The Lab
Driving Sustainable Investment

Monetizing Water Savings (MWS)

LAB INSTRUMENT ANALYSIS
September 2020

DESCRIPTION & GOAL —

A novel, collaborative approach to improve economic outcomes for farmers, create resilient supply chains and increase water efficiency by using "pay for performance" to accelerate sustainable agriculture practices in water-stressed regions.

SECTOR —

Sustainable Agriculture, Water, Nature-Based Solutions

FINANCE TARGET —

Corporations (food and beverage), water utilities and water funds; development finance and impact investors.

GEOGRAPHY —

For pilot phase: Mexico
In the future: Brazil and the rest of Latin America

The Lab identifies, develops, and launches sustainable finance instruments that can drive billions to a low-carbon economy. The 2020 Global Lab cycle targets four specific sectors across mitigation and adaptation: nature-based solutions; sustainable agriculture for smallholders in sub-Saharan Africa; sustainable energy access; and sustainable cities, as well as three regions: India, Brazil and Southern Africa.

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The authors of this brief are Federico Mazza and Matthew Solomon.

The authors would like to acknowledge the following professionals for their cooperation and valued contributions including the proponents Maggie Gonzalez, Ana Gabriela Morales, Todd Gartner (World Resources Institute) and David Moreno (FEMSA Foundation).

The working group members are: Hugo Alberto Contreras and Justus Raepple (The Nature Conservancy), Steven Baillie (International Finance Corporation), Casey Brown and Alexa Bruce (University of Massachusetts), Alice Caravani and Angelina Avgeropoulou (UK BEIS), Alejandro Diaz Loyola (Convergence), Joao Domingo Cicarini Junior (BB Securities), John Dore (Australian Department for Foreign Affairs and Trade), Emily LeCornu (AECOM), Patricia Martha Narváez García (Asociación Bancos de México), JP Moscarella (Climate Finance Advisors), Raúl Muñoz, Larissa Denea Trejo Carcamo, Keisuke Sasaki, Ricardo Sandoval Minero and Pedro Moreo Mir (Inter-American Development Bank), Eduardo Ovejas and Isaac Martinez (RRG Solutions Mexico), Eduardo Piqueiro and Alba Aguilar Priego (CCFV), Everardo Esquivel and Carlos Hurtado (FEMSA Foundation), and Angelique Pouponneau (SeyCCAT). The authors would like to acknowledge the contribution of the experts: Jake Davis (NatureVest), Vincent Lagace and Maria Luisa Luque (Nuup), Thomas Legrand (independent consultant) and Gabriel Thoumi (Planet Tracker). Special thanks to Albert Amos (former-World Resources Institute).

The authors would also like to thank Ben Broche, Barbara Buchner, Elysha Davila, Ricardo Narvaez, Daniela Chiriac, Leigh Madeira, Valerio Micale, Rob Kahn, and Júlio Lubianco for their continuous advice, support, comments, design, and internal review.

The Lab's 2019/2020 programs have been funded by the Australian, Dutch, German, and UK governments, as well as Bloomberg Philanthropies, GIZ, the International Fund for Agricultural Development (IFAD), the Rockefeller Foundation, and the Shakti Sustainable Energy Foundation. Climate Policy Initiative (CPI) serves as Secretariat and analytical provider.

SUMMARY

Climate change is worsening water scarcity issues around the world. Agriculture irrigation accounts for 70% of freshwater consumption globally. Intensive groundwater pumping depletes aquifers, affecting urban water supply and food production, while increasing the vulnerability of smallholder rural farmers in arid and semi-arid areas.

Improving agricultural irrigation practices has enormous potential to address water crises, but farmers in developing and emerging countries often lack the right resources, business models to participate in, or incentives to implement them.

Monetizing Water Savings (MWS) aims to provide smallholder agricultural producers, who otherwise do not have access to financing to implement sustainable solutions, with the necessary incentives and resources to increase their productivity without bearing high levels of financial risk, while increasing water efficiency, improving soil quality and increasing the climate resilience of already water-stressed regions.

This instrument meets all four of the Lab endorsement criteria and the Secretariat therefore recommends for endorsement:

Innovative: MWS is a novel approach to coordinating the efforts of government, corporate and agricultural actors to address agricultural water inefficiencies in highly water-stressed regions of emerging economies. Its specific combination of factors has not previously been seen in the water sector in a developing country.

Financially Sustainable: With the creation of two revenue streams (from producers and utilities) and a corporate partner committed to purchasing the agriculural products, MWS is expected to become commercially viable and sustain a significant level of capital and technical assistance for implementing sustainable agriculture improvements that contribute to reducting regional water deficits.

Catalytic: The proposed pilot transaction in the highly water-stressed region of Guanajuato, Mexico, is expected to serve 4,000 smallholder farmers over approximately 20,000 hectares, contributing to increase farmers' yields by approximately 30%, while reducing water consumption by 3,500 cubic meters per hectare per year. Once proven, the model can be replicated in other arid and semi-arid agricultural hotspots around the world. The instrument can generate economic, environmental, and social returns amidst COVID-19, making it a viable instrument for green recovery.

Actionable: The combined existence of an experienced proponent providing agricultural, financial, and water management expertise, a pilot site, and a private sector corporate partner who is sponsoring feasibility studies are key elements for implementation, although additional steps are required to secure farmer interest and confirm the logistics of the instrument. Further analysis into the details of monetization, metrics development and legal arrangements are being taken to secure the participation of water utilities, which is a critical component for actionability.

