CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

LED BY: IWMI International Water Management Institute

AGRICULTURE CHALLENGES ARE MEETING THEIR MATCH

WLE 2019-19 RESEARCH HIGHLIGHTS

CGIAR Research Program on Water, Land and Ecosystems

PHOTO CREDIT: MULUGETA AYENE/WLE

IN PARTNERSHIP WITH:

Bioversity International, CIFOR, CIAT, CIP International Potato Center, FAO, ICARDA, ICRISAT, IFPRI, ILRI, RUAF Foundation, World Agroforestry Centre, WorldFish

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

LED BY: IWMI International Water Management Institute

Finding the right solutions puts sustainable agriculture within reach

Agriculture is one of humanity's great success stories, yet it is one of the lead causes of environmental degradation and social inequity. Business as usual is clearly unsustainable - we cannot afford to produce food the way we are now if we are to survive as a planet or a species.

The CGIAR Research Program on Water, Land and Ecosystems (WLE) promotes a new paradigm, in which sustainably managed agricultural food systems are the key to healthy, functioning ecosystems and human well-being.

Agriculture doesn't have to be the cause of degradation - it can be part of the cure.

IN PARTNERSHIP WITH:

Bioversity International, CIFOR, CIAT, CIP, FAO, ICARDA, ICRISAT, IFPRI, ILRI, RUAF Foundation, World Agroforestry Centre, WorldFish

CONTENTS

MESSAGE FROM WLE PROGRAM DIRECTOR

Sustainable agriculture faces a constellation of ever-shifting challenges. Our world's population grows toward ten billion, but there is now indisputable evidence of multiple serious social and environmental impacts caused by current agricultural and food systems. We are fast approaching our limits. And there is an urgency to assure our solutions can meet new challenges – demographic shifts, urbanization and consumption patterns. And of course climate change, which may just tip our systems over.

And who stands to bear the brunt of these risks? It's the most vulnerable. Smallholders in the developing world, many of whom are women. Youth. Indigenous peoples. The poor. All face a world veering into the unknown, and all have limited resources to respond.

But as vexing as these challenges seem, new solutions are arising. We are finding new ways to manage resources. New technologies to harness water are scaling. Data is being collected at farm to global levels, feeding into better decisions. Cutting-edge practices and technologies are re-greening degraded lands. Women are better targeted through improved investments. And WLE is moving these pockets of innovation toward policy and institutional change. But much more needs to be done to transform our food systems.

So have our challenges finally met their match? WLE is leading the way on resolving three of CGIAR's global challenges: Living within PLANETARY BOUNDARIES, sustaining FOOD AVAILABILITY and promoting EQUALITY OF OPPORTUNITY. Here, we highlight 10 key results – all realized through WLE support. And all prove that we can find our way past these global challenges through better natural resource decisions.

Our partners have helped us improve FOOD AVAILABILITY, while living within our PLANETARY, BOUNDARIES, by supporting massive new investments in solar irrigation, developing a water scarcity indicator adopted by the UN, rolling out a soil data system across sub-Saharan Africa, and developing sustainable land use alternatives for an incentive scheme to preserve the Amazon rainforest. We've also been feeding real-time drought data into government decisions, supporting a data platform to find better water sources, and developed recommendations for how to use otherwise destructive floodwaters to irrigate forages and crops.

Moving towards EQUALITY OF OPPORTUNITY, WLE partners influenced irrigation investments to directly target women and engaged with universities to bring wealth-from-waste business models to young professionals.

And to help guide us through interconnected challenges, WLE is establishing a commission on sustainable intensification of agriculture.

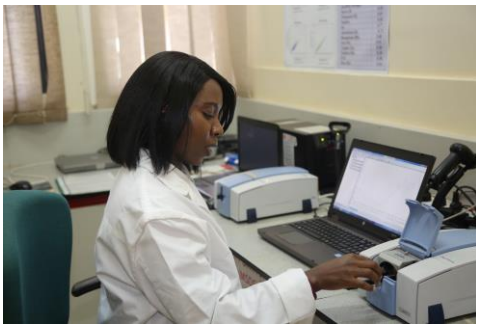
These 10 solutions are but a few highlights from across the WLE portfolio. But each has the potential to scale out and to serve as guideposts for problem-solvers, at a local to global scale.

As tough as our challenges seem, we are making progress. With the right research, investments and political support, we can produce enough nutritional food in an equitable way, while restoring and improving our planet. Indeed, our challenges have begun to meet their match!

