also been limited in addressing ecosystem losses. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), up to 75% of the Earth's land surface is significantly altered by human activities. This loss of biodiversity affects ecosystems' ability to provide services, including clean water and climate regulation.

An important report in 2021, the [Dasgupta Review](#), outlined the compelling case for valuing natural resources, and stated that biodiversity should be restored to avoid economic loss and breakdown. This report aligns with findings from other publications, such as the Food and Agriculture Organization of the United Nations State of Land and Water Report, which states that land and water systems are at a breaking point largely as a consequence of agricultural practices. In 2022, Earth overshoot day fell on July 28, meaning that our population consumes 75% more natural resources than the Earth can regenerate.

Thus, the urgency in addressing these interconnected crises has never been more apparent. The global discourses increasingly underscore the need for a paradigm shift, placing a premium on governance reforms and institutional evolution, and embracing a holistic 'nexus approach' to decision-making. Simultaneously, there is a growing realization of the transformative potential within the fusion of nature-based solutions and conventional infrastructure: a dynamic strategy that is reshaping water management policies worldwide.



Water, Climate Change and Resilience

Global temperatures have risen by approximately 1.2 degrees Celsius above pre-industrial levels. In 2022, multiple records for extreme weather events were broken. Across every continent, climate change led to more frequent and severe storms, floods, heatwaves and droughts. In Pakistan, more than 32 million people were displaced by the extreme floods that submerged one third of the country and wreaked havoc on its infrastructure. In Ethiopia, Somalia and Kenya, more than 20 million people needed food assistance – an increase of over 70% compared to the 2016 and 2017 food crises in the Horn of Africa.

Each year, increasing numbers of countries face extremely high levels of water stress, while global water demand continues to rise with population growth and economic development.

Nevertheless, there is a growing recognition among governments and international organizations of the imperative for coherent policies and governance frameworks to confront the intersecting challenges of water and climate. During COP27, a historic consensus was reached on the pivotal role of ‘water systems’ in climate mitigation and adaptation. Moreover, a roundtable of Heads of State and Government issued a compelling call for immediate action to address the ‘global water crisis’. They emphasized the urgency of enhanced global collaboration, increased investments in water security and the elevation of water as a higher political priority, spanning climate, food, biodiversity, finance, and peace and security agendas.

Advances in technology, data analytics and modeling are also helping communities and organizations better understand and manage water resources in the face of climate change. This includes early warning systems for extreme weather events and improved water management practices.



Water, Growth and Inclusion

As the effects of the COVID-19 vaccines started to take effect in 2022, many developed countries' economies were able to begin their recovery. However, inflation and currency devaluation continued to challenge social and economic development in the Global South by eroding purchasing power and affecting trade and foreign exchange reserves. The escalation of the Russia-Ukraine conflict in February 2022 further strained global agricultural and food supply chains, which were already reeling from the effects of the pandemic. This conflict led to mounting fuel and food prices, added inflation and supply chain disruptions, placing a significant burden on Africa's economies and food systems.

These global socio-political trends, including rising protectionism and increased global inequality, marked 2022 as a year of sustained low growth. Global economic growth in 2022 was only half of the previous year's annual rate, the sharpest decline since the global economy rebounded after a recession more than 80 years ago. Diminishing water supplies further exacerbated this slow growth, with some regions potentially facing a 6% decline in GDP by 2050 due to water-related losses in agriculture, health, income and prosperity. Ensuring a consistent water supply amid increasing scarcity is crucial for achieving global poverty alleviation goals.

The gender disparities in water access and management that persist in many regions also continue to slow growth in the Global South. Women and girls often bear the burden of water collection, which can limit their participation in education and economic activities. While nearly all aid and development efforts have increasingly embraced inclusive strategies that prioritize the well-being of women and other marginalized groups, it remains a stark reality that women, youth, persons with disabilities, Indigenous groups and other underrepresented and marginalized groups still lack access and a voice in the water sector.

Despite the growing recognition of the importance of Indigenous knowledge in water management and environmental conservation, there is still progress to be made on the inclusion of Indigenous and traditional knowledges in research for development. The factors driving exclusion of these groups are increasing and it is estimated that climate change will force over 140 million people to migrate within their countries by 2050. According to the Internal Displacement Monitoring Center (IDMC), an average of 12 million new displacements happens each year due to droughts and floods alone, mainly through adverse impacts on agriculture. In turn, migration and conflict limit vulnerable communities' access to water resources.

Addressing these multifaceted global challenges demands international cooperation, substantial investments, and unwavering commitment to inclusivity and sustainable development. Progress is slow, but efforts are being made. In 2022, the Government of the Netherlands formed the Global Commission on the Economics of Water – an independent commission which launched its first report at the UN 2023 Water Conference. The report called for collective action, and changes in policy and business approaches to support climate and water justice, sustainability, and food–energy–water security. Similarly, the 2022 World Water Forum that took place in Dakar in late March emphasized the role of transparent, efficient and inclusive water management, the importance of water governance for both nature and people as well as greater coherence between water policies and policies for other areas.



Water Data Science and Digital Innovation

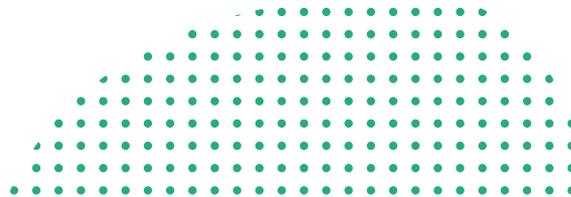
Data collection and analysis are becoming increasingly critical for water security. Advanced technologies, including remote sensing and artificial intelligence (AI), are being used to gather and analyze water-related data to inform decision-making. According to this year's Global Water Policy Report, national governments consider information and data about water that can be used within their own countries to be the most valuable service coming from international scientific efforts.

However, the persisting gaps in knowledge, data and information sharing services slow our progress towards achieving global water security. The fragmentation of water systems science and the lack of data in certain regions of the world hinder the work of researchers in developing, informing and implementing comprehensive solutions.

Overall, there is a need for global water data platforms that facilitate data sharing and collaboration among countries and stakeholders. Water data and information are currently scattered across different international, national and regional portals and platforms, making it difficult for stakeholders to make informed decisions.

In addition, in 2022, almost half of the world's population still had no access to the internet. This digital divide predominantly impacts women, rural populations and vulnerable communities who live in developing regions of the world. Bridging this digital gap is crucial for equitable access to water-related information and the benefits of data-driven solutions.

The integration of AI in water systems also holds immense promise for improving water security worldwide. AI can optimize water distribution, predict water quality issues and enhance resource management. However, a critical concern in implementing AI for water systems is addressing bias, fairness and associated risks. One risk of using AI in water management, for instance, is the use of data that is not representative of all communities to train an algorithm. To mitigate these risks, robust AI governance mechanisms, standards and regulations are essential, especially in developing countries where access to AI is very limited. By addressing these challenges and fostering responsible AI use, we can harness the full potential of AI to advance global water security while ensuring fairness and inclusivity for all communities, regardless of their access to digital resources.



Stories of change



Photo: Hamish John Appleby / IWMI

CGIAR Research Initiatives



BIG PICTURE STORY

A whole systems approach to water, energy, food and ecosystems

Integrated and sustainable management of water, energy, food and ecosystems is challenging, even more so in transboundary river basins. The CGIAR Initiative on [NEXUS Gains](#), one of two CGIAR Research Initiatives led by the International Water Management Institute (IWMI), recognizes that systems approaches – facilitating integration across sectors to identify positive synergies

and manage trade-offs – are a prerequisite for sustainable development. The initiative promotes systems thinking to realize multiple benefits across the water–energy–food–ecosystems nexus.

As NEXUS Gains completes its first year, we highlight three of the initiative’s activities, which demonstrate why a systems approach is needed to tackle some of the most pressing global challenges.

Photo: Nirman Shrestha / IWMI

Role of sand dams in an integrated storage network

Water storage is essential for building climate resilience and underpins many nexus interventions. To date, storage has largely been synonymous with man-made or gray infrastructure, such as dams and tanks, but there is growing interest in broader storage assessments which would also integrate natural or green infrastructure, such as aquifers and soil moisture. These storage solutions already retain large amounts of water and are of particular importance in semi-arid regions and with increasing climate change.

An assessment of water storage possibilities in the Shashe catchment – a sub-basin of the Limpopo River Basin shared by Botswana and Zimbabwe – indicated that sand dams present a promising yet underutilized water storage option. Sand dams – concrete barriers constructed in ephemeral sand rivers – combine gray and green infrastructure. Inflowing water is stored within the sand dam during the wet season; the sand reduces evaporation losses, and the water can be abstracted during the dry season.

