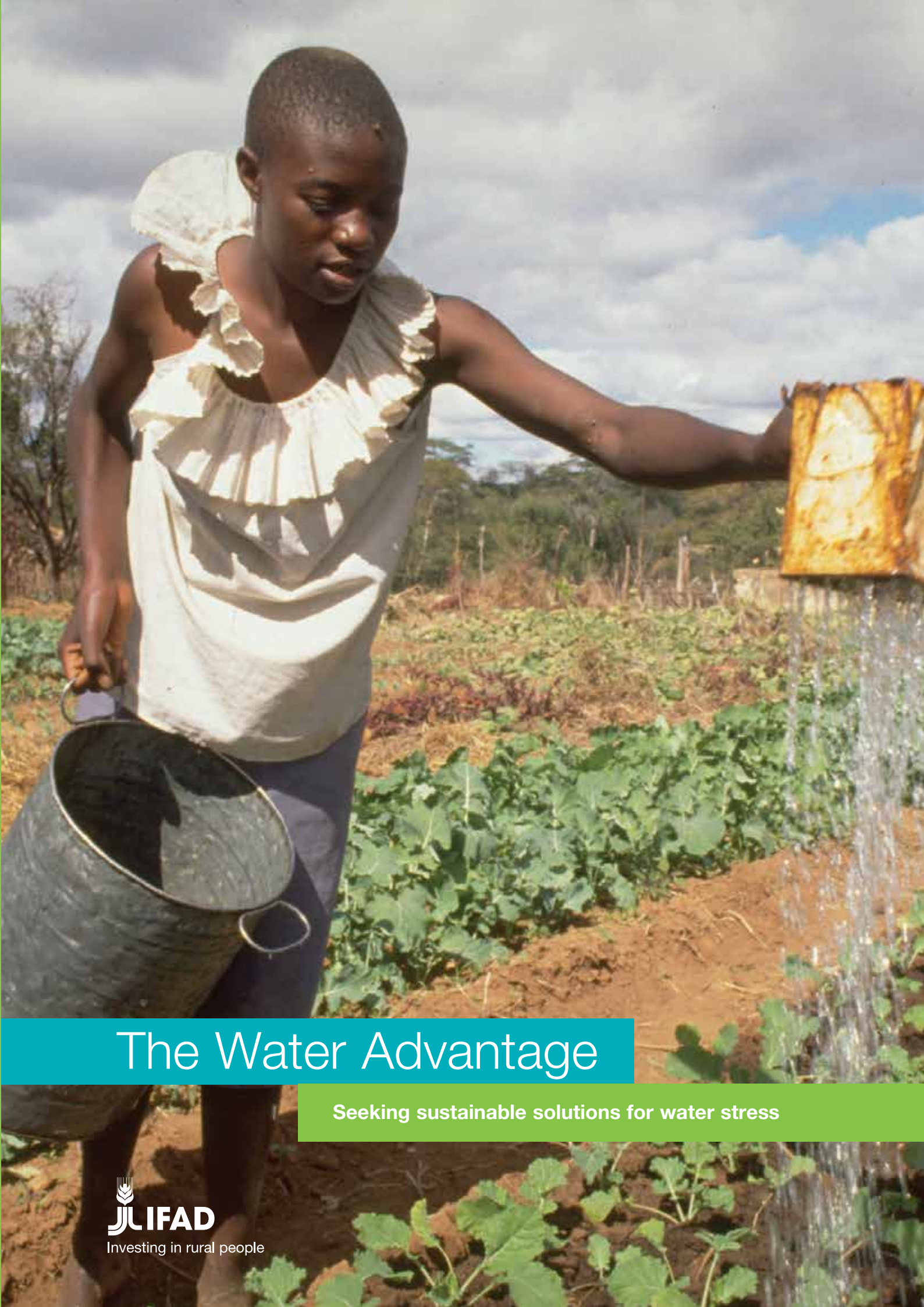

The Water Advantage

Seeking sustainable solutions for water stress

IFAD
Investing in rural people

"For smallholder farmers in developing countries, water is the difference between a decent life or poverty, hunger and malnutrition."

Gilbert F. Houngbo, President, IFAD

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This review was prepared by the IFAD Environment and Climate Division based on project documentation and references.

Prepared by: Soma Chakrabarti, Independent Consultant.

Internally reviewed by the following at IFAD: Tarek Ahmed, Country Programme Manager (Sudan); Margarita Astralaga, Director (Environment and Climate Division); Alice Brie, Environment and Climate Change Consultant (West and Central Africa Division); Paxina Chileshe, Climate Change Adaptation Specialist (Environment and Climate Division); Mawira Chitima, Lead Technical Specialist, Water and Rural Infrastructure (Policy and Technical Advisory Division); Rikke Olivera, Senior Technical Specialist, Natural Resource Management (Policy and Technical Advisory Division); Oliver Page, Regional Climate and Environment Specialist (Latin America and the Caribbean); Guido Rutten, Technical Specialist (East and Southern Africa); Audrey Nepveu De Villemarceau, Senior Technical Specialist (Policy and Technical Advisory Division); Amath Pathé Sene, Regional Climate and Environment Specialist (West and Central Africa); Nicolas Tremblay, Lead Technical Specialist, Environment and Climate (Near East, North Africa, Europe and Central Asia); Steve Twomlow, Regional Climate and Environment Specialist (East and Southern Africa); Wanaporn Yangyuentham, Programme Analyst (Asia and the Pacific). Editorially reviewed by Brian Thomson, Senior Communications and Advocacy Specialist (Environment and Climate Division).