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Next steps: FEMSA Foundation, WRI and their partners are currently developing a pilot transaction and finalizing feasibility studies, impact metrics and causality links to develop a model to monetize farmers' water savings by incorporating local utilities. As the project evolves, additional financing will be necessary to meet the intended scale to serve thousand of farmers and untap the full potential of nature-based solutions beyond the farmed lands. All of these steps would benefit from the Lab endorsement.

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CONTEXT

Irrigated agriculture is the single largest source of water consumption worldwide. Improving irrigation efficiencies can greatly contribute to addressing water crises exacerbated by climate change.

Agriculture irrigation accounts for 70% of freshwater consumption globally (FAO, 2020). Intensive groundwater irrigation pumping to support inefficient agricultural practices not only depletes aquifers but is expensive and can expose consumers to unsafe water. In many parts of the world, regulating the excessive use of groundwater is often impeded by political considerations. Floods and droughts are also intensifying due to land degradation, poor environmental management and climate change, making it increasingly critical to manage water resources and build overall hydrological resilience.

Improving water management in the agricultural sector has enormous potential to address water-related crises while improving the stability and profitability of agribusiness and connected value chains. However, despite the obvious benefits, smallholder farmers in developing countries often lack the access to financing, correct incentives and technical know-how to implement improvements.

The Monetizing Water Savings (MWS) instrument provides agricultural producers with the necessary tools to become more productive while significantly reducing their water consumption. These solutions improve the resilience and reduce the water deficit of already water-stressed agricultural-intense regions, contributing to the business continuity and profitability of producers themselves, the supply chains of related large corporate buyers, local water utilities and governments, and ultimately household consumers in nearby cities.

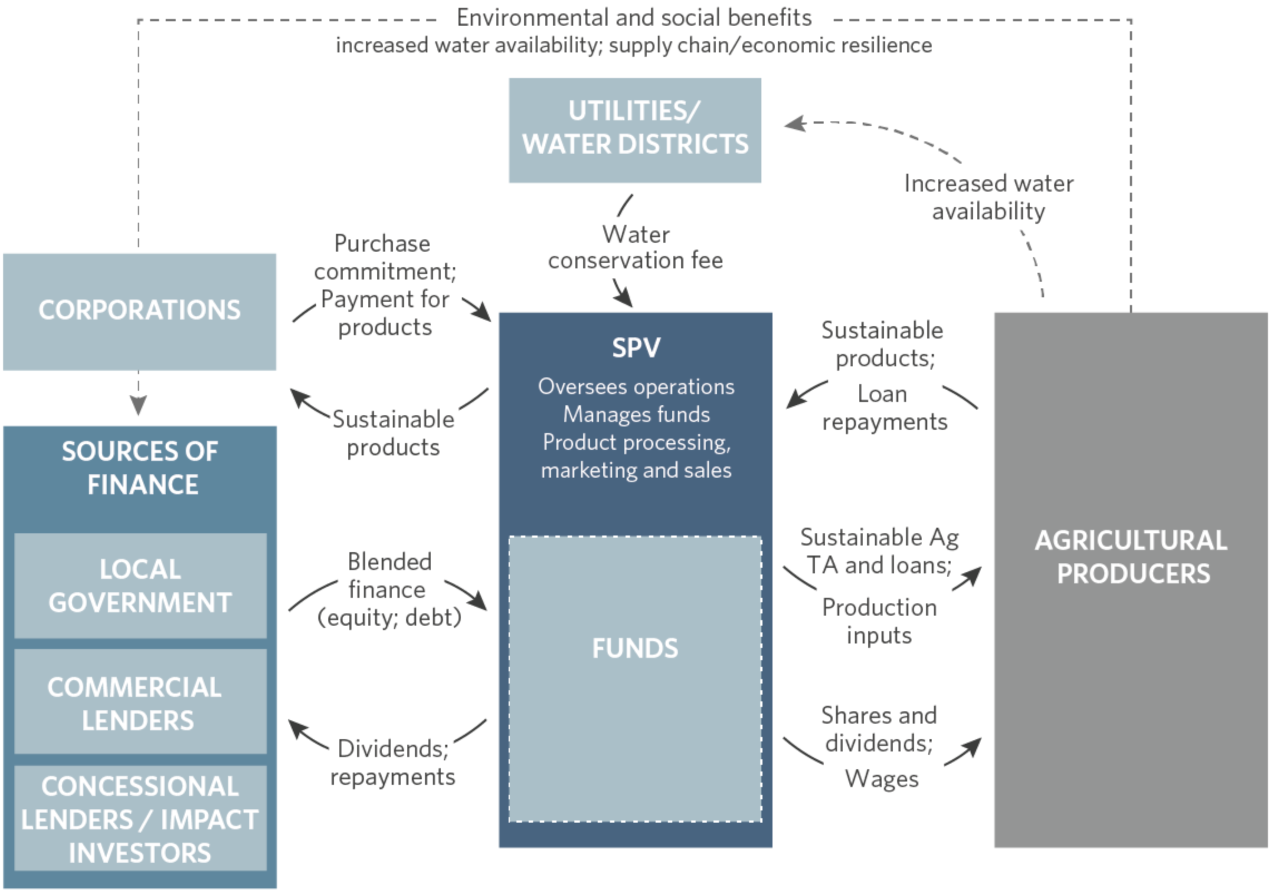
CONCEPT

1. INSTRUMENT MECHANICS

MWS will improve water conservation and economic outcomes of agricultural producers by providing financial and technical resources to expand sustainable agriculture practices.