In partnership with the [Dabane Trust](#), researchers working under NEXUS Gains [assessed the impact of 20 sand dams](#) in the Shashe catchment. The results showed that the existence of sand dams ensured that water was available for an average of 4.4 additional months a year, and 3.9 additional months during a drought year.

While the study identified some risks to be investigated further, such as issues with the quality of abstracted water and infrastructure sustainability, the benefits suggest that sand dams are a promising innovation. Coupled with other storage options, sand dams can, in the right circumstances, play a key role in ensuring rural water security and building drought resilience.

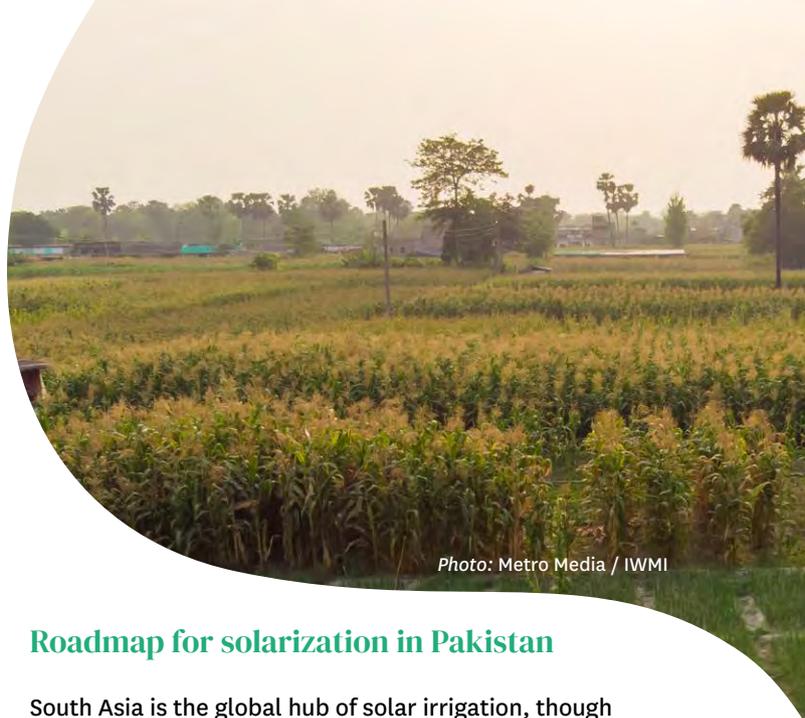


Photo: Metro Media / IWMI

Roadmap for solarization in Pakistan

South Asia is the global hub of solar irrigation, though it remains concentrated in India and Bangladesh. With funding from the World Bank, NEXUS Gains is developing a solarization roadmap for Pakistan's Punjab region, where 95% of irrigation wells run on diesel. While the case for solarization seems clear, a nexus approach is essential for identifying, assessing and responding to the multiple trade-offs.

With no running costs, farmers can extract as much groundwater as they can access using solar pumps, potentially overexploiting and depleting aquifers. Through NEXUS Gains, IWMI has developed strategies to reduce the risk of overexploitation of aquifers. A key prerequisite to implementing these strategies is groundwater vulnerability mapping, which allows policymakers to customize solar irrigation business models and deploy strategies that fit local contexts.

Another innovation is the solar irrigation pump sizing [tool](#), which calculates the optimum pump size for cropland-crop combinations, reducing the risk of overdesign with pumps that are too large or too small and fail to meet farmers' needs.



In some locations, a feed-in-tariff offered to farmers can act as an instrument to manage groundwater and energy: during dry periods, higher tariffs can encourage farmers to use less energy (and groundwater) for irrigation, and instead feed surplus electricity back into the grid. This would contribute to the government's renewable energy targets and enhance smallholder farmers' climate resilience.

Whole systems solutions for Nepal

Globally, irrigation uses 70% of all water abstracted by humans. Even in a country such as Nepal, where water is abundant during the monsoon season, there is a growing recognition that irrigation water must be used more efficiently to ensure year-round water availability, for other sectors as well as for the environment.

To help the country better understand irrigation water use, researchers from NEXUS Gains partnered with government departments to gather data from [three irrigation projects in Western Nepal](#). Although researchers concluded that there was sufficient water for irrigation, the water user associations and farmers consulted indicated that water was not being used efficiently and some stated they did not have enough water throughout the year.

Having analyzed the data, researchers identified a variety of reasons for this unavailability of water. For example, over-irrigation by farmers upstream leaves insufficient water for those downstream. This could be resolved with better management, plans and infrastructure, as well as enforcement of water allocation rules. Poorly planned maintenance schedules cause water supply issues during the dry months, while a lack of awareness of irrigation requirements for different stages of crop development means that farmers are not optimizing irrigation schedules.

The findings demonstrated the need for collaboration between government entities responsible for irrigation and agriculture in order to optimize water use in food production. NEXUS Gains has also helped to enhance the capacity of policymakers in the country to include a nexus approach in the government's new irrigation policy.

We gratefully acknowledge CGIAR for funding the CGIAR Initiative on NEXUS Gains.



Photo: Agricom Media

OUTCOME STORY

Reality TV promotes climate-smart agriculture

Smallholder farmers in Zambia are facing the interlinked challenges of climate change, dwindling resources, increasing population and greater demand for food. There are many solutions, technologies and tools which can support farmers to face these challenges. However, with a lack of access to smartphones and the internet, there is a real barrier to sharing knowledge and raising awareness.

This is where [Munda Makeover](#) comes in. The first reality TV series of its kind in Zambia, this “farmer makeover show” is about farmers, for farmers. Munda Makeover, created by production company Mediae, packages climate-smart agriculture best practice along with climate information services (such as early warning alerts, seasonal forecasts and other digital agro-advisories) and delivers them to audiences nationwide, including market networks and agribusinesses, through the Zambia National Broadcasting Corporation (ZNBC). Crucially, the show both entertains and informs.

The show is an innovation of the [CGIAR Initiative on Diversification in East and Southern Africa](#), also known as Ukama Ustawi, and the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) project. Ukama Ustawi and the AICCRA project cluster in Zambia are led by the International Water Management Institute (IWMI) to support the diversification of smallholder agricultural systems to promote resilience in Zambia and East and Southern Africa more broadly.

Launched in November 2022, Munda Makeover promotes best farming practices for crop, tree and livestock production and marketing. It shares advice on market pricing, farmer cooperation, the consumption of nutritious foods and clean cooking practices.

In this way, Munda Makeover aims to increase farm productivity and profits, improve Zambia’s food security, and support climate change adaptation and resilience building.

Knowledge helps to build resilience

The format of Munda Makeover enables a variety of topics to be covered in an engaging way in a short space of time. During each [26-minute episode](#), the presenters and subject experts visit a family farm and ask the farmer what challenges they are facing. The experts then demonstrate practical solutions that could improve farming practices, including technical and commercial solutions.

Running in parallel with the main growing season in Zambia, from November to January, the initial episodes cover topics such as soil testing and seed selection. As the season progresses, the show moves on to pest and disease management, harvesting, and finally storage and markets. Woven throughout the episodes are the themes of financial inclusion, solar irrigation and efficient water use in food production, and nutrition and modern cooking solutions, with each approach presented as holistically and accessibly as possible.

“I’ve learned a lot from Munda Makeover because when I watch that show, I learned more, especially when they were making compost manure, I enjoyed that. When I go home, I’ll also make compost manure.” – Catherine Moono, Zambian farmer and Munda Makeover viewer



Munda Makeover is modeled on [Shamba Shape Up](#), a farm makeover show which has been broadcast in Kenya and Tanzania for over a decade and now reaches audiences of around 8 million people in East Africa. From the people who watched the most recent series, 93% said they had made changes on their farms after watching the show and 63% reported better yields.

In Zambia, the first season of Munda Makeover focused on profiling innovators of the AICCRA Accelerator Program: 14 businesses were selected to scale climate-smart agriculture and climate information innovations in a partnership model. The episodes showed how these small and medium-sized enterprises are strengthening the agribusiness ecosystem in Zambia by providing farmers with cost-effective and well-packaged technologies, as well as the necessary services to improve farms and maximize their potential.

For example, Munda Makeover viewers saw farmers using off-grid solar pumps coupled with micro-finance offerings. In other episodes, farmers gained access to a digital platform with critically important climate information, market prices and solar irrigation pump specifications.

IWMI and other CGIAR centers – the Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT), International Maize and Wheat Improvement Center (CIMMYT), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), International Institute of Tropical Agriculture (IITA) and WorldFish – provided quality assurance on the information shared in the show, ensuring that it was technically sound, based on evidence and appropriate to the context.

It is important that the products promoted and used by the experts are accessible to audiences across the country, along with technical advice and education. Messages from the show can be reinforced through social media, apps and radio, for example, to promote behavioral change. The show aims for around 50% of its audience to be women.