Izabella Koziell
Program Director, CGIAR Research Program on Water, Land and Ecosystems (WLE)

| PLANETARY BOUNDARIES

Food systems are a major driver of the unsustainable use of the planet's increasingly fragile ecosystems. Water, land, forests and the biodiversity are precious, yet finite, natural resources. Current trends show that we are pushing the limits of what Earth can handle. How can we transform agriculture so that it's no longer part of this problem, but part of the solution?



1.1 New technology aiding soil restoration across sub-Saharan Africa.

1. 2 Environmental flows go global: Indicator and guidelines adopted by UN help countries measure "water stress"

1.3 New financial incentive may drive Amazonian smallholders to restore forest and mitigate climate change

1.4 Overcoming today's planetary emergency requires knowledge on how to sustainably intensify agriculture

1.1 New technology aiding soil restoration across sub-Saharan Africa.

Seventeen African countries are now using soil–plant spectral technology developed by the World Agroforestry Centre (ICRAF) and the CGIAR Research Program on Water, Land and Ecosystems (WLE) to restore soils and boost agricultural production, food security and livelihoods.

About 40% of soils in sub-Saharan Africa are low on nutrients. Widespread soil degradation hampers food production and leads to erosion and desertification. Globally, restoring just 12% of degraded agricultural land could increase smallholder incomes by USD 35-40 billion. However, African governments and other decision makers have long had little knowledge of where to implement what kind of restoration measures.

That's why ICRAF, WLE and other partners, through the Africa Soil Information Service (AfSIS), have developed and shared technology that can quickly and cheaply measure and map soil and plant properties as well as match soil problems with appropriate solutions. This facilitates better targeting of soil management measures.

The Soil-Plant Spectral Diagnostics Laboratory has helped 14 government institutions, three private sector labs and one development agency to adopt the technology. Data has been used to create soil property maps of Africa at 250 m resolution (SoilGrids). The maps are being used by research and development agencies to guide land management decisions and by the World Soil Information organization to develop fertilizer recommendations for West Africa.

At national levels, AfSIS has helped develop state-of-the-art soil information systems based on spectral technology in Ethiopia (EthioSIS), Ghana (GhaSIS), Nigeria (NiSIS) and Tanzania (TanSIS). Nongovernmental organizations are also using the technology: One Acre Fund, for example, has established a rural spectral lab in Kenya.

Step Aston is the director of agriculture research at One Acre Fund, a direct farmer service organization that provides over 800,000 smallholder farmers with access to credit, agricultural inputs, and training across Africa. "Access to reliable and large-scale, but low-cost soil data is an important part of our ongoing efforts to develop more locally tailored soil fertility management recommendations, and monitoring the long-term impacts that our programs have on soil health," he said.

"To date, our soil lab has processed 50,000 soil samples, deriving insights to inform program strategy and decision-making in six countries. This effort would have been cost prohibitive were it not for the technological breakthroughs and support delivered by the soil–plant diagnostic laboratory."

Conservation International, Technoserve and The Nature Conservancy have commissioned spectral analysis services, while the World Bank Living Standards Measurement Study piloted soil spectral technology in Ethiopia and Uganda. In addition, ICRAF has provided advisory services to private companies now deploying spectral technology in 22 countries.

The technology is also helping smallholder farmers benefit from soil- and plant-testing services, through satellite-based data, mobile laboratories and handheld devices. A low-cost, handheld spectrometer was developed and tested, and it has potential to provide a quantum leap in accessibility of the technology for smallholder farmers, helping them solve soil challenges right on their farms.

Over the past four years, ICRAF has trained over 1,000 people from 17 countries on the technologies. More African and Asian countries plan to adopt the technology.

1.2 Environmental flows go global: Indicator and guidelines adopted by UN help countries measure 'water stress'

Countries globally are now better placed to ensure sustainable freshwater use and supply, thanks to new guidelines on monitoring environmental flows developed by the International Water Management Institute (IWMI) and the CGIAR Research Program on Water, Land and Ecosystems (WLE) and adopted and disseminated by the United Nations.

All countries report on environmental flows as part of their self-assessment of progress toward the Sustainable Development Goals (SDGs). Quantifying environmental flows helps monitor progress on Sustainable Development Goal 6.4 on alleviating water scarcity through monitoring 'water stress'.

Environmental flows describe the quantity, quality and timing of water flows needed to sustain freshwater ecosystems as well as the livelihoods and well-being of the people dependent on them. Assessing how much water is needed for environmental flows helps reveal how much freshwater is available for other uses, including economic activities.

Withdrawing a lot of water when supplies are limited can cause 'water stress'. Measuring water stress entails comparing how much freshwater is being withdrawn by all economic activities, to the total renewable freshwater resources available. Managing these levels is crucial to meeting electricity, irrigation, drinking water and sanitation needs.