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Introduction

Why fresh water matters to IFAD

Among ecosystems services, freshwater is one of the most fundamental for life. For smallholders, water means the difference between a decent life and poverty, hunger and malnutrition. The majority of poor rural people depend on rainfed farming systems for their livelihoods: the Food and Agriculture Organization of the United Nations (FAO) estimates that, globally, rainfed agriculture is practised on 83 per cent of cultivated land, and supplies more than 60 per cent of the world's food.[1]

But this precious resource is under stress, with massive potential impacts on the livelihoods of poor rural communities. More than a billion people live in water-scarce regions, and as many as 3.5 billion could face water scarcity by 2025.[2] It is not just a question of having enough water; water stress includes the inability to access good quality and clean water. Growing populations, expanding cities and unsustainable natural resource management are increasing water stress on rural communities, while climate change and shocks are exacerbating flooding, landslides and saltwater intrusion into freshwater systems. The degradation of our ecosystems also affects three core dimensions of water resource management: quantity, quality and disaster risk management.

1 See http://www.fao.org/docrep/005/Y3918E/y3918e10.htm, accessed January 2010.

2 World Resources Institute website. "Water: mapping, measuring, and mitigating global water challenges." Website accessed January 2018.

Food security and nutrition (FSN) for smallholders and beyond, which is central to IFAD's mandate, is under threat, and in 2015 the Committee on World Food Security (CFS, 2015) responded with a call to all actors to:

- Promote sustainable management and conservation of ecosystems for the continued availability, quality and reliability of water for FSN
- Improve coherence between water and FSN-related policies, strategies and plans
- Achieve equal access to water for all, prioritize the most vulnerable and marginalized of all ages, and empower women and youth
- Improve the efficiency and diversity of water use and the productivity of agricultural systems for FSN
- Manage risk and increase resilience to water variability for FSN
- Develop and share knowledge, technologies and tools related to water for FSN
- Foster inclusive and collective collaboration and national and local governance on water for FSN
- Promote the full and meaningful implementation of international human rights obligations and instruments as they relate to water for FSN.

Water in IFAD investments

IFAD has long recognized that water is fundamental to its mandate, and its current Strategic Framework (2016 – 2025) integrates water management into all three strategic objectives – see Table 1.

Table 1: Water in IFAD's Strategic Framework

Strategic objective 1: Increase poor rural people's productive capacities	Increase access to water as a natural resource and for better nutrition outcomes for poor rural people
Strategic objective 2: Increase poor rural people's benefits from market participation	Improve water management for value addition
Strategic objective 3: Strengthen the environmental sustainability and climate resilience of poor rural people's economic activities	Manage watersheds and improve water management systems

Today, some form of water management features in many IFAD investments, with around 38 per cent of its agricultural investments having a water-related component (IFAD, 2014). Launched in 2012, IFAD's Adaptation for Smallholder Agriculture Programme (ASAP) has an outcome objective of "increased availability of water and efficiency of water use for smallholder agriculture production and processing", with 14 projects contributing directly to this outcome and the Programme set to exceed its target of 100,000 households by 2020. IFAD also contributes to the Global Environment Facility (GEF) aim of tackling land degradation through an integrated watershed management approach, including actions to support smallholders' land rights, developing management plans for micro-basins, restoration measures, protecting and rehabilitating degraded watersheds, and increasing water availability and access for rural women. IFAD results in its 2017 GEF portfolio alone

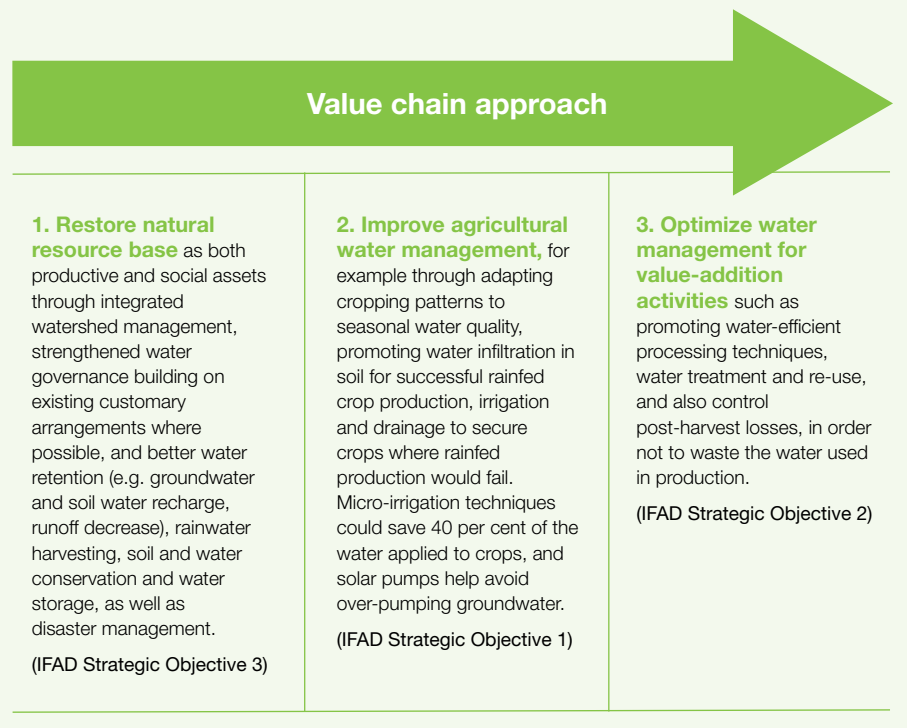
included 135,394 hectares managed with practices to improve soil fertility and soil/water conservation, 21,404 hectares recovered through soil and water conservation practices, 650 micro-watershed management plans prepared, 650 community watershed committees and 4,462 members of watershed committees established, and 2,166 members of committees trained in watershed management techniques.