“The show is educative. Even without enough finances, you can still farm by following the show’s example of how manure was made. We have learned a lot of nice things.” – Grace Mwiinga, Zambian farmer and Munda Makeover viewer

Entertainment meets education

The first season of Munda Makeover was well-received by the 655,000 Zambians who tuned in, and many invited friends and neighbors to watch with them, reaching an estimated 1.9 million viewers. The impact of the show was extended even further as farmers shared knowledge through their communities via word-of-mouth. To reach more farmers who either do not have access to television or who speak languages other than those broadcast in the show, IWMI and AICCRA partners collaborated with the National Agricultural Information Services and Community Markets for Conservation to convert the show into radio segments, translate it into other local languages and broadcast it over ten local radio stations.

Munda Makeover has leveraged television as a powerful communication medium, using ‘edutainment’ to capture audiences and share important information in a fun and easily digestible way. The show has the potential to stimulate innovation, promote cooperation and networking, and raise awareness of the importance of climate-smart agriculture for smallholder farmers across Zambia.

CGIAR’s support of Munda Makeover is in collaboration with IWMI under the framework of the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) project and with the Alliance of Bioversity International and CIAT under the CGIAR Initiative on Diversification in East and Southern Africa. AICCRA is supported by a grant from the International Development Association (IDA) of the World Bank.

Strategic Program: Water, Food and Ecosystems



Photo: Thai Tai Minh / IWMI



BIG PICTURE STORY

Solar irrigation offers a bright future for African smallholders

Sometimes the answer really does fall from the sky. As African farmers look to move away from expensive, polluting and carbon-emitting diesel pumps, solar-powered irrigation offers vast potential to boost agriculture across the continent. In addition to saving money and reducing the environmental impacts of farming, solar irrigation can strengthen water security, increase food production and improve nutrition for millions of Africa's off-grid smallholders.

However, many farmers [struggle to afford](#) the upfront cost of switching to solar irrigation. This is especially true for female farmers, who are less likely to own land or have access to the credit needed to invest. On top of this, solar manufacturers and distributors have struggled to expand operations in Africa due to a lack of information about the potential market. IWMI has been working with farmers and the private sector in Ethiopia, Ghana and Mali to overcome these challenges and make solar irrigation affordable, accessible and profitable for everyone along the irrigation value chain.

Innovation bundles overcome barriers to solar irrigation

In Ghana, IWMI has teamed up with [Pumptech](#), a national distributor of solar irrigation equipment with a special focus on off-grid water pumping, to find ways to better understand and reach smallholders. This has centered on developing a [bundle of solar irrigation technologies and services](#) that addresses many of the current barriers to solar-powered, farmer-led irrigation.

To ensure this bundle reflects the real needs of smallholders, IWMI and Pumptech worked with farmers and other stakeholders to break down the potential solar irrigation market into distinct categories. This [market segmentation](#) allows companies such as Pumptech to tailor their products and services to specific groups and reach new customers. These new customers include women and youth, who have traditionally struggled to access solar irrigation technologies.

An essential component of these bundles is [innovative financial models](#) such as pay-as-you-go and pay-as-you-own. The pay-as-you-go option allows resource-poor and resource-limited farmers to use pumps and pay for each unit of water accessed while ownership of the pump remains with the provider. The pay-as-you-own option allows farmers to use a pump while paying installments to own it, preventing the need for upfront payments to purchase a pump. The installments can be paid at regular intervals – weekly, monthly or quarterly – or scheduled to coincide with harvest times, when farmers have more cash in hand. This flexibility means that a greater number and diversity of smallholders can access solar irrigation technologies. To facilitate pay-as-you-go financing, IWMI and Pumptech organized demand–supply linkage workshops and demonstrations attended by 2,514 value chain actors, including farmers, the private sector entities, government agencies and nongovernmental organizations.

Private-sector collaboration in Ghana and Ethiopia

IWMI has continued to develop and build upon these initiatives in 2022. One of its latest innovations has been the co-development of [internship and innovation grants](#). In 2022, these grants enabled two young professionals to intern at Pumptech, where they helped develop digital data management and marketing systems to improve the effectiveness of the company’s customer targeting. Internships such as these are not only helping solar irrigation manufacturers and distributors reach smallholders, but are also nurturing a new generation of Ghanaian solar irrigation experts.

Thanks partly to IWMI’s support, Pumptech has established 17 distribution networks, identified 862 potential customers for its smallholder-targeted PS2 pumps, and seen its sales increase by [more than 80%](#) in 2021.



Photo: Thái Thị Minh / IWMI



Photo: David Brazier / IWMI

Equally encouraging numbers are emerging from Ethiopia, where IWMI has partnered with renewable energy company [Rensys](#) to offer similar technology and service bundles to smallholders. As a result of this partnership, almost 100 farmers have acquired solar irrigation technologies – 18 under a pay-as-you-go arrangement – and nearly 300 more have expressed interest in buying a solar pump.

Affordable irrigation for Africa

The past year saw IWMI continue its research into solar irrigation in Africa. This included a [study of the irrigation supply chain](#) in Ghana based on in-depth interviews with farmers, importers, manufacturers, distributors, government agencies and nongovernmental organizations, as well as investigating the opportunities for [greater inclusion of women and youth](#) in the country's irrigated vegetable value chain. IWMI also published a [technical brief](#) on evidence-based strategies to accelerate innovative irrigation technologies in Africa and a [report on the potential for irrigation market development](#) in Ghana.

Together with IWMI's collaborations with African businesses, this research is helping to make solar irrigation affordable and accessible to smallholders across the continent. This will provide a vital boost in the race to increase African food production, improve food security and strengthen climate resilience.

Disclaimer: IWMI does not endorse particular brands of solar pumps. Smallholder farmers may access this technology through the provider of their choice.

We gratefully acknowledge the United States Agency for International Development (USAID) Feed the Future Innovation Lab for Small-Scale Irrigation (ILSSI) and Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) projects for their contributions.

OUTCOME STORY

National roadmap for food waste reduction in Sri Lanka

The 2030 Agenda for Sustainable Development has called for halving per capita global food waste at the retail and consumer levels and reducing food losses along production and supply chains, including post-harvest losses ([Sustainable Development Goal \[SDG\] Target 12.3](#)). Globally, state and non-state actors have introduced regulatory and incentive mechanisms to mitigate food waste at the local, national and regional levels.

Food waste occurs across the entire food supply chain. In most cases, stakeholders are not aware of the magnitude of the waste generated and believe that it is just part of 'doing business'. This results in preventable [socioeconomic and environmental costs](#).

About 22% of the total population of Sri Lanka does not have sufficient food to sustain a healthy life, and about 33% [cannot afford a nutritious diet](#). For this reason, initiatives to prevent and reduce food waste have the potential to play a significant role in contributing to achieving SDG 2 (zero hunger). In addition to SDGs 12 and 2, reducing food waste also contributes to SDG 6 (clean water and sanitation), SDG 11 (sustainable cities and communities), SDG 13 (climate action), SDG 14 (life below water) and SDG 15 (life on land). For example, approximately 87% of available freshwater is used for agriculture in Sri Lanka, so preventing food waste will help to reduce the pressure on available water resources and the demand for water in the food production system.



Photo: Pay Drechsel / IWMI

Where, why and how is food wasted?

In Sri Lanka, food waste represents between 50% and 76% of total municipal solid waste. The total food waste generated is estimated to be nearly 4,000 tons per day. The International Water Management Institute (IWMI) has been working with the Food and Agriculture Organization of the United Nations (FAO) to ascertain why, how much and where food is being wasted by different sectors in Sri Lanka.

In 2020, a [study conducted](#) by IWMI and FAO, which focused on three major waste disposal centers in Sri Lanka's Western Province, revealed that about 724 tons (55%) of the total waste collected in a day is food waste. The study further noted that the Colombo Municipal Council contributes to 42% of the total food waste transported to these disposal sites.

In a series of [case studies](#), researchers from IWMI and FAO examined food waste at nine sites across five sectors: food services, wholesale markets, retail markets, caterers/ institutional canteens and households. At each site, major sources of waste generation were identified and the wasted food was separated, weighed and categorized. The study revealed the volume of wasted food along with the causes of waste generation.

Strategies were identified to reduce food waste. For example, [one major hotel](#), which had been wasting around one-third of the food it produced, was able to cut its daily food waste from 540 grams to 200 grams per customer.

Roadmap for food waste reduction

With the support of IWMI, FAO was able to develop a roadmap for preventing and reducing food waste in Sri Lanka. The *National Roadmap on Urban Food Waste Prevention and Reduction* was accepted and launched by the Ministry of Environment in 2021. The Ministry of Environment, as the leading authority, established a steering committee with key actors and players involved in the food waste system in order to operationalize the roadmap.