Yet, many countries still do not have clear criteria on how to define or measure environmental flows. The new methodology and guideline developed by WLE and

IWMI contributes to the 'water stress' indicator and ensures that environmental flows can be quantified in all countries.

It is at the country or even local level that this information can really help decision makers decide how to balance water needs with environmental needs. For example, how much water can be withdrawn for industry or how much wastewater can be discharged before soils, fish populations or drinking water is harmed? Improved water management can in turn help ease growing water scarcity challenges, as explicitly pursued under SDG Target 6.4.2.

WLE and IWMI led the development of the environmental flows method and guidelines to support countries' reporting. The Food and Agriculture Organization of the United Nations (FAO) is distributing these to all countries. FAO recently launched the guidelines with a live broadcast. During this event, the head of ecosystems in UN Environment, Joakim Harlin, noted that this is the first time that environmental flows is being adopted as part of a global policy.

In tandem with the guidelines, IWMI has substantially upgraded its Global Environmental Flow Information System online calculator for decision makers to determine environmental flows.

FAO is supporting further work to support global experts to refine the approach and develop further guidelines.

1.3 New financial incentive may drive Amazonian smallholders to restore forest and mitigate climate change

The Amazon rainforest provides an important environmental service by absorbing carbon dioxide from the atmosphere. Therefore, when the forest is under pressure, the impacts are severe: Globally, deforestation accounts for nearly 20% of all greenhouse gas emissions — more than the world's entire transport sector.

To help smallholders in the Amazon implement forest conservation practices and mitigate climate change, the Financing Fund for the Agriculture Sector (FINAGRO) is testing a methodology developed with support from the CGIAR Research Program on Water, Land and Ecosystems (WLE).

Peru and Colombia – accounting for 23% of the Amazon rainforest – are aware of their importance as providers of ecosystem services at the local, regional and global level. They support efforts to design viable land use and management alternatives that can reduce pressure on the Amazon rainforest.

The objective of the Sustainable Amazonian Landscape (SAL) project, led by the International Center for Tropical Agriculture (CIAT) with WLE support, was to support

the development of science-based practices to enable farmers to improve their well-being, while enhancing their capacity to mitigate and adapt to climate change. Sustainable land use alternatives were co-designed and pilot-tested jointly with a network of 42 farmers on 262 hectares in Colombia and Peru.

The farms in Colombia then participated in a pilot led by FINAGRO to simulate the application and viability of a new agri-environmental financial incentive, as part of the Vision Amazonia program, led by the Ministry of Environment of Colombia. This financial incentive (called Instrument for Sustainable Productive Transformation) is designed for small- and medium-size landholders to promote the conservation of the remaining forests and restoration of deforested areas, while concentrating cattle ranching activities in less fragile, but more productive areas.

Under this scheme, farmers receive a soft loan that includes benefits such as low interest rates (56% less than ordinary credit), guarantees and conditions of access, and flexibility of payment, including an incentive for releasing pasture areas for restoration, for up to 25% of the value of the credit.

After the simulation exercise with farmers, FINAGRO selected a first cohort of potential beneficiaries. Currently, 14 farmers from the SAL project and another 40 farmers that did not participate in the SAL project have been selected for receiving the soft loan.

One of the bottlenecks in the adoption of new and more sustainable practices is access to technical assistance. Therefore, the protocols developed by the SAL project for implementing the new practices were shared with FINAGRO to help them design technical assistance protocols for new farmers, who will benefit from this incentive.

It has been estimated that this FINAGRO-led financial incentive scheme could, by 2019-2022, benefit 4,413 farmers with an investment of USD 12.9 million, USD 13.1 million in the second period (2023-2026) and USD 13.5 million for the last period (2027-2030). The funds could be provided by public and private banks, international cooperation for the conservation of the environment, private investment funds, the Ministry of Agriculture and Rural Development, and regional and local governments. At the national level, the 12,043 farmers across 546,235 hectares could potentially benefit in the future.

1.4 Overcoming today's planetary emergency requires knowledge on how to sustainably intensify agriculture

Agricultural expansion and land use change are among the top culprits behind an unprecedented decline of nature, according to a recent report by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES).

Although food production has increased in recent decades, this progress has been fueled by unsustainable uses of fertilizers, pesticides and natural resources, resulting in large-scale degradation of land, water, biodiversity and overall environmental health. The productivity of 23% of land areas globally has declined due to degradation, and nearly 75% of freshwater resources are now devoted to crop or livestock production.