IFAD's approach to water

IFAD manages this precious resource in line with its strategic objectives, broadly structured along a typical value chain, as set out in Figure 1.

IFAD's approach can also be described as targeting "multiple benefits," which include women's empowerment, improved nutrition and reduced conflict. In Mozambique, for example, a current IFAD-funded programme[3] has invested in solar-powered multifunctional boreholes (like the one shown here) that have water points for domestic water supply, family gardens, washing clothes and also for animals. As well as boosting red meat production and therefore associated income, it has freed women from drudgery and increased the availability of vegetables for better nutrition from gardens. The project's success has prompted demand from neighbouring communities for similar boreholes.[4] Water is closely intertwined with the work that rural women do, and this project puts the spotlight on this nexus of issues.[5]

Figure 1: IFAD's approach to water resource management



3 Pro-poor value chain development project in the Maputo and Limpopo Corridors (PROSUL).
4 Source: IFAD, 2017. Website accessed January 2018. "Where there is water, there is life."
5 For example, see "Gender and Water: Securing water for improved rural livelihoods: The multiple-uses system approach" (IFAD, 2007).

In Chad, water access is a sensitive issue that generates conflict among ethnic groups. In addition, a lack of water points for animals often forces pastoralists to reduce their mobility and use the water resources of the sedentary populations, which also creates serious conflict. The main aim of the Pastoral Water and Resource Management Project in Sahelian Areas (PROHYPA[6]) (2010-2015) was therefore to improve access to water for mobile pastoralists and their animals in search of grazing areas and water. The project was consistent with IFAD's objective of aiming to solve water disputes between communities, and focused on the planning and management of pastoral water infrastructure through local institutions and conflict management commissions. This was done with traditional leaders – in fact, PROHYPA put them at the heart of the entire process of establishing water points and transhumance corridors as a means to adapt to climate change. The project not only reduced the number of conflicts, but also contributed to better management of conflicts when they arose.

Freshwater resources represent a fundamental input for agriculture. They are also key to greenhouse gas mitigation from better soil and water management, and can protect communities from climate-related disaster and also improve nutrition outcomes for smallholders. They need to be managed so as to ease women's work burdens, and to avoid conflict.

Case studies

The five case studies in the following pages highlight different dimensions of IFAD's investments in water, from irrigation to reducing climate-related risks in arid areas, to disaster risk management and access to clean water for nutrition and sanitation. They offer a glimpse of how IFAD is working on improving the management of this fundamental natural resource for smallholders in different contexts and represent a selection of IFAD's portfolio over the years.

6 PROHYPA: *Projet d'Hydraulique Pastorale en Zone Sahélienne.*

©IFAD/GMB Akash

Bangladesh: Protecting villages from flash floods and improving livelihoods in the Haor basin (wetlands)

Key facts

Project name	Haor Infrastructure and Livelihood Improvement Project (HILIP)/ Climate Adaptation and Livelihood Protection (CALIP) – scaling up best practice and testing new adaptation interventions
Dates	HILIP 2012-2020, CALIP 2014-2020
Target groups	Poor and vulnerable rural people, including small and marginal farmers, fishers, landless people, poor women, indigenous community, small traders, intermediaries in local market and microentrepreneurs
Financing	Government of Bangladesh, IFAD including loan, grant and ASAP, Spanish Food Security Cofinancing Facility Trust Fund

The sustainable development challenge

The Haor region is a wetland ecosystem in north-eastern Bangladesh, which is located in a tectonic depression. During the monsoon period, the Haor gets between 3,000 and 4,000 mm of rainfall, together with the flow of monsoon river from the Meghalaya and Barak basins. The Haor gets completely flooded with 4-8 metres of water for around six months of the year. At these times, the area looks like an inland sea. Densely inhabited villages are built on artificially constructed mounds of earth, and during the monsoon season they turn into islands, with boats being the primary mode of transport.

Flash floods are a common occurrence in the Haor, and during the height of the flood period the Haor is wracked with waves as high as 3 metres. Large-scale deforestation over the last 40 years has stripped away the natural barriers that have historically mitigated wave action. A significant part of villagers' income and time is spent fortifying the earthen mounds and repairing their damaged homes. Extreme weather events in 2001, 2010 and 2017 resulted in between 80 per cent and 90 per cent of crops being lost, and this situation is expected to get worse as a shift towards pre-monsoon rainfall is projected to coincide with the paddy rice pre-harvest period. This will severely affect food production in the area, which makes up over 16.5 per cent of national rice production, and is fundamental to the food security of smallholders living in Haor. Their already precarious existence is thus being further exacerbated by climate change impacts. The lack of a pre-monsoon flash flood early warning system means, at best, a three-day advance warning through family networks makes it to downstream inhabitants. This is simply not enough time to harvest rice and transport it to safe ground.

IFAD action

One of the key actions of the ASAP-financed component (CALIP) is to address the lack of an effective flash flood forecasting system to allow farmers to assess risk more accurately. A preliminary model has been developed by the Institute of Water and Flood Management and Institute of Water Modelling; the model takes into account feedback on the different needs of women and men, is currently being tested and will be refined. Villagers and market management committees are also being organized so that they can act on weather and flash flood forecasts, and special platforms are being built to store rice during flash floods.

As well as this early warning system, different engineering models are being tested to protect villages against wave action. The best options will be scaled up. Reforestation will be carried out at the landscape level to recreate natural wave barriers and generate carbon sequestration benefits. Tests are ongoing to identify vegetative species, such as vetiver, as alternative and natural slope stabilizers and crops for livelihoods, as

well as for carbon sequestration. Access to clean water is always problematic during the floods, and indeed access to potable water was identified by all target groups as a top priority when the project was designed. The project is therefore improving access to basic services such as domestic water and sanitation by investing in tube wells and latrines.