Significant progress was made in 2022 as a result of the roadmap, with the following initiatives set in motion:

- Posters, stickers and social media campaigns have been used to target school cafeterias with messages on reducing food waste.
- Informal food banks have been set up by civil society, religious groups and volunteers.
- The Ministry of Environment donated 12 refrigerators to food banks to address the problem of storing food that was rescued.

- A guideline has been drafted for food rescue operations which will be validated with stakeholders.
- Supermarkets and hotel chains have participated in food waste prevention and reduction training programs organized by the Ministry of Environment.
- Discussions have begun with famous local chefs to include food waste reduction messages in their cookery demonstration programs streamed on YouTube.
- The Ministry of Environment has started to develop proposals to seek funds from donors to implement the recommendations provided in the roadmap.

No time to waste

To ensure momentum is not lost, IWMI will be collaborating with the Waste Management Authority of the Western Province to improve resource recovery from food waste. This will include improving the efficiency of composting plants, conducting training in co-composting and introducing a Food Waste Management mobile app to link food waste with end users.

IWMI is also analyzing lessons learned from international best practices on food waste recovery and redistribution, with a view to developing related guidelines and partnership contract templates for countries such as Sri Lanka. FAO is developing a proposal to seek funds from the European Union to consolidate work that has already been done on implementation of the roadmap.

We gratefully acknowledge the Food and Agriculture Organization of the United Nations (FAO) for its contributions to the Technical Cooperation Project with the Government of Sri Lanka.

Strategic Program: Water, Growth and Inclusion



Photo: Alan Nicol



BIG PICTURE STORY

AGRUMIG: Identify and harness the benefits of migration

Across the globe, millions of people leave their home countries in search of new opportunities, driven by poverty, conflict, political instability, climate change, a lack of employment options and other factors. While attention is paid to the countries that receive migrants, there has been much less focus on the locations from where these migrants originate. Agricultural communities in particular experience high levels of outward migration, as their livelihoods are impacted by increasingly erratic weather patterns, land access challenges and a new generation seeking greater access to cash income.

Through the **AGRUMIG** project, researchers examined the impacts of outmigration on agricultural communities in seven low- and middle-income countries: China, Ethiopia, Kyrgyzstan, Moldova, Morocco, Nepal and Thailand.

The International Water Management Institute (IWMI) and other **AGRUMIG** project partners aimed to understand the benefits of migration for sustainable development, contributing insights to policy dialogues at different levels, and focusing on strengthening opportunities and instruments for migration governance. There are multiple potential advantages of migration. However, IWMI recognizes that without effective policy and governance frameworks in place, these benefits may not be fully realized or equitably distributed.



Photo: Agricom Media

Threats to food production and personal security

For farming communities, the impacts of the demographic changes caused by migration can be significant. In Nepal, for instance, women have been forced to take on farm labor and decision-making roles due to the [large number of young men that have left the country](#), which is estimated as being up to four million per year. Yet, [women seldom have access to credit facilities](#) and do not have formal land titles. Declining yields may have also contributed to the departure of some men. These factors can put both livelihoods and food production at risk.

At the global level, migrating women and girls can also face significant risks. Along the Mediterranean route, many are victims of serious gender-based violence, while ‘unfair’ labor agreements between South Korea and Thailand can result in [women being prevented from finding work through legal channels](#).

A ‘positive migration’ approach

Strong governance and policy frameworks can address these pressing issues and ensure that both ‘sending’ and ‘receiving’ countries benefit from migration. By adopting an integrated approach, labor gaps can be filled, tax revenue generated, and innovation and entrepreneurship encouraged. Workers who travel abroad in pursuit of higher or more secure incomes have the opportunity to acquire knowledge, social capital, networks, skills and ideas – often referred to as ‘social remittances’. This can result in far greater rewards – for themselves and their communities – when they eventually return home, with new capacity invested in setting up new businesses or expanding existing ones.

This can be of particular value in rural agricultural communities. Through the AGRUMIG project, researchers highlighted the case of a Thai man who had spent several years working in Israel and South Korea. On his return home, he was able to improve irrigation and fertilization techniques on his farm and sell his produce using online marketing, thanks to the skills, ideas and savings he had gained overseas.

The ‘positive migration’ approach of the AGRUMIG project highlights these successes and encourages migration to

be seen as an opportunity. Rather than trying to ‘solve the problem’ of migration by regulating the movement of people, governments should seek to identify interventions that can harness the outcomes of migration to support more equitable and sustainable agrarian change and rural development.

Key recommendations for policymakers

Through extensive research and dialogues with policymakers and practitioners, IWMI and partners have supported new governance action plans and key recommendations to ensure that migration contributes more fully to sustainable and equitable rural growth. These recommendations were [presented at AGRUMIG’s end-of-project meeting](#) in Brussels, Belgium, in December 2022.

The [recommendations](#) include the collection of disaggregated and gender-sensitive migration data;

promoting the use of accurate and relevant data in policy development; implementing migration governance policies in synergy with broader economic policies; and delivering well-designed pre-departure training to ensure migrants understand their rights and obligations in their host countries.

Global migration is a reality for many, and while it is a complex issue, it can be a powerful driver of sustainable development. The AGRUMIG project has compiled a compelling body of research demonstrating that with an integrated and collective approach to migration policy and governance, it is possible to create safer routes and protect human rights, while supporting rural communities and benefitting food systems.

We gratefully acknowledge the European Commission for its contributions to AGRUMIG.



Photo: Sharad Maharjan



Photo: Lien Arits / IWMI



OUTCOME STORY

Wastewater reuse potential in the Middle East and North Africa

Shifting weather patterns and burgeoning populations are driving unprecedented water stresses around the world. Nowhere is this growing thirst more keenly felt than in the Middle East and North Africa (MENA) region. The naturally arid region has seen temperatures increase and rainfall decrease due to climate change. Together with rapid urbanization and a 50% rise in population over the past two decades, these changes have made MENA the most water-stressed region on the planet. Without urgent action, many of the region's governments will simply not have enough water to meet the demands of their citizens by the end of the decade.

In 2022, the International Water Management Institute (IWMI) and partners completed an ambitious four-year project titled [ReWater MENA](#). The aim of this project was to find solutions to this worrying trend of increasing water scarcity from an unlikely source - wastewater.

Safe water reuse

Wastewater is often seen as just another unwanted consequence of population growth and increased water demand. The amount of wastewater generated in the MENA region has doubled over the past 30 years, but the region's capacity to treat this wastewater has often lagged. As a result, trillions of liters of untreated wastewater are released into the environment every year. This is damaging aquatic environments and contaminating freshwater supplies, exacerbating water scarcity for millions of people.

Under the ReWater MENA project, IWMI championed water reuse to turn this problem on its head by viewing the region's increasing volume of wastewater generated as a valuable opportunity. The project showed how properly treated wastewater can be an important source of water for forestry, farming and industry, and also a source of nutrients, such as nitrogen, potassium and phosphorus, for agriculture and aquaculture.

Water reuse projects in the MENA region have increased from 40 in 1990 to more than 400 today. However, persistent challenges mean that only 10% of the region's wastewater is directly treated and reused. Focusing on Egypt, Jordan and Lebanon, the ReWater MENA project

facilitated inclusive and participatory stakeholder engagement to address these challenges. Through this project, IWMI promoted safe reuse practices that improve food safety and health, strengthen livelihoods and help close the region's water supply-demand gap.

Obstacles to wastewater reclamation

Obstacles to reuse include public perception that reclaimed wastewater is unclean and unhealthy, a scarcity of economic data that hinders investment in reuse efforts, a lack of political urgency, unclear regulations and ineffectual implementation of legislation or a lack of legislation in some countries.

In response to these challenges, IWMI and project partners recommended timely and effective communication materials and public engagement to build trust among farmers and other potential beneficiaries. The project team suggested the creation of bankable water reuse business models and implementation plans to bolster investor confidence. The project also addressed institutional fragmentation and inaction by creating platforms for political cooperation and negotiation to clarify national and local responsibilities.

From research to policy

IWMI presented the findings and recommendations of the ReWater MENA project in several publications. These include a [MENA water reuse sourcebook](#), which documents lessons from existing water reuse innovations and models, as well as previous management challenges; a [policy report](#) on expanding water reuse in the region; and a [scientific paper](#) quantifying rural and urban wastewater generation and reuse potential in the MENA region. The project team also produced national water reuse strategies for Egypt, Jordan and Lebanon, as well as local water reuse plans for six sites in these countries.