Many of the world's poorest communities reside in the regions most likely to experience significant negative effects from changes in climate, biodiversity and ecosystem functions. As these most vulnerable communities face the consequences of poor water quality, degraded land and starved soils, they are likely to lose out on livelihoods and opportunities.

While the impacts of our agricultural production systems remain unsustainable, the quantity and quality of food itself is unsatisfactory. With the planet's population set to hit ten billion this century, food production must increase; some estimates say by 50% globally and by almost 100% in Africa and Southeast Asia before 2050. But it's not only about increased production; better, healthier and more nutritious food is needed too. Today, almost 1 billion people still go hungry, and almost 2 billion people are eating too much of the wrong food.

Finding appropriate, viable and practical solutions to the twin challenge of producing the right kinds of healthy, nutritious food, while taking care of the environment, building climate resilience and reducing inequity is urgent.

"This is precisely why WLE is establishing a commission to convene global experts on sustainable intensification of agriculture," said Ann Tutwiler, Board Chair of the WLE Steering Committee. "These experts will bring together years of research by WLE, our CGIAR partners and other science institutions to synthesize the best policies, economic incentives, tools, technologies and practices as well as lay out a roadmap for a sustainable and equitable food future."

Next steps include appointing 15 commissioners, who will all have one thing in common: their frustration at the present slow pace of agricultural reforms toward sustainability, and their sense of urgency to address this issue if the world is to be a better place. By the time of its completion, the commission will have identified

necessary transitions for delivering sustainable intensification of agriculture at multiple scales, in ways that are both sustainable and equitable.

| FOOD AVAILABILITY

Population growth, demographic shifts, dietary change, climate change and environmental decline challenge everything we know about how to grow and share food. Yet, food production must increase – some estimates say by 50 percent globally, and by almost 100 percent in Africa and Southeast Asia by 2050. But it's not only about increased production. Better, healthier and more nutritious food is needed too.

2.1 Ethiopian floodwaters captured for dryland farmers – and the approach is scaling up

2.2 Indian governments make the leap to drought relief for farmers using real-time data

2.3 Massive Indian investment scales out solar irrigation: Co-op business models enhance groundwater and boost incomes

2.4 Water planning system used to improve Honduran investment decisions

2.1 Ethiopian floodwaters captured for dryland farmers – and the approach is scaling up

The regional government of Afar state, Ethiopia, has adopted an innovative approach for turning potentially destructive floodwaters into a source of irrigation in the Ethiopian drylands.

The practice, developed by the CGIAR Research Program on Water, Land and Ecosystems (WLE) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), takes advantage of interconnected weirs – small dams – that capture and distribute water to revive grazing lands and boost crop productivity by up to 500%. And the approach has been integrated into a large, proposed World Bank project.

About 60% of Ethiopia's land is dry lowland. Home to pastoralist communities, these areas experience alternating droughts and floods, making them inhospitable to crops or grazing. In recent years, extreme floods have affected hundreds of thousands of people in sub-Saharan Africa – many of them pastoral communities. In 2017, dams and rivers in Kenya overflowed, submerging crops, forcing over 300,000 people to flee, and killing 186. In 2019, floods were the major cause of displacement in Mozambique, Malawi and Zimbabwe.

In order to turn this seasonal flooding into an advantage, and restore degraded landscapes, GIZ (Gesellschaft fur Internationale Zusammenarbeit) has invested in a system of 50- to 300-m concrete or stone barriers (water-spreading weirs) in a cascading system in Chifra district since 2015. As the weirs redirect the floodwaters, water and nutrients are deposited across larger areas.

Recognizing the potential to grow forages and dryland crops on this suddenly nutrient-rich and temporarily moist soil, ICRISAT was charged with assessing how best to cultivate and manage this newly arable land. Creating GIS maps of water and nutrient deposits, the scientists developed recommendations on growing schedules and what forages and crops to grow where.

Such interventions rarely bring major impacts for agriculture. But in Afar, crop and forage yields increased abundantly over just three years, despite minimal fertilizer inputs – all while reducing the risk of water-related disasters.

The local community used these crops for domestic consumption and livestock fodder. And they distributed fodder to surrounding pastoralists, reducing local conflict. The project also reduced the amount of sedimentation entering local water sources.

The regional government is looking at expanding the approach to Yallo and Awra districts. And satellite data is currently being used to determine what locations would be appropriate for scaling up the project to other areas of sub-Saharan Africa.

2.2 Indian governments make the leap to drought relief for farmers using real-time data

Governments in India are using satellite data combined with ground measurements to assess and mitigate drought damage to crops. The data improved drought response in three districts and fed into development of 620 district-level drought plans.