To make the best use of the short dry season, the project is also helping to re-excavate irrigation canals that have become silted up. Fish ponds will be rehabilitated because extensive siltation of *beels* (water bodies) is reducing the potential of fish catch. These actions are being completed by a range of initiatives to diversify livelihoods and build capacities.

Impacts

Expected impacts at the end of the project include the following:

- Early weather warning and flash flood system in place for the Haor region, together with emergency rice storage platforms
- Low-cost and robust village protection systems using local materials (already being replicated elsewhere) to protect exposed villages from intensive wave action; 70 per cent decrease in the number of households destroyed by wave action, and 224 villages protected against wave action
- 100 km of canals and 305 *beels* excavated to improve navigation and water-carrying capacity, piloting the use of vegetation to retain excavated soil in situ and the protection of 20 killas (raised earthen platforms) built with excavated earth using vetiver grass and local trees
- Over 300 fish ponds built or rehabilitated, yielding livelihoods as well as nutritional and biodiversity benefits
- Over 100 hectares of land under irrigation rehabilitated
- Over 500 drinking water systems, common toilets and 168 internal walkways constructed to enhance livelihood adaptation
- Improved management of *beels* through *beel* user groups: as of May 2017, women's participation had risen from around 6 per cent to 31 per cent.

Killas (raised land) constructed to keep Boro paddy safe from early flash floods.

©IFAD/Juan I. Cortés

Brazil: Wastewater sets smallholders free in the *Sertão*

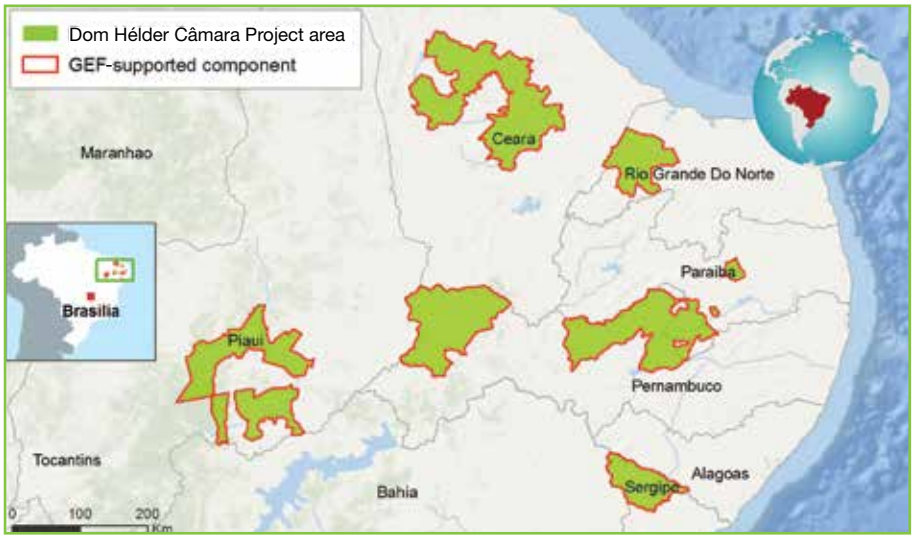
Key facts

Project name	Sustainable Development Project for Agrarian Reform Settlements in the Semi-Arid North-East (Dom Hélder Câmara Project) including GEF-supported component of the same name
Dates	2000-2009 (GEF component 2007-2014)
Target groups	Smallholder farmer communities in and around medium-scale irrigation systems
Financing	Government of Brazil, GEF, IFAD, smallholders and private-sector companies

The sustainable development challenge

Even in water-abundant countries such as Brazil, water still emerges as a constraint affecting particular livelihoods, farming systems or specific geographies. The *Sertão* region of north-east Brazil covers an area of almost 1 million square kilometres, and the *caatinga*, the region's predominant ecosystem and unique to the country, is a biodiversity hot spot. However, the *Sertão* is directly exposed to land degradation, with around 20 per cent of the region already affected by desertification. Since 2011, the *Sertão* has been affected by seven consecutive years of severe drought, representing the most important water crisis affecting the region in a century. This is threatening the livelihoods of about 15 million people. In the semi-arid *Sertão*, water was even

The Galho do Angico community in Caraúbas, Río Grande do Norte. There, with GEF and IFAD funds, the community improved agricultural production by using an innovative system to treat grey water from their homes, drip-irrigation systems and organic soil management techniques.



used by former landlords to control poor rural people and keep them dependent, as landlords had control over access to water.

IFAD action

The project adopted a concept of *Conviver com o semiárido* ("co-existing with the semi-arid"), and therefore one of the objectives was that families in targeted settlements and communities would harvest and manage water efficiently with technical assistance from stronger local institutions and service providers. A key focus of technical assistance included helping farmers to use water resources more sustainably and build essential infrastructure, which were identified as priorities by project target groups during preliminary consultations. The project worked to leverage public investment programmes to provide families with water tanks to harvest and store rainwater, and build reservoirs, artesian wells and underground small dams. These water-related small-scale interventions were decentralized and easily absorbed by the project's target population of poor rural people.

The project supported better access to water for both domestic use and agricultural activities. For example, a drinking water tank programme (*Programa um milhão de Cisternas* or One Million Cistern Programme) was also financed by the government, with Articulação no Semiárido Brasileiro (ASA) as the main implementing partner. Meanwhile, an "Investment Fund for Social and Productive Projects" also financed water tanks for individual houses; productive activities included wells and underground dams for water harvesting; and conservation for productive uses and beekeeping, animal husbandry and vegetable production. Partnerships with the private sector were also pursued; for example, in *Sombras Grandes*, Petrobras (an oil company) financed the basic infrastructure through a grant to enable communities to build and maintain their own water systems as part of its corporate social responsibility programme.