Proposed to the Lab by the World Resources Institute (WRI) and the FEMSA Foundation, MWS is a multi-stakeholder approach to increase sustainable water usage in the agricultural sector of emerging countries, while improving economic outcomes for agricultural producers and the resilience of related supply chains. Figure 1 illustrates the key actors and financial flows.

Figure 1. Instrument mechanics



MWS will be set up as a Special Purpose Vehicle (SPV), responsible for aggregating multiple agricultural producers and facilitating and monitoring the adoption of new equipment and practices, that will increase farmers' productivity while significantly reducing their water use and associated costs. These practices include the implementation of Nature-Based Solutions (NBS), such as conservation agriculture, riparian buffer strips, or cover crops, along with technification and other water efficiency measures, and will be tailored to characteristics of the specific country or region targeted.

An overarching committee formed of representatives from the different groups of stakeholders involved (including an anchor corporation, technical water management experts, individual producers and cooperatives, local NGOs, public sector and financial partners) will i) set up the SPV, ii) identify the optimal locations for implementation, iii) oversee and coordinate operations (including the screening and monitoring of producers), iii) aggregate, process and sell the product, and iv) allocate funds to farmers and collect repayments.

A corporate partner helps to secure the demand of crops produced by farmers through a purchase commitment signed with the SPV, which aggregates and processes the crops produced by the individual farmers, organized under a newly established cooperative association. This approach enables the corporation to obtain reliable, sustainable and resilient sourcing and over time creates a more integrated supply chain.

Funds will be deployed to farmers in three main ways:

- Capital investments, in the form of loans at favorable terms to i) purchase modern and efficient irrigation systems, ii) introduce conservation agriculture practices, including NBS. The financing terms are targeted at farmers that might not otherwise have access to financing at all, offering favorable combinations of term length and interest rates as compared to the financing options normally available. Loan terms may vary based on the extent of conservation agreed by the farmers: for example, interest rates decrease as farmers implement supplementary measures and environmental practices to increase their water efficiency. In exchange for the favorable loan terms, producers agree to sell their products to the SPV and accept its water monitoring requirements.

  Depending on the farmers' preferences and the on-the-ground conditions, there may be an option for the farmers to become equity shareholders in the SPV, in addition to receiving loans.

- Technical expertise, offered before, during, and after the loan agreement.
  Pre-financing: MWS' experts identify what practices bring the highest gains to individual farmers in terms of productivity, cost reduction and water savings and work with them to develop a tailored financing plan. MWS' water management and financing experts will determine what the optimal strategy will be in terms of reducing the water deficit and how to best structure agreements between the farmers and the SPV. These initial assessments will also explore what NBS can be implemented and the potential for switching to higher value crops.

  During the whole financing cycle: MWS will continue to assist farmers throughout the financing cycle, helping them to implement and maintain new equipment and practices, expand market access, monitor water usage, and track savings. As part of its capacity building activities, MWS will develop a longer-term commercial strategy with farmers and formalize their role in the supply chain of the anchor corporate partner.

- Production inputs, like seeds, fertilizers and wages.

Along with the sale of products to the corporate, once operational the model unlocks two additional revenue streams:

1. Repayments of farmer loans through increased crop revenues, reduced costs and improved access to markets.
2. Monetization of systemic water savings, from water utilities or other public institutions through a water conservation fee paid to the SPV and calculated with a "pay for performance" approach. The SPV will be responsible for monitoring water savings and will work with a third-party entity that will independently audit these water savings on a regular basis.

Upfront capital to set up and scale the model will come from different investor classes, ideally as a blended mix of equity and debt from development finance institutions, local governments and agencies, impact and commercial investors, and corporate partners.

1.1 KEY STAKEHOLDERS

An initial pilot of this mechanism is currently being developed in the state of Guanajuato, Mexico with a specific focus on improving water efficiency for local production of grains (more in Section 3.1). The model can be replicated in other countries where similar conditions exist and key stakeholders are mobilized to implement it. Below is a summary of the stakeholder types in MWS and the benefits they receive from participation in the scheme.

Anchor corporate partner: The corporate partner will contractually agree to buy crops produced by farmers participating in the instrument, simplifying and further integrating the supply chain, thus reducing the company's uncertainty and the risk of participating farmers.

The ideal corporate partner is a large food or beverage company, willing to pay a price to improve their water efficiency of its suppliers in order to safeguard its operations from current and projected water scarcity, as well as to create a more sustainable, integrated and resilient supply chain strategy. In addition, the corporate partner could receive value from the model by providing upfront funding and participating as an equity investor.

The FEMSA[1] Foundation will be the main corporate partner in the pilot project, and is coordinating with the technical advisors to develop a technical and financial strategy to ensure a financially viable, environmentally sustainable and socially equitable project.

Water management experts and technical advisors: These technical advisors will play a key role in laying the analytical foundation to generate the desired impact in terms of reducing the water deficit and creating positive economic outcomes.