Throughout 2017-2018, the South Asia Drought Monitoring System (SADMS) provided an index that integrates rainfall data with data on vegetation, soil moisture and temperature. Every eight days, the system publishes drought bulletins with detailed maps showing drought severity across Afghanistan, Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka.

The system has been produced and is maintained by the International Water Management Institute (IWMI) as part of the CGIAR Research Program on Water, Land and Ecosystems (WLE) research theme on variability, risks and competing uses. The index was applied to drought-affected states across India, producing maps showing widespread agricultural drought across multiple states. SADMS supplied the periodic bulletins to authorities, along with briefings to members of parliament and state-level principal secretaries, enabling them to better target and inform drought-relief efforts.

In three Indian districts, Kurnool (Andhra Pradesh), Amravati (Maharashtra) and Aurangabad (Maharashtra), SADMS provided real-time drought severity data along with briefings to high-level officials, farmer groups and agricultural extension officers.

At the village level, the project helped implement real-time contingency planning measures, including attaining drought-tolerant seed varieties, supplementary irrigation, rainwater harvesting and spraying of potassium nitrate to relieve drought stress.

As a result, the crop yields and incomes in these areas were significantly higher than in the control areas, indicating the vital role the approach can play in food and livelihood security.

Over one billion people in South Asia depend on agriculture-related livelihoods – most of them poor and vulnerable to drought impacts. With incidents of serious drought on the rise, partly due to changing weather patterns, governments need to

improve their response, including by providing faster and better targeted relief, staple grains and monetary support.

But, for local and national authorities to implement such measures and avoid major food or social disruptions, they need to know the extent and nature of damage. SADMS provides this data as part of wider WLE efforts to enhance the resilience of agriculture in the face of natural resource-related risks – including through data and digital technology.

In 2019, the concept will be scaled-up in other drought-prone regions, particularly in Karnataka. Further, the World Bank has reportedly decided to use the SADMS approach for a new drought insurance project in Asia and Africa. Other scaling efforts are underway to bring this solution to Southern Africa, the Middle East and Southeast Asia.

2.3 Massive Indian investment scales out solar irrigation: Co-op business models enhance groundwater and boost incomes

Indian governments are tackling climate change and poverty threats through a major expansion of solar irrigation. And a key component of the rollout is a CGIAR Research Program on Water, Land and Ecosystems (WLE) business model that protects groundwater and bolsters income of smallholder farmers.

In 2018, the government of India formally confirmed a previously announced plan for a national mega scheme to expand solar energy through a total investment of USD 16.4 billion, of which the central government will provide a 30% capital subsidy. The 10-year scheme aims to convert 7.5 million currently subsidized electric irrigation pumps to solar.

The scheme, KUSUM (Farmer Energy Security and Development Mission), promotes the Solar Power as Remunerative Crop (SpaRC) business model, in which farmers form co-ops to sell surplus power back to utilities. The sell-back option provides incentive to use energy and groundwater judiciously.

This model was first developed in 2016-17 by WLE, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) and the IWMI-Tata Program (ITP). The KUSUM announcement followed further consultations between ITP and the Indian Minister of Finance.

The state of Gujarat is already rolling out the model. Gujarat has announced its own pilot investment of USD 120 million. The government of Gujarat estimates that sale of surplus power will double the income of participating farmers. At least seven Indian states are also now piloting the model.

Speaking of the model's potential, Diego Senoner, technical expert with the Indo-German Energy Program, stated that, "a well-designed KUSUM policy is important for India to secure sustainable development of agriculture, maintain food security and safeguard groundwater during times of changing climatic conditions."

Based on India's experience to date, further rollout is expected to 1) introduce clean energy for irrigation and lower emissions; 2) build smallholder resilience by increasing productivity, food security and incomes; and 3) improve the financial sustainability of utilities.

In the past, irrigation expansion in India has brought about several challenges that switching to solar-powered pumps can mitigate. Notably, subsidies for fuel and electricity have led to over pumping and groundwater depletion. Providing subsidized electricity to farmers has even bankrupted some electric utilities.

On the other hand, when the SpaRC model was first piloted, the results were impressive: Farmers' incomes doubled, mostly from the sale of excess power, but also due to reduced pumping costs.

The model is now attracting attention from outside of India: With the support of WLE and the Swiss Development Cooperation (SDC), IWMI has initiated a long-term regional partnership to promote solar irrigation in India, Pakistan, Nepal and Bangladesh. WLE will also disseminate SPaRC lessons to countries in sub-Saharan Africa and Latin America.