Finally, one of the project's innovations was to promote ways to treat wastewater for use in vegetable production. Many families had simple ditches and sewage pipes to make use of grey water from their kitchens and daily bathwater to water fruit

trees in the back garden. However, much of this water was used and remained as open-air sewage. Whether used for irrigation or not, this untreated water represented a risk of environmental pollution, since it potentially contained products that are harmful to plants (detergents), to the soil (salts and heavy metals) and to human health (pathogens).

A partnership with a non-governmental organization and the Federal Rural University of the Semi-arid Region, together with three farming families from the municipality of *Olho-D'Água do Borges*, marked the start of efforts to develop a "family bio-water system" that made use of domestic grey water for food production and to make back gardens more sanitary. The system consists of a filtering process with a mechanism to physically and biologically block the residues present in the grey water, so that the organic matter is biodegraded by micro-organisms and earthworms. The water is reused through a drip-fed closed irrigation system that feeds vegetables, fruits, medicinal plants, green leaves for laying hens, and other kinds of foods. As well as the evaluation of the system as a whole, the efficiency of the filtering unit, the soil cultivated with the treated water, and the quality of filtered water were assessed in regard to suitability for the irrigation of fresh vegetables and fruit. The system is particularly suitable for the cultivation of vegetables (leaves, roots and tubers; and fruits such as guava, passion fruit and mango) in areas of around 300 m^2, with sustainable management tools based on the principles of agroecology without the use of pesticides.

Impacts

By leveraging public investment programmes, the project provided families with water tanks to harvest and store rainwater; and built reservoirs, artesian wells and underground dams, thus reducing the families' dependence on landlords. Overall, the project improved water management for some 3,500 families. This in turn allowed the families to diversify production, and increase productivity and food consumption. Over 55,000 hectares, including the *caatinga*, were brought under sustainable management practices. These included agro-ecological vegetable gardens and orchards, watershed management and grey water reuse systems, as well as other soil and water management practices.

With regard to the "family bio-water system" for grey water reuse, field trials and successive laboratory analyses showed that plant growth and development, physical and chemical properties of the soil, and chemical properties of the water all met required standards for agricultural use. Moreover, the reused water contained high quantities of nutrients and did not present a risk of environmental pollution. The water also had the potential to lower the risk of *E.Coli* infection and met World Health Organization guidelines for grey water. Low installation and maintenance costs were additional benefits, and the quantity and type of grey water produced by families proved to be sufficient for the system to keep a family supplied with irrigated greens, fruit and root vegetables from their back gardens, and even to produce marketable surpluses in the rainy period. The Secretariat for Agrarian Development in the State of Ceará took up the system through a World Bank-financed project (São José III), replicating the experience and contributing to capacity development among advisers, farming families and others in its installation and management.

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Malawi: Water catchments for climate-resilient nutrition

Key facts

Project name	Programme for Rural Irrigation Development (PRIDE) including Enhancing the Resilience of Agro-ecological Systems Project (ERASP)
Dates	2017-2024
Target groups	Smallholder farmer communities in and around medium-scale irrigation systems
Financing	Government of Malawi, GEF, IFAD including ASAP, smallholders

The sustainable development challenge

Over the past 20 years, droughts and prolonged dry spells have become more frequent in Malawi, resulting in poor crop yields and, in some cases, total failure. Climate models predict a wetter regime for the northern regions while the south is expected to be drier with shorter and more intense rainfall periods. Intense rains, as experienced in January 2015, lead to severe floods and increased rainfall variability, which means that farmers are sometimes forced to delay planting and even to replant their crops. Less than 4 per cent of cultivated land is under irrigation, and smallholders experience major problems around distribution of water and access to irrigated land. Malawi also has one of the worst malnutrition rates in Africa, and the changes in rainfall caused by climate change have multiple implications for nutrition.

Philip Njalale came home from South Africa and now grows maize and potatoes and has 3 cows, 30 goats and 5 pigs, all as a result of an IFAD-supported project that brought irrigation to his land.

For example, a reliable water supply would also make homestead gardens – one of the solutions proposed by an IFAD study on improving the nutritional status of target groups[7] – a more viable strategy. Increased consumption of animal proteins from farmers' own livestock is also more of an option if there is an adequate water supply, because there is more drinking water for livestock, as well as irrigated fodder to feed animals.

IFAD action

PRIDE aims to reduce the vulnerability of smallholder communities to food insecurity and climate change effects through more secure water access, as well as management of water as a resource at the catchment level. Investing in irrigation and water storage helps farmers cope with rainfall variability; precise and timely application of irrigation water can help to produce crops in predictable quantities, levels of quality and time frames. Good preparation and maintenance of irrigated soils also helps maximize soil storage of moisture, and erosion management helps maintain vital nutrients in the soil – and our food.

PRIDE is therefore investing in improving smallholder productivity from both irrigated and rainfed agriculture on lands belonging to villages involved in irrigation scheme "cluster areas". Rainfed farms benefit from support for good agricultural practices and market linkages. One of these good agricultural practices, which is water-efficient and good for the soil, is to increase production of high-value cash crops, including legumes. This will also bring economic and nutritional benefits to target communities, as it will be supported by nutrition education so that people are aware of the benefits of consuming legumes. Water storage is also very important because of increasing rainfall and streamflow variability resulting from climate change; the project will therefore also support small dams and ponds.

7 The study was on smallholders participating in the IFAD-funded "Rural Livelihoods and Economic Enhancement Programme", and it informed the design of PRIDE. IFAD and Government of Malawi. 2015. Baseline report on food knowledge, attitude and practice (KAP).