Project findings were also disseminated at high-level events. At Cairo Water Week in October 2022, Javier Mateo-Sagasta (Senior Researcher and Coordinator-Water Quality, IWMI, and Leader – ReWater MENA project) offered policy recommendations for improved water reuse to the High-Level Joint Water-Agriculture Technical Committee of the League of Arab States. The following month saw IWMI present the ReWater MENA sourcebook to policymakers and implementers at the United Nations Climate Change Conference of the Parties (COP27), sharing advice on safe water reuse and stressing the many social, environmental and economic benefits it can bring.

These events marked the culmination of the project. Over the course of four years, the ReWater MENA project conducted much-needed research into the state of wastewater and water reuse, equipped stakeholders across the region to implement sustainable water reuse models and fostered political will to help alleviate water stress in the MENA region. As the ReWater MENA project policy report states, “wastewater is only a waste if we decide to waste it.”



Photo: Lien Arits / IWMI

We gratefully acknowledge the [Swedish International Development Cooperation Agency](#) (Sida) for its contributions to ReWater MENA.

Strategic Program: Water, Climate Change and Resilience

Photo: Esther Wahabu



BIG PICTURE STORY

Support to climate-resilient agriculture in Africa

A greater proportion of people work in agriculture in Africa than anywhere else on Earth. Yet, the continent's farms are also some of the most vulnerable to climate change. Without significant and urgent changes to food production, a dangerous mix of higher temperatures, longer droughts and more erratic rainfall will see **crop yields tumble** – burdening millions more Africans with hunger, malnutrition and precarious livelihoods.

Efforts to close the investment gap in Zambia

The International Water Management Institute (IWMI) has been at the forefront of efforts to improve Africa's climate resilience. In Zambia, IWMI is working with the Accelerating Impacts of CGIAR Climate Research for

Africa (**AICCRA**) project to increase private sector investment in climate-smart agriculture.

Private funds will be essential to meeting the additional USD 226 billion needed annually to create sustainable food systems across the continent. However, a lack of data and high perceived risks have prevented investors from supporting African agribusinesses. These agribusinesses, in turn, have struggled to access the investor networks they need to expand their operations.

In February 2022, the AICCRA project team launched the **Accelerator Program** in Zambia to identify win-win solutions for investors and agribusinesses. It supports some of the country's most promising small



and medium-sized enterprises with tailored technical assistance to improve their investment prospects. At the same time, the program provides investors with the knowledge they need to select investments that will generate positive, systemic change in the agriculture sector. IWMI's role is to provide science-based technical assistance to help scale innovative climate-smart agriculture and climate information services.

Not only is the Accelerator Program proving to be good for businesses and investors, it is also making it easier for Zambia's 1.5 million smallholder farmers to access science-based climate-smart innovations. After just one year, the program has already helped 5,500 rural community members, including people from vulnerable groups, access off-grid solar irrigation technologies, supported 45,154 fisher folk improve integrated agriculture-aquaculture practices, enabled 5,200 farmers to use climate-smart seed varieties, and spread awareness of gender empowerment and social inclusion among 59,392 people, among [other achievements](#). The Accelerator Program has improved the livelihoods of over 118,000 farmers, including more than 42,000 women. It has also secured USD 500,000 from the United States Agency for International Development (USAID) to invest in food security solutions.

Climate-smart policies in Ghana

IWMI is supporting regional decision-makers in Ghana to develop climate-smart policies and programs that can respond to the rapid societal shifts being brought about by climate change.

The Resilience Against Climate Change – Social Transformation Research and Policy Advocacy (REACH-STR) project was established in 2019 to bring thinking on social transformation into Ghana's climate policy. Funded by the European Union and implemented

by IWMI, this six-year project has trained development officers to create policies, programs and projects that work with ongoing social changes in Ghana to increase the country's climate resilience.

As part of this work, IWMI has held annual learning events for district-level development planners. The latest event, held in October 2022, explored [how social transformation can be incorporated into project planning](#), implementation and monitoring processes. Thirteen women and 24 men from the Upper West Region of Ghana, the most climate-vulnerable region in the country, participated in the event. To date, annual events organized by the REACH-STR project have trained 130 people, including 40 women.

The project also made it possible for scholarships to be awarded to Ghana's next generation of decision-makers. So far, 4 PhD students and 15 MPhil students, including 8 women, have been given the opportunity to study subjects related to social transformation, under themes of climate resilience, migration and gender.

Route to resilient agriculture

IWMI's contributions to the AICCRA Accelerator Program and the REACH-STR project are supporting both the public and private sectors to rise to the challenge of climate-proofing African agriculture. By working together, governments, businesses, investors and organizations such as IWMI can provide the knowledge, funds and supporting policies needed to transform farming across the continent into a productive, prosperous and resilient component of global food systems.

We gratefully acknowledge the World Bank and the European Union for their contributions to the AICCRA and REACH-STR projects, respectively.



Photo: Usman Ghani / IWMI



OUTCOME STORY

Data and analysis help prepare for increases in floods and droughts

A warming climate and variability in rainfall are making extreme weather events more frequent. Floods and droughts threaten lives and livelihoods, and can cause billions of dollars in damage due to their lasting impacts on food, land, water and energy systems, and the environment.

The International Water Management Institute (IWMI) has used its extensive experience in data collection, analysis and modeling to support governments to deal with these

extreme weather events in some of the world's most vulnerable countries. Using remote sensing and satellite data, IWMI has developed bespoke early warning systems and response frameworks to enable governments to better predict, monitor and manage floods and droughts across South Asia, the Middle East and North Africa, and Southern Africa.

Pakistan experiences worst floods in history

In 2022, Pakistan was devastated by the worst flooding in its history, leaving around a third of its land under water. The deluge hit all four of the country's provinces, killing over 1,700 people and **impacting 33 million more** through the loss of homes, livelihoods, livestock and crops. The Government of Pakistan has estimated that the flood caused around USD 32 billion of damage.

It is predicted that Pakistan is one of the countries most at risk from climate change. Over the last two decades, the number of major floods occurring in the country has doubled, as the monsoon season becomes more erratic. In addition, warming temperatures affect the quantity and timing of snow and glacier melt; the 2022 floods were exacerbated by extreme heatwaves prior to the monsoon, which melted northern mountains.

IWMI supports Pakistan's government

When the floods hit, government departments in Pakistan requested substantial support from IWMI, primarily on mapping and analyzing flood damage, as well as building a resilient framework and guiding decision-makers on relief efforts. This work focused on the provinces of Balochistan, Khyber Pakhtunkhwa and Punjab.

IWMI used pre- and post-flood high spatial-resolution satellite images to assess the extent of flood damage, and coordinated with international partners to develop clear, coherent messages and response options. Over the following months, IWMI assessed the damage to crops and infrastructure, including roads and irrigation systems, using satellite imagery and ground sensors. The resulting high-resolution maps were shared with national and provincial government departments, enabling them to carry out assessments of the damage to provide cash disbursements to those impacted by the floods, and to better plan and prepare for future flood events.

Balochistan province was hit particularly hard by the floods, as 25 small dams were damaged and the area was cut off due to riverine flooding. IWMI provided analytical support to the provincial Irrigation Department with flood mapping and better future planning for the Nari and Polari river basins which were heavily affected by the floods.



Photo: Seersa Abaza / IWMI

Systems and plans to predict and manage drought

South Asia is particularly vulnerable to droughts as well as floods, having experienced 50 major droughts since 1990. In 2022, in partnership with the Indian Council of Agricultural Research (ICAR), IWMI launched the [next generation of the South Asia Drought Monitoring System \(SADMS\)](#), covering Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. SADMS uses complex remote sensing data to provide access to weather updates in real time, as well as open-access satellite data, enabling users to forecast, monitor and better manage droughts in the region.

By increasing the lead time on drought prediction, national authorities can develop frameworks for mitigation measures, protecting smallholder farmers from the worst impacts and better stabilizing food production.

The original version of SADMS was developed in 2014 and has been used by farmers and those who manage agriculture and water resources, as well as ICAR, World Food Programme, World Bank partners and others.



Photo: Seersa Abaza / IWMI

IWMI has built on this experience to develop the [Zambia Drought Management System \(ZADMS\)](#) in partnership with Zambia's Ministry of Agriculture through the CGIAR Initiative on Climate Resilience. Using the same technology as SADMS, ZADMS gathers and provides the information needed by agricultural extension officers and farmers to mitigate drought impacts and identify the best actions to support Zambians through extended dry periods. The system uses data supplied by satellites and other sources at district and national level to generate [easy-to-interpret maps and simple bulletins](#). ZADMS will be launched in 2023.