2.4 Water planning system used to improve Honduran investment decisions

Much of Western Honduras can be brutally dry, constraining most farmers to rain-fed subsistence agriculture. With climate unpredictability, farmers and governments often lack the information needed to make the smartest water and agricultural investments.

But the government of Honduras has piloted and adopted a major new data platform, supported by the CGIAR Research Program on Water, Land and Ecosystems (WLE) and International Center for Tropical Agriculture (CIAT) science. Agua de Honduras provides communities with data on hydrology, vegetative cover, soil properties and water demand, along with future climate scenarios. The platform aids water management decisions on farms, in communities and across entire micro-watersheds, sub-watersheds or watersheds.

At the local level, the platform was successfully piloted with local organizations and municipal governments in four areas. One of these organizations used it to decide where to purchase land to invest in potable water systems. The successful results so far have led to interest from other agencies in expanding this system to other areas of Honduras.

One important component of the platform is AGRI (AGua para RIego), a tool for identifying sites for irrigation and drinking water. The award-winning AGRI has already been used more than 150 times in western Honduras to identify rainwater harvesting sites, 25 times to determine river diversion points and 3 times to select the best routes to increase aqueduct water supplies.

The government of Honduras officially adopted the platform as one of the main water management systems of the Ministry of Environment. The tool is expected to help water conservation investments as well as access to water for smallholder farms and human consumption.

Since 2015, the United States Agency for International Development (USAID) in Honduras has supported, through CIAT, water-related information initiatives. The Water Planning System (WPS), which deploys Agua de Honduras, aims to benefit millions of Hondurans, by providing policy makers with the information necessary to make smarter water investment decisions.

“This demonstrates the potential that alliances between research centers and development agencies have to generate products that provide concrete solutions to real problems in agriculture,” says CIAT/WLE research lead Marcela Quintero. “Likewise, these partnerships allow technical and scientific products to reach end users faster.”

By providing critical data, the platform already supports the implementation of several national laws and policies such as the General Water Law, National Plan, Country Vision, and the Water, Forest and Soil Master Plan. In the future, it may benefit millions of Hondurans.

| EQUALITY OF OPPORTUNITY

In this era of planetary degradation, the world's poorest and most marginalized often bear the brunt of the burden, losing livelihoods and opportunities. This can drive conflict and migration. With men increasingly leaving rural areas, women are playing a greater role in agriculture, but are still often marginalized and lack access to decision-making and resources. At the same time, the sector offers fewer and fewer viable jobs to youth. Solutions are only sustainable if they are also equitable.

3.1 Influencing water investments to support women in Tajikistan

3.2 New wealth-from-waste business models offer opportunities for entrepreneurial youth

3.1 Influencing water investments to support women in Tajikistan

Community water management investments in Tajikistan are now better targeted to women, with an aim to increase food production and stabilize farming systems.

The changes came after an evaluation by the International Water Management Institute (IWMI) and CGIAR Research Program on Water, Land and Ecosystems (WLE) found that not addressing the needs of women can harm a project's prospects. As more and more men migrate from farms, women have been thrust into farm management roles in Tajikistan and around the developing world.

With support from the United States Agency for International Development (USAID), Tajikistan introduced water user associations (WUAs) in 2012 and trained thousands of farm managers to take charge of their own water management decisions. IWMI evaluated these WUAs over a four-year period, to better understand impacts and areas for improvement.

IWMI found that providing repeated agronomic training of farm managers and WUAs significantly improved WUA financial performance, farmer participation and fee recovery. In addition, water delivery services, cultivated area and crop diversity also showed remarkable improvements.

But there was an unexpected finding: While untrained male farmers also benefited from the trainings, untrained female farmers were not accessing these benefits.

The program targeted those named as manager in the farm title – 98% of whom were men. But male migration often left untrained women in charge of farms – excluded from training under this system. And as these shifts occurred, knowledge on how to take part in WUA activities was mostly being transferred to other male shareholders, but not to women.

Despite being at a disadvantage, women like Abdullaeva Uguloi, one of the few women to head a WUA, feel that they could be making important contributions: "All water user associations should be headed by women. There is so much work, especially at the beginning, but you have to balance so many tasks, and you cannot give up. Women are more likely to overcome all the barriers. You have to be happy to always be working. Women are much better at this than men."

The evaluation also found that training programs were also seldom tailored to the timing, location and educational needs of women. This left them ill-equipped to step in and run the farms, secure water for irrigation, or even cultivate their home gardens.

Based on these findings, IWMI recommended targeting women farmers. With more knowledge and skills, women could then better contribute to WUA decisions and secure water for their farms and kitchen gardens. IWMI also recommended redesigning training materials, using women trainers, organizing childcare support and holding trainings in locations that are easily accessible for women.