An institutional innovation is the "integrated contract", or single contract for the design, building and transfer of irrigation schemes. Companies are required to form consortia including an engineering firm, a works contractor and an organizational development specialist in order to bid for these contracts. The contract will include a "performance bond" clause linked to the performance of the scheme after an initial period of functioning. The purpose of this pilot is to incentivize contractors to keep costs down and maximize the amount of land under irrigation through water efficiency gains – and to achieve all this by working more closely with the community to align expectations and share responsibilities.

However, two risks in the wider landscape could impact the sustainability of PRIDE irrigation investments. The first is the level of sedimentation washed down from the upper catchments, leading to flooding over time. The second is ensuring that there is enough surface water to feed the irrigation systems, given the impacts of climate change on rainfall variability in Malawi. Seventy per cent of the land covered by PRIDE is rainfed and depends on surface waters that now have lower flows or run dry for long periods because of climate change and catchment degradation. These two risks need to be managed at the level of the wider catchment area; PRIDE is therefore combining forces with a larger scale "integrated approach pilot" cofinanced by the GEF. ERASP will focus on the agro-ecological dimensions of land management in the upper catchments with an impact on PRIDE investments.

This holistic approach means that the project strategy to improve the nutritional status of communities by promoting integrated homestead food production (encompassing both crops and livestock) is more likely to be sustainable, and farmers can move towards more diversified and nutrient-rich production and consumption.

Impacts

Expected impacts at the end of the project include:

- Smallholder households sustainably operate climate-resilient land and water management systems on both rainfed and irrigated lands (an ASAP outcome), including:
  - 1,000 hectares of land with degraded ecosystems systems, including water, rehabilitated
  - Over 5,000 additional hectares of irrigated land throughout all seasons
  - Over 15,000 farmers have secure access to land and water
  - 17,000 farmers reporting 20 per cent yield increases and adopting climate-smart practices
  - Increased resilience to climate change, where resilience is measured by households having access to irrigated land and cultivating at least three different crops (diversification) as well as applying good agriculture practices.
- Around 17,000 smallholder households reporting decreased incidence of hunger periods, measured by number of meals per day and by increased dietary diversity – an important indicator of nutrition.

©IFAD/Olivier Asselin

Senegal: What a little freshwater can do

Key facts

Project name	Climate Change Adaptation Project in the Areas of Watershed Management and Water Retention, part of the Agricultural Value Chains Support Project (PAFA)[8]
Dates	2012-2016
Target groups	22,000 households in the regions of Kaolack, Kaffrine, Fatick and Diourbel
Financing	Government of Senegal, IFAD, GEF and smallholders

The sustainable development challenge

Senegal faces a persistent lack of rain due to its location in the Sahel-Saharan climatic zone. In recent decades, human activities such as monoculture farming, bush fires, inappropriate or lack of fertilization and overgrazing have degraded the natural environment. This has resulted in lower production from crop and pastures, and the relentless march of desertification. Desertification and drought have also resulted in migratory flows and massive concentrations of people along Senegal's coastal areas, as they abandon much of the land in the interior. Salinization increasingly affects soils, surface waters and groundwater.

8 PAFA: *Project d'appui aux filières agricoles.*

All this has led to falling agricultural productivity. For example, the "groundnut basin" of Senegal, which falls within the area covered by IFAD's Agricultural Value Chains Support Project, suffers from salinization, loss of biodiversity and organic matter, and erosion. Water availability and rainfall are decreasing, evidenced by barely filled water ponds and isohyets[9] slipping southwards. The shift effectively means less rain for cultivated lands. Rising temperatures linked to climate change mean that water for farming and life is ever more precious. This degradation has drastically reduced the incomes of rural people, which, combined with the lack of alternative sources of income and basic infrastructure, is set to exacerbate rural poverty as climate change makes matters worse.

IFAD action

The project aimed to increase the resilience of agricultural production systems and associated value chains to climate impacts on water resources, thus ensuring the supply and availability of freshwater for agricultural use in this context of increasing water scarcity resulting from climate change and soil salinization. The project interventions included a focus on water harvesting and watershed management, as well as water conservation coupled with efficient irrigation.

The Government of Senegal has recognized the importance of creating water retention basins as a way to use surface water efficiently. These have therefore been supported as an option that is particularly useful for smallholders, rather than large-scale producers.

The project component on water conservation and efficient irrigation aimed to use scarce water more efficiently through improved irrigation systems and diversified production. Drip irrigation and other appropriate and cost-effective technologies were introduced, supported by awareness-raising for farmers' organizations and communities on water use and irrigation management. Improved wells have also been installed.

9 An isohyet is a line on a map connecting locations that receive the same amount of rainfall.

Impacts

Results include the following:

- Two pilot municipalities are being supported to integrate a climate and environment lens. The project will continue this activity and adapt to integrating climate and environmental considerations into local investment plans, which have just been introduced instead of local development plans.
- Over 500 hectares of salinized land has been restored for rice production in four valleys in the region of Fatick, thanks to a combination of dykes and salt-tolerant species.
- Over 4,300 metres of dykes have been built as a measure against saltwater intrusion, as well as containment dykes to prevent the loss of freshwater.
- Seven spillways will help channel floodwater for controlled irrigation.
- Almost 11,000 metres of bunds have been constructed to improve water retention of soils.
- Drainage systems have been established or rehabilitated.
- To date, 77 hectares of rice fields have been put under irrigated production to serve 6 farmers' organizations, benefiting 295 households.
- The project has supported certified seed production for the "Nerica" rice variety, which is well adapted to environments with less water availability, thus paving the way for more resilient livelihood options for farmers.
- Twenty-two kitchen gardens totalling over 70 hectares have been rehabilitated, including with solar equipment; and 17 kitchen garden management committees have been supported, reaching 429 people (222 women, 116 men, 33 young boys and 58 young girls).
- Women have benefited significantly from the broader PAFA targeting approach, and concretely from initiatives targeting a reduction in their workload, such as solar energy powering pumps that extract water from wells and enable them to water their kitchen gardens. Their economic empowerment has also improved, with many attracted back to abandoned kitchen gardens and better able to provide for their families.
- Nutritional benefits have resulted from diversified production, including from fish consumption, made possible by irrigation and better water availability.
- 3,500 households have been trained in efficient water management techniques for rice cultivation.