FEMSA Foundation has strategically established a partnership for the pilot stage with the World Resources Institute; RRG Solutions Mexico, a sustainability-focused private equity firm; University of Massachusetts; and Rieggo[2], an irrigation solutions organization. RRG Solutions Mexico, WRI, and the University of Massachusetts are contributing financial, hydrological systems, and regional analysis required to choose a pilot site, construct the instrument, and

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[1] FEMSA Foundation works to positively impact people and communities through social investment for sustainability. It focuses on three strategic areas: i) promote the efficient management of resources for sustainable development, ii) foster a comprehensive development for early childhood and iii) disseminate Latin American art and culture. FEMSA Foundation contributes to the creation of social and environmental value of FEMSA, a listed multinational beverage and consumer products company based in Monterrey, Mexico with over 300,000 employees in 13 countries. For more information: www.femsafoundation.org

[2] https://rieggo.com/

model impacts. It is conducting the initial assessment of water availability, potential savings, and value of such savings in the pilot project region. Rieggo will provide support for implementing the technification solutions.

Public sector partner (water utilities, state governments, water districts, municipalities): Public sector entities have similar interests in reducing water overconsumption from agricultural producers but lack the jurisdiction and resources to address the underlying issues that have caused it. For example, inadequate pricing of water and electricity for pumping, or unsustainable allocation of water extraction rights are a major concern for many public sector entities. At the same time, growing urban centers in many parts of the world often face water shortages and need to identify alternative water sources, especially as they prepare for the increasing potential of drought conditions.

Technical efficiencies introduced by the MWS will reduce the water needs of participating farmers, easing the pressure on the local surface and groundwater resources. If properly monitored, a portion of this water savings may be transferred for use by water utilities in nearby urban centers that rely on unsustainably over-tapped aquifers, partially relieving the urban water deficit and potentially even reduce the cost to implement more expensive water infrastructure solutions. In exchange for these benefits, public sector institutions will pay a "conservation fee" to MWS.

Civil society organizations: CSOs will be vital in implementing MWS through local relationships, expertise in introducing and maintaining sustainable practices, and assistance in formalizing farmer interactions.

Several CSOs are currently partnering with the proponents to design the pilot project:

- Nuup[3], a Mexican non-profit organization, will conduct market research, contribute to the design and inform high-level strategy, and facilitate stakeholder dialogue.
- A platform to aggregate farmer financing such that farmers are shareholders in the SPV and payments and communications are simplified will be based on similar initiatives from Grupo Paisano[4], a multidisciplinary fair trade company focused on smallholder producers.
- Water funds, such as the newly established water fund in Guanajuato named Cauce Bajío[5], will assist with governance and supervision of the fund.

Farmers: MWS initially targets smallholder farmers (< 5 hectares) who use inefficient irrigation practices and systems and who may or may not be the owners of the land they cultivate. Many of these farmers do not have access to longer-term financing and technical assistance to upgrade their irrigation practices. In order to scale quickly and reach as many farmers as possible, MWS will contract a specialized company to create a new cooperative or association to aggregate the farmers and manage their products and cashflows. Through the cooperative, farmers will sell their products directly to the corporate end-buyer, bypassing various intermediaries that reduce their share of revenues.

Independent impact evaluator: A third-party independent organization will be necessary and tasked with: (i) conducting the initial assessment of water availability, potential savings and value of such savings in the region, and (ii) monitoring and measuring the realized impacts. As part of the initial feasibility assessment, the University of Massachusetts is currently running a hydrological and water resilience study on water flows in the pilot area in Mexico,

[3] https://nuup.co/
[4] http://www.grupopaisano.com/
[5] https://www.burocreativo.com/femsa/

water efficiency interventions on groundwater recharge, and economic outcomes for farmers which will act as the baseline for the independent impact evaluation.

1.2 NBS AND TECHNIFICATION SOLUTIONS

The MWS aims to increase farmers' efficiency, while generating water savings, through sustainable agriculture practices, including two main types of activities: technification and NBS[6].

Technification: The model primarily supports the purchase, installation and maintenance costs of modern irrigation systems (e.g., automated drip irrigation), which allow for more efficient use of water and targeted use of fertilizers and pesticides, the single main cost for most farmers. Energy costs will also decrease, as farmers will reduce the extraction of groundwater through diesel-powered well pumps. MWS will also invest in a monitoring system, as this will be a critical component to ensuring compliance with the model.

Other practices for sustainable water conservation may be funded, including systems for rainwater harvesting, water reservoirs, irrigation land levelling and farmer's digitalization. Well perforation and groundwater pumping equipment will not be funded, since one of the goals of the instrument is to reduce groundwater extractions.

Nature-Based Solutions: One key condition for farmers to access the MWS financing solutions is the adoption of conservation agriculture (CA) practices. CA is a sustainable farming approach based on three principles: crop diversification, minimal soil movement and permanent soil cover. The benefits are widespread, as CA conserves natural resources, biodiversity, and labor, while improving long-term soil quality, water retention and drought resilience (CIMMYT, 2020).

Depending on field location, soil type and farmer preferences, the MWS team will work closely with farmers to introduce additional NBS that have potential to further improve the soil quality and add benefits for biodiversity and climate resilience. Some of these solutions may eventually unlock new income streams for the farmers. Examples of these practices could include different forestry and agroforestry solutions, like alley-cropping (potentially with high commercial value trees), filter strips with native vegetation or conversion of field hedges to sown pollinator areas.

Beyond the farm level, MWS will leverage connections with municipal and state governments to introduce **"landscape improvements"** (when applicable), restoring degraded and unused lands of public domain.

Crop switching: In parallel to the previous two categories, MWS will also work with farmers to explore the possibility of diversifying their current production and switching to different crops that have higher value and are more water efficient. This change will require a broader set of solutions, from irrigation equipment, to provision of expertise and practices, to different transportation and selling arrangements for the new produce.