The Middle East and North Africa (MENA) region has only 2% of the world's renewable water resources, and increasing droughts in the region threaten the livelihoods of millions of people. IWMI launched its [MENAdrought project](#) in 2018 and worked with the governments of Jordan, Lebanon and Morocco's Souss Massa region to produce the first national Drought Action Plans. These plans incorporate information from the drought early warning and rainfall forecasting systems developed through MENAdrought. These systems were embedded in the relevant government ministries to ensure drought management will continue to be supported long after the

project ends in 2022. The output indicator from the early warning system categorizes drought conditions into three main classes. Each drought class triggers specific response actions by various ministries, which were agreed during the process of developing the Drought Action Plans.

Weather data and systems to increase resilience

While the only way to truly address the occurrence and intensity of these extreme weather events is to reduce greenhouse gas emissions globally, there are proven strategies to support countries to become more resilient to the impacts of floods and droughts at a more localized level. Weather data and modeling, for example, can be used to develop early warning systems, which governments can then act upon to create contingency plans to protect populations and food systems from the worst impacts of these events. These plans may include mitigation measures such as importing food or providing supplementary irrigation for agricultural production. While individual countries cannot prevent the next extreme weather event, by using IWMI's expertise and technical support, they can at least be better prepared when these events occur.

We gratefully acknowledge the Foreign, Commonwealth and Development Office (FCDO), United States Agency for International Development (USAID), and European Union (EU) for funding mapping activities in Punjab, Khyber Pakhtunkhwa and Balochistan, respectively; Global Water Partnership Organisation (GWPO) and World Meteorological Organization (WMO) for contributing to the South Asia Drought Monitoring System; CGIAR and International Development Association (IDA) for supporting ZADMS; and USAID for their contributions to MENAdrought.

Strategic Program: Water Data Science and Digital Innovation



BIG PICTURE STORY

Simplification of complex environmental tools enables widespread use in South Asia

Data science and digital innovation are needed to combat water insecurity, which is critical for our food systems. However, creating a highly advanced ‘tool’ will not produce results unless it is accessible, scalable and easy to use by those who need it – whether researchers, decision-makers, farmers, planners or civil society actors.

In South Asia, the International Water Management Institute (IWMI) has developed highly innovative tools that are uniquely suited to different country contexts. In India, a simple tool enables the proper sizing of solar irrigation pumps, while in Sri Lanka, a robot constructed from everyday materials is helping residents monitor and conserve their own resources.



Photo: IWMI

Size is key to solarization

India is a world leader in the solarization of agriculture, with more than 93% of global off-grid capacity installed for use in agriculture in the country. More than 350,000 solar irrigation pumps are already in use, and the Government of India plans to deploy at least 3.5 million more.

Solar pumps shield smallholder farmers from rising diesel prices and generate no carbon emissions, but using a pump of the correct size is crucial to success of the system. Oversized pumps generate excess energy that may be wasted. With no running costs, there is evidence that solar pump owners pump for longer hours than diesel pump

owners. This may threaten the sustainability of groundwater resources, especially if pumps are oversized. Undersized pumps fail to meet farmers' irrigation requirements, creating a poor user experience and risking disadoption.



Photo: Tanmoy Bhaduri / IWMI

Additionally, since the costs of installing solar pumps are too high for most smallholder farmers, the government is offering high capital subsidies. Correct sizing of pumps will make the most of these public investments.

With support from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and in partnership with the Indian Council of Agricultural Research (ICAR) and the Borlaug Institute for South Asia (BISA), IWMI has developed a tool to assist researchers, technical personnel, farmers, planners and decision-makers to select the optimum pump size for each solar irrigation adopter. This tool was created using Microsoft Excel, which is widely available and can function offline, allowing use of the tool in areas with poor internet connectivity.

Secondary datasets on climate, soils and crops are incorporated into the tool, enabling pump sizing at a regional scale. Users can also input their own data to access a pump size specific to their farm(s). This enables calculations at different levels, in data-poor and data-rich environments.

Solar pumps typically last 20–25 years and investment decisions, therefore, must account for future needs. The IWMI-ICAR pump sizing tool enables users to simulate scenarios such as lowering of the groundwater table, a change in the crop cultivated or an adjustment to crop water demand due to rising temperatures caused by climate change.

The beta version of the pump sizing tool has been adopted by India's Ministry of New and Renewable Energy (MNRE) for use in its ambitious solarization campaign, [Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyaan \(PM-KUSUM\)](#). IWMI has committed to supporting the Government of India in further refining this tool, incorporating feedback from the growing number of users. A mobile phone app and online versions are now in development.

The sizing tool is being replicated by IWMI in Nepal through the CGIAR Initiative on NEXUS Gains and as part of a collaborative project with GIZ titled Solar Energy for Rural Livelihoods (SE4RL). There is also demand for developing a similar tool for Bangladesh. It is hoped that the tool can be scaled and replicated for use in other countries in Asia and Africa, maximizing the potential of solar irrigation for a greener future.

Residents and robots collaborate to monitor wetlands

Wetlands can, in some instances, reduce flood risk, enhance biodiversity and provide multiple additional ecosystem services. However, global wetlands are disappearing three times faster than rainforests, making them one of our most threatened ecosystems.

Urban wetlands can provide vast benefits. The Colombo Wetland Complex, which sits amid the sprawl of the Sri Lankan capital, directly benefits 60% of the city's households, creating livelihoods and contributing to the food system, with products including fish and rice. Indirect benefits include flood protection, pest regulation and climate cooling. Since the 1980s, 60% of the complex has been lost. Infilling, waste dumping and dredging have resulted in a shrinking ecosystem with poor water quality, threatening its flora and fauna. The Government of Sri Lanka recognizes that urgent action is needed to conserve this vital habitat.

Given the community's dependence on the wetlands, fostering local ownership of any conservation initiative is essential to its success. In recognition of this, IWMI has co-developed **Float**: a low-cost, easy-to-build robotic device that communities can use to monitor the water quality of the wetlands. Float can cruise, unmanned, through the wetlands to collect and report real-time dissolved oxygen, pH and water temperature. These are all indicators of wetland health.

Design Engineering student Luisa Charles worked with IWMI and other partners to create Float as one component of the [Increasing the resilience of biodiversity and livelihoods in Colombo's wetlands](#) project, funded by [the Darwin Initiative](#). Luisa collaborated with local engineering students, wetland communities and other partner organizations, and held workshops to gain feedback from potential users. Crucially, the basic version of Float can be built with readily available materials – such as a pressure cooker gasket – and the code used is open source.

Luisa is now working with a local nonprofit organization to design a mobile phone application which will enable users to input data collected by the device, as well as observations such as the color of the water or signs of dredging.

Luisa's work focuses on human psychology and behavior. Float has been designed with communities in mind, so she is keen to understand which features will encourage the greatest adoption of the device. Will communities use Float once it is available to them? Is it intuitive enough to not require a user manual?

Enabling both communities and researchers to monitor the water quality of the wetlands they depend on will provide a better understanding of this ecosystem at all levels of society. This, in turn, supports the conservation and health of these important ecosystems and the vital services they provide.



Photo: Luisa Charles

We gratefully acknowledge the German Agency for International Cooperation (GIZ) and Department for Environment, Food and Rural Affairs (DEFRA) for their respective contributions to the pump sizing tool and Float innovations.



Photo: Nafn Amdar / IWMI



OUTCOME STORY

Jordan's farms prove fertile ground for water-saving innovations

Few countries understand the problem of dwindling water supplies like Jordan. The Middle Eastern state, which spans diverse but generally arid terrain between the Red Sea and the Dead Sea, has been ranked as the second most water-scarce country on the planet.

A combination of climate change, agricultural expansion and a doubling of the country's population over the past decade has caused water availability in Jordan to drop by a third in recent years. Today, the average Jordanian has access to less than 100 cubic meters of renewable water resources per year, which is well below the 500-cubic-meter threshold that signals severe water scarcity. In addition, the shortages are threatening Jordan's agricultural productivity and food security.

Water-saving technologies

The Water Innovation Technologies (WIT) project was set up in 2017 to turn the tide on Jordan's growing water scarcity. It was designed to conserve water at the household, farm and community level by promoting the widespread and lasting use of water-saving technologies and practices.

The project, which was completed in 2022, focused on using market systems to reduce over-irrigation in olive, grape and stone fruit farms in the Jordanian Highlands. With agriculture accounting for over half of Jordan's total water use, water savings in this sector could not only strengthen food security, but positively impact the country's overall water security.

As a sub-awardee of the WIT project, IWMI worked alongside primary implementor Mercy Corps to conduct the project's monitoring, evaluation and learning. As part of this, IWMI developed an on-farm water accounting approach using analog water meters to quantify water savings in participating farms. This approach tracked water savings by comparing water use in trial plots, where farmers adopted techniques such as improved drip irrigation, with water use in control plots, where farmers made no changes to their existing practices.