This case study is adapted from "The Drylands Advantage: Protecting the Environment, Empowering People" (IFAD, 2016c).

©BIRDP/IFAD

Sudan: Reducing risk in rainfed agriculture

Key facts

Project name	Butana Integrated Rural Development Project (BIRDP)
Dates	2008-2019 (a second phase with additional financing was approved in 2016)
Target groups	Phase 2: 384,000 households (directly) and 64,000 households (indirectly)
Financing	Government of Sudan, IFAD including ASAP, smallholders

The sustainable development challenge

The Butana region of Sudan is dominated by desert to arid agroecological zones, and characterized by low and erratic rainfall. This, together with a short growing season, poses a significant risk to agricultural productivity and livelihoods in the region. Both sedentary smallholders and nomadic pastoralists rely on animal herding, which is the dominant livelihood system. However, open access to range and water resources has led to severe environmental damage around water points and contributed to acute water shortages. Small-scale rainfed agriculture of mainly sorghum and millet is also practised, but a changing climate means even less rainfall and more drought. Indeed, pastoralists perceive climate change and land clearance for agriculture, overgrazing and herbicide application, as some of the main causes of a steady deterioration of

In the Butana region of Sudan, these women have joined hands to protect and restore community grazing land.

the extent, productivity and biological diversity of rangelands. Weak governance and environmental degradation exacerbate people's dependence on low and erratic rainfall, and poverty rates are high. Around half the population of herders in the region are classified as poor.

IFAD action

The project has a multiple-benefit approach, designed to promote more sustainable production and environmental protection, as well as reduce climate risk and poverty. Key strategies from the start have been the conservation and restoration of the ecosystem services on which livestock and agriculture depend, and the sustainable management of natural resources – including scarce water resources. BIRDP builds on best practices in soil water conservation techniques proposed in Sudan's National Adaptation Programme of Action (NAPA), such as modified terrace cultivation, earth-bund construction and V-shaped water harvesting structures, as well as rangeland and forest rehabilitation.

Access to water for people and animals is being improved through building water infrastructure and developing conservation techniques, such as *hafirs* (underground reservoirs to store water carried by streams), rainwater harvesting from roofs and road surfaces, water cisterns and water yards. Investments have been guided by a water resources assessment, as well as local investment plans. Meanwhile, a collaboration with the International Center for Agricultural Research in the Dry Areas (ICARDA) is working to identify innovation in making the best possible use of irrigation water more efficiently ("more crop per drop"[10]).

The project also places great emphasis on improving governance and supporting strong institutions, including for water management. Local natural resource management (NRM) groups have been supported, and these will be linked to the Ministry of Agriculture and its federal departments to lobby for a workable governance framework and harmonized laws and regulations across the region. Studies, such

10 See http://www.icarda.org/systems-solutions/improving-water-productivity-achieving-more-crop-drop.

as an ecological zoning study, will inform policy support and discussions in local NRM forums. Local development and environmental plans are being developed, and these are being supported by a cadre of extension agents trained in soil and water conservation, management of water facilities and advanced gender mainstreaming, among other skills.

Impacts

Since 2009, the first phase of BIRDP has reached more than 87,000 people in 140 "mother" communities; of these, around 66 reached out to 119 "satellite" communities to replicate good practices. More than 100 *hafirs* and water yards have been constructed, and a sound system to manage the infrastructure is in place, supported by relevant training. More than 20,000 households have adopted natural resource related technologies and about 150,000 hectares of land is under NRM practices.

Expected impacts of a second phase, approved in 2016, include improved water access for domestic use as well as livestock and agriculture; improved governance of water as a key ecosystem service; greater resilience to droughts; and improved livelihoods. Additional benefits include better nutritional status and human health from improved domestic water supplies and water investments, and greater women's empowerment from more participation in community decisions, as well as reduced time collecting water.

Today, the project is aiming for:

- 5,000 people, mainly pastoralists, reporting secure access and user rights to water
- 280 climate-resilient community village plans, which include water management provisions
- 75 new water infrastructure investments and 375 people to be trained in their management
- Time spent collecting water to be reduced from up to 3 hours to 30 minutes a day
- Development of rainwater harvesting in 150,000 hectares of public range and forest land, thereby scaling up the successes of the first phase
- Introduction of irrigation systems in 100 hectares
- 360,000 hectares of land to be brought under climate-resilient practices and 50,000 hectares under rainfed agro-forestry
- Development of efficient policy and natural resource management framework governance to better manage the shrinking natural resources in the Butana area.

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Conclusions and way forward

World Water Day 2018, devoted to "Nature-based solutions for water", reminds us that we can reduce floods, droughts and water pollution by using the solutions we already find in nature.[11] IFAD is striving to do just this, and in addition IFAD is seeking to protect the livelihoods of the millions of smallholders who depend on fresh water.

Given its ambition to be "bigger, better and smarter" (IFAD, 2016a), IFAD is focusing on how to scale up its water-related investments as part of the drive to deliver on Agenda 2030 and IFAD's related goal of inclusive and sustainable rural development. One way forward is to step up IFAD's engagement in policy dialogue on water issues at the international, regional and national levels, building on successful local changes in water governance to shape policies on food security and water resources management.