In order to bolster the successful implementation of all the sustainable practices, MWS will provide long-term capacity building to farmers in other related areas such as strategy development, formalization of the purchase contract with the corporate partner, and assistance with the payment mechanisms.

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[6] Nature-based solutions are defined by IUCN as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits" (IUCN, 2020).

2. INNOVATION

For the first time in an emerging country's water sector, MWS will monetize the benefits that corporates, water utilities and other stakeholders may accrue from increased long-term water security and availability.

2.1 BARRIERS ADDRESSED: PROVIDING FARMERS TOOLS TO INCREASE WATER EFFICIENCY AND YIELDS

The instrument addresses key barriers that are preventing agricultural producers in water-stressed areas from investing in sustainable agriculture practices and water efficient technologies.

Barrier: water efficiency is not effectively tracked and paid for by beneficiaries. In Mexico, many water meters are either uninstalled or do not function properly (Hoogesteger and Wester, 2017), and there is limited state capacity to offer a solution. Since there is no mechanism for utilities or other beneficiaries of water savings to receive or pay for these efficiencies, there is limited financial incentive to institute solutions.
Response: MWS partners with utilities to monetize water efficiency, ensuring a monetary benefit of increased monitoring and verification. MWS will develop a monitoring and evaluation plan with which smallholders are required to comply to access loans and other support.

Barrier: limited incentives for farmers to implement water efficient practices. In many countries, the cost of water and electricity for pumping groundwater[7] are often subsidized, representing only a minor component of farmers' expenses. In addition, when multiple farmers extract water from a communal well, investment in water efficiency may be jeopardized by the collective action problem in which neighboring farmers that have not adopted sustainable practices will benefit from increased water availability without making similar investments. Therefore, investments into water efficiency are not considered by smallholders as a priority to save money or increase sustainability in the system, even as they recognize the broader regional water crisis.
Response: MWS will focus on improving farmers' economic outcomes by increasing yields and profits, as well as reducing the associated costs of adopting modern irrigation systems (e.g., fertilizers[8] and labor) that simultaneously generate significant water savings and create the appropriate incentives for farmers to collectively adopt these types of practices.

Barrier: lack of awareness and financing solutions to implement sustainable agriculture and NBS best practices. Public and private investment into sustainable agriculture remains small in emerging countries, with local entities often lacking the necessary technical awareness[9] to implement them successfully. In Mexico, access to financial resources for climate smart agriculture is a major challenge, as only 1.5% of finance products are channeled to the rural sector. Farmers often struggle to access finance products because this financing is not

[7] In Mexico, agricultural consumers pay the lowest electricity prices among all consumers. This disincentive encourages elecricity consumption to pump up water from underground wells.
[8] Fertigation is the application of fertilizers with irrigation water. Its efficiency can be maximized with modern systems, leading to significant cost savings for the farmers.
[9] In Mexico, for example, less than a third of agricultural producers apply fertilizer based on soil analysis (World Bank; CIAT; CATIE. 2014). Some farmers also appear not to know precisely the size of their fields, which means calculations about the necessary irrigation levels are very inaccurate (Löffler-Dauth, 2017).

aligned with farmers' productive conditions (World Bank; CIAT; CATIE. 2014).
Response: MWS will provide financing at competitive terms to purchase modern irrigation systems and introduce conservation agriculture practices, for smallholders to which commercial financial institutions would otherwise not lend. Depending on the land conditions, there might be a possibility for the farmer to achieve lower financing rates by opting in to installing and maintaining NBS that result in greater long-term environmental benefits. MWS will also provide initial and ongoing technical assistance and training to de-risk these operations and increase the reliability of repayment.

Barrier: Farmers generally operate individually and must rely on intermediaries, lowering their profits and increasing supply chain complexity and costs for corporate partners. Variance in farmer professionalization further increases costs and uncertainty for all stakeholders.
Response: MWS will work with local civil society organizations with pre-existing farmer relationships to establish an internal cooperative structure to aggregate farmers and their products. This cooperative structure will allow farmers to gain a preferential selling channel for their products, ensure cooperation and monitoring of water savings, and depending on the region and the farmers' preferences, they could join the SPV as shareholders. Corporate partners will benefit too as they will sign long-term supply contracts and interact with a centralized group of dedicated suppliers, on top of the environmental and social responsibility benefits.

2.2 INNOVATION: MONETIZING WATER SAVINGS

At the heart of MWS is the concept of monetizing the benefits of water efficiency practices and NBS. MWS is unique because it not only has in-house expertise and technical knowledge, but it partners both with a corporation to incentivize farmer involvement, and with a water utility or governmental entity to capture the benefits of increased water availability to the entire water system through a "conservation fee". While these concepts have been used in the water sector in the US and other developed countries in a few different projects, they have not yet been developed in Latin America.

Water efficiency practices and NBS at the farm level can increase the overall availability and sustainability of water in the region. In theory, a portion of the "additional" water in the system from sustainable sources can be transferred to water utilities in nearby urban centers that are otherwise relying on unsustainable sources. MWS can therefore contribute to easing the pressure on overexploited local water sources in the rural and urban sectors and reducing the local water deficit. Depending on the biophysical conditions and regulatory environment, this net benefit can be achieved in different ways, and the specific transaction structure will depend on the unique set of conditions. Four scenarios are presented in Annex I.