WLE partners reported that these recommendations have been incorporated into USAID's Feed the Future's Global Learning Agenda, and contributed to a re-targeting of programs in Tajikistan. Chemonics, the implementing agency, re-focused the program on building the capacities of female irrigators.

As gendered migration trends look set to continue, making sure women have the skills and knowledge to participate in water management will help ensure the success of farms – and of farming systems. In this way, women can more fully participate in the decisions that so profoundly affect their lives.

3.2 New wealth-from-waste business models offer opportunities for entrepreneurial youth

As agriculture changes, developing countries are grappling with how to provide meaningful employment and entrepreneurial opportunities to youth and others. More than 85% of the world's 1.2 billion youth live in developing countries, and the once dominant agricultural sector is shrinking. This results in a lack of opportunities for youth, which can in turn lead to migration and political insecurity.

Now, entrepreneurship opportunities are arising from an unexpected source: Waste. Business models for turning waste into wealth are being adopted into curricula in 19 universities in Asia, Europe and Africa.

"The business of safe recovery of water, nutrients and energy from domestic and agro-industrial waste offers significant opportunities to generate economic and social benefits to women and unemployed youth, especially in developing countries," said Miriam Otoo, research group leader for resource recovery and reuse at the International Water Management Institute (IWMI).

"These entrepreneurs, however, face high market entry barriers due to a lack of social networks, specialist skills and capital. It is therefore important to identify appropriate business training for youth or women entrepreneurs, tailored to their specific needs and capacity gaps under each unique geographical context.

Population growth and urbanization are creating waste crises. Especially in developing countries, waste continues to pollute, affecting drinking water, dangerously overfilling landfills or septic tanks, or dirtying public spaces. Often the waste is burned, choking up local air and releasing carbon. Growing urban centers are keenly looking for waste management solutions.

At the same time, organic waste is rich in nutrients, water and energy that can be recovered to grow food and power economies. For savvy entrepreneurs, waste is packed with potential wealth, offering opportunities particularly for women.

Scientists working with IWMI and the CGIAR Research Program on Water, Land and Ecosystems (WLE) have released a major compendium of wealth-from-waste business models, all based on real-world examples. They include innovative models for converting human waste into safe fertilizer, food waste into biogas, and wastewater into irrigation sources. The models have the potential to create new forms of business and are being further developed in Ghana and Sri Lanka.

Now, WLE and IWMI aim to bring these business models into school curricula. WLE is engaging with 19 universities to adapt this work into syllabi, giving young professionals opportunities to learn new marketable skills. An intensive training program was already held for 25 university teachers to deliver material to students. These 'train-the-trainer' programs help tailor material for engineering, health, economics or business courses, and they support peer training. A free online curriculum will be uploaded to sswm.info.

With these recent developments, resource recovery and reuse business models look set to bring opportunities for youth, a more circular economy and a cleaner environment.

RESEARCH PROGRAM ON Water, Land and Ecosystems

LED BY: IWMI International Water Management Institute

PUBLICATION HIGHLIGHTS

JOURNAL ARTICLES

- The paradox of irrigation efficiency: Higher efficiency rarely reduces water consumption
- Distilling the role of ecosystem services in the Sustainable Development Goals
- Crop pests and predators exhibit inconsistent responses to surrounding landscape composition
- Crop pests and predators exhibit inconsistent responses to surrounding landscape composition
- Integrating wood fuels into agriculture and food security agendas and research in sub-Saharan Africa
- Can Sub-Saharan Africa feed itself? The role of irrigation development in the region's drylands for food security
- Playing games to save water: Collective action games for groundwater management in Andhra Pradesh, India
- Biological control of an invasive pest eases pressures on global commodity markets
- Satellite sun-induced chlorophyll fluorescence detects early response of winter wheat to heat stress in the Indian Indo-Gangetic Plains
- The Different Dimensions of Livelihood Impacts of Payments for Environmental Services (PES) Schemes: A Systematic Review
- Impacts assessments without true baselines: assessing the relative effects of training on the performance of water user associations in southern Tajikistan
- Food- and feed-based nutrient flows in two West African cities
- Probabilistic Decision Tools for Determining Impacts of Agricultural Development Policy on Household Nutrition
- Uncovering the economic value of natural enemies and true costs of chemical insecticides to cotton farmers in China
- What Happens after Technology Adoption? Gendered Aspects of Small-Scale Irrigation Technologies in Ethiopia, Ghana, and Tanzania
- Power as agency: a critical reflection on the measurement of women's empowerment in the development sector