IFAD has also placed great emphasis on knowledge management as a foundation for scaling up. For example, a grant to the CGIAR (the CGIAR Challenge Programme on Water and Food) has led to a series of "outcome stories", all of which have scale potential.[12] Some key learning points from IFAD in scaling up agricultural water management in particular are given in Box 1.

Yet another part of IFAD's strategy with scale potential is the marrying of the traditional knowledge of smallholders with modern science and technologies. For example, in Bolivia, IFAD is supporting a climate change adaptation project that

11 From UN-Water website accessed January 2018.
12 Accessible at https://waterandfood.org/outcome-stories/.

uses an indigenous climatic information system called the Pachagrama. This system (which derives its name from Pachamama, Mother Earth) is a register that catalogues "bio-indicators" (i.e. the behaviour of plants and animals). Indigenous peoples' communities compile and share the Pachagrama in order to know when to plant, when the rains are expected to begin and how long they will last. This system supports processes of managing agro-climatic information. In Bolivia, which relies on a weak meteorological reporting system, the Pachagrama is a cost-effective and reliable system, which has proved to coincide with scientific data and has helped to reduce agricultural losses. It thus constitutes a good practice for producers and decision makers who are developing processes of adaptation to climate change. In addition to adopting indigenous peoples' systems, the project is introducing new techniques compatible with local practices. Such is the case of the *quthañas*, a water-harvesting system used by the Aymara people that collects water by means of small dams. The project is integrating the *quthañas* into a larger scheme that includes the construction of basins, ponds, and small and medium-sized dams at the family and group levels in watersheds, intended as an adaptation measure to overcome the negative effects of climate change on water availability (IFAD, 2016b).

Scaling up ways to tackle women's water-related work burden and nutrition gains also represent critical opportunities.

Looking ahead, UN-Water sets out how IFAD and its partners can work towards positive outcomes to celebrate on World Water Day in 2020, when the theme will be "climate change":

"Water plays a pivotal role in how the world mitigates and adapts to the effects of climate change. An integrated view on water, the biosphere and environmental flows is required to devise sustainable agricultural and economic systems that will allow us to decelerate climate change, protect us from extremes and to adapt to the unavoidable at the same time."

The second phase of ASAP presents an important opportunity to scale up sustainable solutions for managing climate-related water stress for smallholders, for example by strengthening the capacities of water user groups.

To conclude, IFAD is committed to protecting freshwater resources that represent a fundamental input for smallholders, and in so doing to mitigate greenhouse gas emissions from better soil and water management, protect communities from climate-related disaster, ease women's work burdens and also improve nutrition outcomes for smallholders. Concretely, IFAD will invest in protecting water as a natural resource as well as promote better water management for agriculture and value-addition activities.

Box 1: IFAD's key messages for scaling up results in agricultural integrated water management

A watershed management approach is the foundation for planning and implementing integrated agricultural water management interventions. Climate change will affect the way that watershed management will be carried out, which will possibly involve the development of complex water allocation systems and provision of incentives to save water in the era of economic and/or physical water scarcity. With a watershed management approach, projects are about collective action and managing externalities. Putting in place the right incentives for everyone to act towards a common goal, equitable representation of users, and delegation of authority to the appropriate local level are critical when considering scaling up pathways.

A supportive policy environment and the right institutional set-up are key, particularly with respect to water users. Strong rural institutions are also central to sustainable scaling up of agricultural water management impacts.

IFAD's comparative advantage lies in downstream undertakings, such as the development of irrigation, capacity development of poor rural people and their institutions, and improving access of farmers to markets and financial services. The importance of technology choices should not be understated. Such choices should be tailored to the needs and capacities of the users and depend on the physical characteristics of the area, the scale of the project, and preferred ownership and operation arrangements. Technology choices should be flexible enough to allow multiple uses of water.

Making sure that more secure access to water leads to higher productivity and income is a multidisciplinary endeavour. It requires better coordination between the ministries of water, of irrigation and of agriculture, providing better integration into value chains and market opportunities, access to credit, technical assistance and private-sector involvement. It also means getting a better handle on the economics of water use and awareness of whether or not government subsidies skew incentives towards sub-optimal use of water. To assist farmers in developing medium- and large-scale irrigation systems, IFAD will need to partner with other investors (governments, international financial institutions, the private sector) and the farmers themselves, as it does not have the financial capacity to fund the development of bulk water supply infrastructure.

Adapted from "Agricultural Water Management: Scaling Up Note" (IFAD, 2015).

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The appointment of IFAD's President, Gilbert F. Houngbo, as the new Chair of UN-Water in 2017 is an important opportunity for IFAD to serve the global community in the fight to conserve the world's freshwater.

"I am pleased to take on the chairmanship and look forward to leading this global framework that aims to provide all people with access to sustainably managed water and sanitation services," he said.

ASAP Donors and Partners

IFAD's Adaptation for Smallholder Agriculture Programme (ASAP) is a multi-donor programme that helps smallholder farmers cope with the impacts of climate change so they can increase their resilience.

As of 1 October 2017, the total commitments from ten donor countries (Belgium, Canada, France, Finland, Netherlands, Norway, Republic of Korea, Sweden, Switzerland and United Kingdom) amount to US$366,498,858 (subject to market currency fluctuations).

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International Fund for Agricultural Development
Via Paolo di Dono, 44 - 00142 Rome, Italy
Tel: +39 06 54591 - Fax: +39 06 5043463
Email: ifad@ifad.org
www.ifad.org
ifad-un.blogspot.com
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