In order to properly align incentives and share risks for the SPV, the water utility, and other investors and off-takers, the "conservation" payments from the utility to the SPV should be based on the instrument's ability to meet certain criteria, whether that is, for example, cubic meters of water saved or farmers serviced:

- If MWS does not meet this threshold, the utilities do not get the benefits of water savings and will pay a lower amount to the SPV. In this case, utilities are forced to acquire water from more unsustainable sources and in some instances spend more on grey infrastructure, charging those costs to consumers in the territory.
- If MWS does meet the threshold, then the utilities provide full (or excess) payment to the SPV, resulting in excess returns to investors. The rate of payment would be structured such that even when it is higher due to instrument success, the utility still

benefits because the payment is lower than either the utility's avoided costs or the value to the utility of having access to alternative water sources.

As a result, the SPV and the utility are financially incentivized to implement the project as effectively as possible. This type of scheme is appropriate for the utility (or other public sector institutions) because the utility has a higher ability to bear risk than a smallholder farmer and has substantial upside benefits from effective implementation.

Calculating the most appropriate conservation fee, can be done with two approaches: "pay for success" and "pay for performance." The best approach depends on ease of monitoring, risk appetite, and ability to connect actions to end outcomes. Examples of comparable PFS and PFP instruments are provided in Annex II.

- In a pay for performance (PFP) arrangement, the utility would pay the SPV a set amount based on an easily trackable and relevant metric, such as number of farmers who received drip irrigation systems or who switched crops. PFP does not require as extensive modelling or monitoring of water flows, but payments will be less accurately tied to real-world outcomes. This option is more likely to be implemented in the current MWS framework due to its relative simplicity and low cost of implementation.
- Under a pay for success (PFS) model, the utility would pay the SPV based on the exact amount of farmers' water reduction. This arrangement rewards actors for tangible beneficial outcomes, such as cubic meters of increased water availability, but comes with higher administrative and analytical costs. Comparable examples of PFS instruments in the water sector are primarily in the US, Europe, and the Middle East, and this type of instrument has not been developed extensively in developing countries.

2.3 CHALLENGES TO INSTRUMENT SUCCESS

To increase the probability of its success, the Lab Secretariat has thoroughly analyzed potential challenges to implementation (Table 1), along with the strategies to address them that the proponents will incorporate into the design and operational practices of MWS.

Table 1. MWS challenges and response

Challenge	Description	Response
Low adoption rate from farmers	Due to historical and cultural ties to established farming practices, rural communities may be reluctant to adopt changes that MWS proposes (in particular, farmers that do not own the land may be unwilling to invest in long-term practice improvement)/.	MWS will focus on increasing farmers yields as the main incentive to attract farmers. Additional benefits that generate immediate cashflow will be also offered, such as offering a stake in the SPV, providing labor payments (such as wages or service contracts), and guaranteeing the purchase of produce. MWS will also promote longer term rental contracts or provide low-cost long-term loans for farmers to acquire the land they farm. The newly built cooperative will be tasked with outreach to and coordination of farmers.

Farmers defaulting on loans	Many factors may cause farmers to underperform, resulting in an inability to repay the loans, including i) risk of new crops failing, ii) variable crop yields based on drought conditions, and iii) farmer selection process	To reduce risks for farmers and the SPV, loans will cover up to 90% of the cost of the irrigation system, and the loan terms will be structured in a way that simplifies the repayment (aligning them with the farmers' production conditions and liquidity cycles). The anchor corporate partner will sign long-term purchase agreements, securing a source of income for the smallholders which helps the loan repayment. Other risk mitigation strategies like drought insurance, first-loss funds, and additional guarantees to de-risk the model especially throughout its early stages are being explored to further reduce the risks of the SPV.
Failed conversion of improvements into environmental and water benefits	Despite the adoption of water-efficient practices, farmers may fail to fully or consistently comply. For instance, by continuing to use flood irrigation and pumping of groundwater beyond their concession. Mismanagement of the new irrigation systems and abandonment of NBS may also hinder the achievement of environmental and water benefits.	Farmers involved will agree to follow monitoring guidelines and respect the water consumption concessions. The SPV would penalize farmers who violate the terms, by increasing interest rates or removing them from the facility. MWS will carry out periodic farm visits to monitor and provide free assistance on equipment maintenance and NBS implementation Enforcement efforts will be coordinated with local governments, water utilities, regulators and other stakeholders.
	Water savings may be jeopardized by increased consumption from other farmers and industrial players extracting from the same water source.	The MWS will focus its activities and outreach efforts around the area served by a specific water source (a single river or aquifer), working with as many farmers as possible in the area. The corporate partner will also commit to adopt sustainability practices and not increase its own water consumption.
	The model requires robust metrics for measuring water savings, accurate monitoring systems and attribution methodologies.	Proponents and other stakeholders in the pilot area of Guanajuato are currently collecting data to create these components. Once completed, the results will inform the creation of accurate monitoring and evaluations approaches, with templates that can be developed and used in other geographies.

3. IMPLEMENTATION PATHWAY AND REPLICATION

An initial pilot transaction is currently being explored in the region of Guanajuato, Mexico, focused on grains production.