Behavioral change supports water conservation

At the time of completion in 2022, the WIT project had, among [other accomplishments](#), collaborated with six suppliers to provide more efficient irrigation technologies to farmers, supported the development of loans which encouraged the uptake of water-saving tools, and reached more than 5 million Jordanians with awareness-raising communications and other initiatives.

These and other measures enabled the WIT project to [conserve 28 million cubic meters of fresh water](#) – far exceeding its original target of 18.5 million cubic meters. Participating farms optimized water use across more than 2,000 hectares of farmland, saving 24 million cubic meters of water. An [economic analysis](#) of the project found that farmers who adopted water-saving technologies enjoyed a high return on investment. This suggests that adopters of such technology, even if they bear the full cost of installation, will still enjoy a positive return on their investment.

In a surprise finding, IWMI identified that use of its on-farm water meters proved to be a water-saving technology in itself. Able to see how much water they were using, farmers began reducing water use in control plots by mirroring the practices they had adopted in the trial plots, which led to a lasting change in water-use behavior. This suggests that IWMI's water meters could have an important role to play in future water optimization projects beyond merely monitoring water use in Jordan.

Recognition and awards

The outcomes of the WIT project have seen IWMI recognized as an expert in highlighting the relationship between sustainable water management, agriculture and food security. In recognition of its findings, IWMI

was awarded first prize in the [World Food Forum Transformative Research – Innovation Lab Award](#) in 2021.

In 2022, IWMI was invited to join the World Food Forum and the Food and Agriculture Youth Institute in hosting the [Role of Water prize](#). The global prize, which will be awarded in 2023, will celebrate young researchers' innovative solutions that simultaneously address the world's water crisis and contribute to achieving Sustainable Development Goal 2 (zero hunger). The winners will receive internships at IWMI, helping to ensure that water-saving innovations in agriculture will remain a priority for the next generation of researchers.



Photo: Seersa Abaza / IWMI

We gratefully acknowledge the United States Agency for International Development (USAID) for its contributions to the WIT project.



Photo: Hamish John Appleby / IWMI

Major awards



2022 World Food Forum Transformative Research Challenge (TRC): Special prize

Sidra Khalid (Senior Research Officer – Gender and Social Inclusion, IWMI, Pakistan) and Najeeb Ullah (Monitoring Evaluation and Learning Specialist, IWMI, Pakistan) won the special prize at the 2022 [Transformative Research Challenge \(TRC\)](#) hosted by the World Food Forum. The prize was awarded for their research pitch on ‘Transforming nutritional practices and livelihoods through improved fish farming in Pakistan’. The TRC recognizes outstanding research that will have a positive impact on global and local agri-food systems. It aims to inspire research and innovation to end hunger and transform agri-food systems.



2022 Derek Tribe Award

Dr. Lisa-Maria Rebelo (Principal Researcher, Earth Observation for Sustainable Development, IWMI, Sri Lanka, and Lead Scientist, Digital Earth Africa) was the recipient of the 2022 [Derek Tribe Award](#). Lisa-Maria received the award in recognition of her work on remote sensing, natural resource management, wetland monitoring and assessment, basin water accounting and water productivity across the African continent and in South and Southeast Asia.

Key events

9th World Water Forum

The 9th World Water Forum was held in Dakar, Senegal, on March 21–26, 2022. It was the first World Water Forum to be held in sub-Saharan Africa and brought together over 5,000 delegates. IWMI experts [participated](#) in 17 events, signed the [Water and Nature Declaration](#), and engaged with a wide range of stakeholders in the water sector to share our vision for strengthening water security and climate resilience across West Africa and around the world.

MENA Climate Week 2022

The [first-ever MENA Climate Week](#) was held in Dubai, United Arab Emirates, on March 28–31, 2022. The event helped set the agenda for the United Nations Climate Change Conference of the Parties (COP27), bringing the focus of climate adaptation and mitigation efforts to a region that is facing significant risks. IWMI had the opportunity to interact with diverse stakeholders, including policymakers, development practitioners and donors, and helped position our research priorities to continue to be relevant.

World Water Week 2022

[World Water Week](#) was held in Stockholm, Sweden, on August 23–September 1, 2022. With the theme ‘Seeing the Unseen: The Value of Water,’ the event appreciated water from multiple angles: its value for people, development, nature and climate change, and the financial and economic value of water. A key message was that we need transformation rather than just problem-solving. This was highlighted with the launch of the [Transformative Futures for Water Security](#) initiative (TFWS) by IWMI and partners at the event.



Africa Climate Week 2022

Africa Climate Week was held in Libreville, Gabon, on August 29–September 2, 2022. The event, seen as an important step prior to the start of COP27, engaged and empowered stakeholders to drive climate action across countries, communities and economies. Together with partners, IWMI hosted a side event titled ‘Climate crisis is a water crisis: Water management approaches to strengthening climate resilience in Africa’, which highlighted the findings of our research-for-development activities.

Pakistan Water Week 2022

Pakistan Water Week 2022 was held in Islamabad, Pakistan, on October 24–28, 2022. In a year marked by extreme droughts and flooding in Pakistan, IWMI co-organized the event, which aimed to address the systemic cross-sectoral thinking across water, energy, food and environmental systems for climate-resilient development in Pakistan. The conference was designed to shape the focus of and agenda for water planning and management going forward.



Photo: Nabin Baral / IWMI

Financials

IWMI was financially stable in 2022 with a surplus of USD 0.48 million. There was a slight drop in grant revenue as well as expenses, but bilateral revenue increased by 16%. Current assets increased significantly, enabling a sound working capital ratio. IWMI received an unmodified audit opinion on its 2022 annual financial statements and satisfactorily completed several mandatory project audits as per grant agreements. The Institute continues to ensure that it complies with the donor regulatory requirements, and delivers accurate and timely financial reports to its donor agencies. IWMI works closely with many 'Communities of Practice' in the Business Operations & Finance Group of CGIAR to further strengthen its policies and processes to have a robust internal control system. IWMI has taken initial steps to move to 'One Corporate System', the Project and Financial Management System used by CGIAR.



Statement of Financial Position

As of December 31, 2022 and 2021 (in USD '000)

	2022	2021
Current assets	27,040	22,056
Non-current assets	3,046	3,530
Total assets	30,086	25,586
Current liabilities	14,993	11,542
Non-current liabilities	2,850	2,276
Total liabilities	17,843	13,818
Designated net assets	2,385	2,871
Undesignated net assets	9,858	8,897
Total net assets	12,243	11,768
Total liabilities and net assets	30,086	25,586

Statement of Activities and Other Comprehensive Income

For the years ended December 31, 2022 and 2021 (in USD '000)

	2022	2021
CGIAR Trust Fund (Windows 1 and 2)	10,512	15,746
CGIAR Trust Fund (Window 3)	1,031	923
Bilateral	16,328	14,103
Total grant income	27,871	30,772
Other revenue and gains	366	362
Total revenue	28,237	31,134
Research expenses	24,407	28,719
General and administration expenses	3,880	3,113
Total expenses and losses	28,287	31,832
Operating deficit for the year	(50)	(698)
Financial income and disposal gains	696	868
Other comprehensive (loss) / income	(171)	305
Total comprehensive surplus for the year	475	475

Expenses by Function

For the years ended December 31, 2022 and 2021 (in USD '000)

	2022	2021
Personnel costs	13,013	13,137
CGIAR collaboration expenses	98	6,393
Non-CGIAR collaboration expenses	1,554	1,404
Supplies and services	11,303	9,828
Travel	1,167	368
Depreciation / amortization	860	406
Cost sharing percentage	292	296
Total expenses and losses	28,287	31,832

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)
- African Union (AU)
- Agence Française de Développement (AFD)
- Asian Development Bank (ADB)
- Australian Centre for International Agricultural Research (ACIAR)
- Bill & Melinda Gates Foundation
- 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 Commission (EC)
- Food and Agriculture Organization of the United Nations (FAO)
- Foreign, Commonwealth & Development Office (FCDO), United Kingdom
- Global Environment Facility (GEF)
- Green Climate Fund (GCF)
- The Leona M. and Harry B. Helmsley Charitable Trust
- InsuResilience Investment Fund (IIF)
- International Development Research Centre (IDRC)
- International Fund for Agricultural Development (IFAD)
- International Science and Technology Center (ISTC), Kazakhstan
- ITC Limited, India
- 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
- Ministry of Foreign Trade and Development Cooperation, Netherlands
- Netherlands Enterprise Agency (RVO)
- Norwegian Institute of Bioeconomy Research/Norsk institutt for bioøkonomi (NIBIO), Norway
- Social Science Research Council, Singapore
- Swedish International Development Cooperation Agency (Sida), Sweden
- Swiss Agency for Development and Cooperation (SDC), Switzerland
- Tata Education and Development Trust, Mumbai
- The National Lottery Community Fund, UK
- 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
- United States Forest Service (USFS)
- Water Research Commission (WRC), South Africa
- World Bank