BOOKS

- Advances in groundwater governance
- Resource recovery from waste: business models for energy, nutrient and water reuse in low- and middle-income countries
- More people, more food, worse water? a global review of water pollution from agriculture
- Agricultural Development and Sustainable Intensification

- Fostering Food Security and Climate Resilience Through Integrated Landscape Restoration Practices and Rainwater Harvesting/Management in Arid and Semi-arid Areas of Ethiopia

BRIEFS

- What women and men want: Considering gender for successful, sustainable land management programs
- Mapping the suitability of solar energy-based irrigation pumps in Ethiopia
- Recommendations for the wise use of urban and peri-urban wetlands in Kolkata, India
- Enhancing fisheries productivity through improved management of reservoirs, dams and other water control structures
- Gender-equitable pathways to achieving sustainable agricultural intensification

REPORTS

- Feeding degraded soils in Ethiopia to feed the people and the environment
- Business model scenarios and suitability: smallholder solar pump-based irrigation in Ethiopia. Agricultural Water Management – Making a Business Case for Smallholders
- Recovering bioenergy in Sub-Saharan Africa: gender dimensions, lessons and challenges
- The use of Earth Observation for wetland inventory, assessment and monitoring
- Gender dimensions of community-based groundwater governance in Ethiopia: using citizen science as an entry point
- Soil carbon under current and improved land management in Kenya, Ethiopia and India: Dynamics and sequestration potentials
- An analysis of land management stakeholders in Lushoto (Tanzania) and Ntcheu (Malawi).
- Atlas of West African urban food systems: examples from Ghana and Burkina Faso
- Meeting the nutrition and water targets of the Sustainable Development Goals: achieving progress through linked interventions
- Decision analysis methods guide: agricultural policy for nutrition

WLE IN THE NEWS

- Scientist's fuel-efficient stove-for-work program in Ethiopia protects trees | Relief Web
- It's A Rocky Road To Power For Rural Women | NPR
- Over and under the pond | the Kathmandu Post
- What we risk by ignoring nature | Prevention Web
- Inter-institutional team tackles Honduras's water crisis | Relief Web
- Four reasons small farms are running out of water – and how we can fix it | Thomas Reuters Foundation News

- Opinion | New Diet, New Destiny? Saving the Planet Takes More Than Changing What We Eat | Food Tanks
- India Wants to Double Farmers' Incomes – and Tackle Climate Change. Is Technology the Answer to This Double Bind?

THRIVE BLOG HIGHLIGHTS

- Fighting floods with 'sponge cities'
- Surveying soil from the sky: Can satellites predict droughts and floods?
- Here comes the sun: solar technology for agriculture
- Dams, Data and Decisions
- The next great water crisis may be under our feet
- How smallholder farmers in Zimbabwe are succeeding with irrigation and fighting climate change impacts
- Water Crises Are Hitting Our Economies. Time to Hit Back with Natural Infrastructure
- Systems Thinking Empowers Us
- Asia's environment is at a tipping point

THANK YOU TO WLE'S PARTNERS AND DONORS

LED BY: IWMI International Water Management Institute

IN PARTNERSHIP WITH: Bioversity International, CIAT, FAO, ICRISAT International Crops Research Institute for the Semi-Arid Tropics, CIFOR, CIP International Potato Center, RUAF Foundation, ICARDA, IFPRI International Food Policy Research Institute, World Agroforestry Centre, ILRI International Livestock Research Institute, WorldFish

WLE is grateful for the support of CGIAR Fund Donors (www.cgiar.org/funders/), including direct support from

Australian Government Australian Centre for International Agricultural Research

Ministry of Foreign Affairs of the Netherlands

UKaid from the British people

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

CGIAR RESEARCH PROGRAM ON WATER, LAND AND ECOSYSTEMS

The CGIAR Research Program on Water, Land and Ecosystems (WLE) is a global research-for-development program connecting partners to deliver agriculture solutions that protect our natural resources – and the people who rely on them. WLE brings together 11 CGIAR centers, the UN Food and Agriculture Organization (FAO), the RUAF Foundation, and numerous national, regional and international partners to find integrated solutions. The program promotes an approach to sustainable intensification in which a thriving ecosystem is a prerequisite to agricultural development, food system resilience and human well-being. WLE is led by the International Water Management Institute (IWMI) and partners, and supported by CGIAR, a global research partnership for a food-secure future.

Email: wle@cgiar.org
Website: wle.cgiar.org
Thrive Blog: wle.cgiar.org/thrive

Online 2018-2019 highlights: http://wle.cgiar.org/match