3.1 PILOT PROJECT IN GUANAJUATO, MEXICO

WRI, FEMSA Foundation and other partners (RRG Solutions Mexico, Nuup, Grupo Paisano, Cauce Bajío, and Rieggo) are currently designing a pilot transaction in Guanajuato, a highly water-stressed region in Mexico.[10]

In Guanajuato, approximately 84% of water rights allocated are for agriculture, 13% is for drinking and general water consumption, and 3% for industrial uses (GTO Water Commission, 2017). As a result of huge growth in agricultural production and ground water wells (Maranon, 2000), ground water levels in Guanajuato are decreasing by approximately two meters per year (GTO, 2015). Moreover, due to poor water retention practices, leaky infrastructure and highly inefficient irrigation practices, water losses in the account for of up to 60% of the water used, potentially reducing water access for local agricultural producers, industrial users, and nearby cities (SDAYR-GTO, 2013). The most common irrigation method in the state of Guanajuato, as in the rest of the country, is flood irrigation[11], which is the lowest-cost method, but also the least efficient (SIAP 2018; Lopez-Morales 2011).

Given MWS's overarching goal of reducing the region's water deficit, additional studies such as those being developed by UMass, will have to be conducted for each aquifer to assess whether a portion of the "water losses" (i.e., irrigation water not consumed by crops) are currently contributing to recharging the aquifer. These studies will also incorporate the impact of NBS on water filtration and water system sustainability, and only NBS that have a positive overall impact will be suggested and implemented.

In one of the target irrigation areas for this pilot[12], near the La Purisima dam and the second largest city in Guanajuato (Irapuato), the farmers and urban users have different water sources. Irapuato relies on groundwater extractions from the Irapuato-Valle aquifer, which is severely water-stressed: the annual water deficit is 71.5 million cubic meters, and further extraction is increasingly costly and taps more polluted sources (CONAGUA, 2018). The farmers use water from the La Purisima dam, which contains adequate or surplus volume for users in the area. While in the short term it might be cheaper for the utility to continue to extract water from the Irapuato-Valle aquifer, the city cannot continue to drill deeper into this source indefinitely and must find alternative sources but conveying the water savings in the pilot area to urban centers would require the water utility or the State Government to invest in transport and treatment infrastructures.

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[10] According to Aqueduct (WRI, 2020), Guanajuato is the second highest water-stressed region in Mexico (score of 4.94 out 5), well above the country average (3.86), and Mexico is already ranked the 24th country in the world for baseline water stresses.
[11] Also known as surface or furrow irrigation, it is a cheap and low-tech practice still adopted in many less-developed areas, where farmers flow water down small trenches running through their crops (USGS, 2020).
[12] La Purisima is one of the areas being assessed through feasibility studies for the pilot site selection in Guanajuato, and the exact location will be decided at the conclusion of these studies.

The pilot project is centered around grains production in the Alto Rio Lerma Irrigation District (ARLID), due to the interest of FEMSA Foundation, which sources grains from the region. Climate change severely threatens grains yields in the region, and for example barley yields losses are estimated from 3% to 17% (Beverage Daily, 2018).

Figure 2. Map of Guanajuato

3.2 IMPLEMENTATION PATHWAY

MWS will be ideally implemented at scale in 2 stages, with a proof of concept in the planning stages.

Proof of concept: WRI, FEMSA Foundation and other partners have already begun to analyze the market potential and associated capital costs of a small piece of the pilot project within the Alto Rio Lerma Irrigation District (ARLID). Depending on the timing of the technical studies, market sounding activities, and utility participation, the proof of concept covering an initial 250 hectares will take approximately 1-2 years to implement.

COVID-19 is impacting the feasibility studies on the ground, which include surveying farmers' interest in such a model.

Stage 1: The next stage will be to expand the pilot project to other places in Guanajuato where smallholders primarily grow grains[13], targeting a total of 4,000 farmers across 20,000 hectares. This will take approximately 3 to 5 years during which the model will continue to be optimized, particularly in two areas: i) calculating a realistic "conservation fee" to monetize water savings from local water utilities based on the data collected in the previous phase; and ii) incorporating other types of water security investments beyond the farms (e.g. urban NBS, green-gray portfolios, landscape improvements and new potential sources of revenue associated to these distinct environments).

[13] While MWS is primarily focused on grains production in this initial design stage, proponents are also considering how to apply it to higher value crops (such as strawberries).

Stage 2: Assuming the Guanajuato pilot is successful, FEMSA Foundation could expand the model to the rest of Northern Mexico, Brazil and other countries in Central and Latin America where FEMSA operates and that present similar challenges and enabling conditions (more in Section 4.2). MWS will leverage the Latin American Water Funds Partnership[14], a network of more than 25 water funds operating throughout Latin America, including Mexico, and the Cities4Forests initiative[15] to expand the project and identify regions in need of and interested in an alternative approach. These water funds could also provide capital and / or be the utility beneficiary of water efficiency, depending on the region and structure of the fund.

Further replication: The pilot is dependent on the involvement of corporate partner and proponent FEMSA Foundation. There are other corporate partners targeting agricultural producers in various water scarce regions of the world. Given the catalytic and social aims of this project, the proponents of the project plan to share learnings about the model and its implementation on a regular basis through dissemination of results and takeaways.

3.3 PILOT IMPLEMENTATION CHALLENGES

Implementing the initial pilot and its expansions across the entire State of Guanajuato will face specific challenges, which the proponents are evaluating to identify the most effective solutions. The most relevant of these include:

Legal and administrative ambiguities in Mexico water governance: There are governance challenges related to which regulatory body is ultimately responsible for different administrative capacities (monitoring water usage, investing in solutions, etc.). Coordination challenges may arise between the relevant bodies involved and acquiring government signoff for budget allocations can be a time-intensive process. FEMSA Foundation and WRI are experienced working with the authorities in this region of Mexico and are already partnering with local organizations who can help manage these relationships and identify solutions that do not require governance changes.