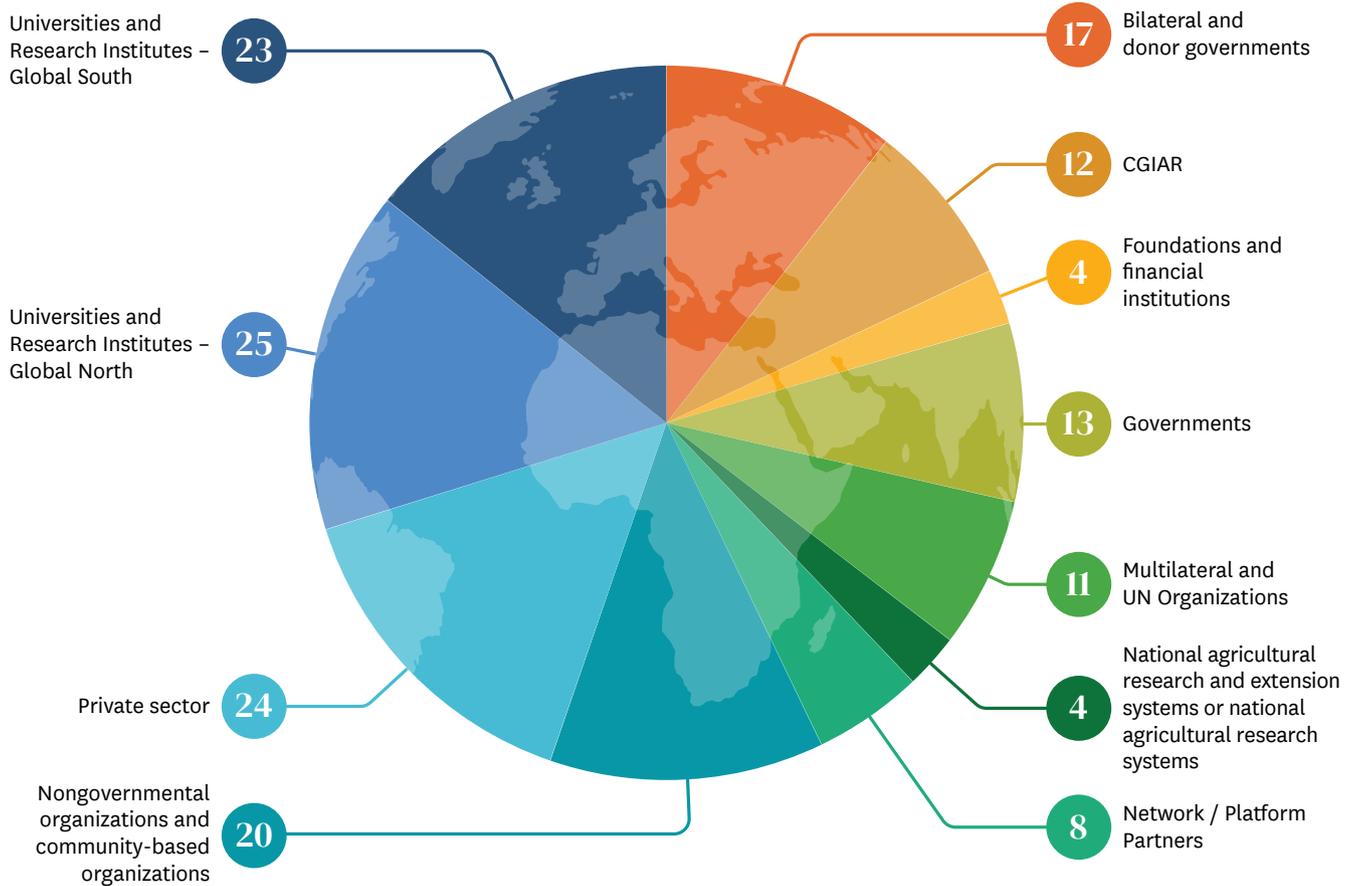
Host countries: Egypt, Ethiopia, Ghana, India, Italy, Lao PDR, Myanmar, Nepal, Pakistan, South Africa, Sri Lanka (global HQ), Uzbekistan, Zambia and Zimbabwe

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.

During 2022, IWMI increased its focus and intent to leverage the power of partnerships more effectively to connect our research capabilities to implementation and impact. This approach aligns closely with the CGIAR Engagement Framework for Partnerships and Advocacy. Guided by this framework, IWMI is working more closely with government agencies, research institutes, the private sector, donor agencies, network platforms, scaling organizations and civil society organizations. Together, we are prioritizing cooperation with coalitions at local, basin and national levels to collectively contribute to a transformative water security agenda.

Moving forward, IWMI will utilize its unique and extensive field-based presence to further embed its approach to partnerships for catalytic action. This approach recognizes that research contributions to innovation systems are only possible through committed partnerships.



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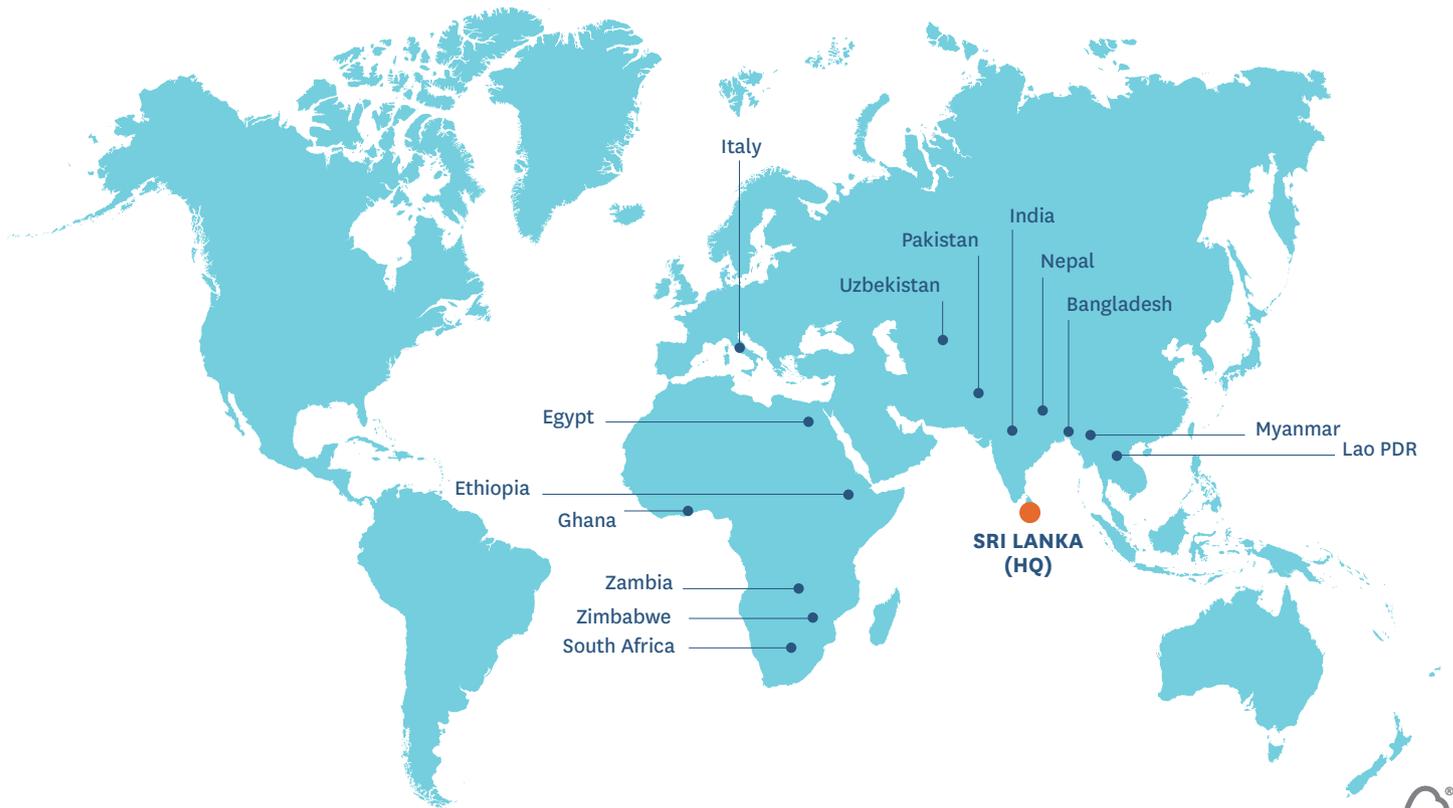
* Member, CGIAR System Board

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