Transfer of water rights: in order to share the systemic water benefits introduced by MWS with urban centers, water should ideally be both physically and legally allowed to be transferred between different users. Under Mexican water law, it is technically permissible for users to transfer to municipalities or water utilities a portion of the water consumption rights allocated to them by their irrigation districts. However, if the whole irrigation district consistently underuses its allocation for two consecutive years, farmers may fully lose or get a reduction of their granted volumes unless they pay a guarantee quota to CONAGUA.

Based on early consultations with experts, MWS could potentially compensate farmers or the irrigation district for the unused water rights and therefore maintain the allocated quota when actual water consumption falls below the allocation. Further research and consultation with lawyers are required to understand whether this will hinder MWS' development. Even without the ability to transfer water allocations to urban users, MWS will still generate net positive economic value due to the increase in farmer revenues, the benefits to the corporate partner, and the environmental benefits.

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[14] A coalition launched in 2011 between the Inter-American Development Bank (IDB), FEMSA Foundation, the Global Environment Facility (GEF), the International Climate Initiative (IKI), and The Nature Conservancy (TNC) to contribute to water security in Latin America and the Caribbean through the creation and expansion of Water Funds. https://www.fondosdeagua.org/en/

[15] The Cities4Forests initiative is a global network of more than 60 cities committed to harness forests and NBS to achieve climate goals. https://cities4forests.com/

COVID-19 pandemic is delaying on-the-ground feasibility studies: The COVID-19 pandemic will potentially slow down MWS' development and implementation due to on-the-ground partners' inability to interact with the local farmers right now. However, the pandemic does not fundamentally alter the longer-term financial sustainability of the instrument and all actors will face the same challenges as they did before with the added need to resolve their long-term water scarcity issues in a cost-effective manner. The instrument's solutions can be safely implemented while maintaining social distancing requirements.

4. FINANCIAL IMPACT AND SUSTAINABILITY

Preliminary modelling for the pilot project projects increased farmer revenues of 37% and an initial instrument investment of $10 million. Further replication is being considered across Latin American countries.

4.1 QUANTITATIVE MODELING

The Lab Secretariat, with the support of WRI and FEMSA Foundation, has modeled preliminary expected financial flows, farmer incomes, and environmental impacts from the proposed set of implementations.

In order to model a realistically implementable case in the next 1-2 years, this modelling exercise focuses on a 250 hectares fraction of the 20,000-hectare pilot area, and results for the expansion to the rest of Guanajuato are extrapolated from the 250-hectare proof of concept project. The baseline scenario considered is for a farmer who grows barley in the winter and corn in the summer on a 5-hectare farm using relatively outdated irrigation practices.

Proof of concept (250ha): The model assumes that the $1.1 million needed to set up the proof of concept will be funded by grant / concessional funding, with some contribution potentially to come from the local water utility or state or federal government, which could pay a portion of the water availability benefits they may accrue due to this instrument. For the initial proof of concept, modeled results include:

- 50 farmers covering 250 hectares served in 6 years (one-year grace period and then five years of repayment), with technical assistance provided to each farmer
- Barley yields increasing by 32% (from 6.8 to 9 tons/ha), and corn yields by 38% (from 13 to 18 tons/ha), resulting in a 37%, increase in operational income for farmers[16]
- An annual internal rate of return for the farmer of 39% over 10 years (based on the 10% cost of the total system and installation cost that the farmer pays as upfront downpayment, and with benefits accruing only from increased yields)
- Total upfront cost to set up the proof-of-concept of $1.1 million, which covers the purchase of technification solutions, technical assistance to install and maintain these systems, support for NBS or crop switching, and operating costs for the fund

Phase 1 (full pilot scale): A minimum scale of 4,000 farmers and 20,000 hectares is expected to be necessary to make MWS economic and provide return on investment for outside investors, based on preliminary findings. If the results from the proof-of-concept show promising results towards implementing a specific model that could help the water crisis while increasing crop efficiency and farmer outcomes in the region, RRG Solutions Mexico will be involved in raising capital, structuring a viable financial product, and identifying the correct investment size and expected returns for the pilot project. The initial estimate is $10 million.

As the FEMSA Foundation's feasibility studies and conversations with local stakeholders continue, this estimate and its details will be refined and fine-tuned. A part of this refinement will be a detailing of investment opportunities comprising varying levels of risk and returns.

[16] Using more conservative assumptions or if the pilot project is located in an area with a different baseline, farmer incomes may instead increase by 23% and water savings could be approximately 13% lower than currently modeled.

This investment would be comprised of blended finance from impact and commercial investors, development finance institutions, local government agencies, the anchor corporate partner, and local water utility.

Additional details about the assumptions used in the model are provided in Annex III.

Table 2. Summary of MWS pilot details

Results over a 6-year period	Proof of concept (250 hectares)	Phase 1 (20,000 hectares)
Number of farmers	50	~4,000
Upfront cost of project	$1.1 million	$10 million
Water savings (cubic meters)	5.25 million	420.3 million
Increased water availability for water utility (cubic meters)	3.7 million	294.2 million

4.2 REPLICATION POTENTIAL

The model aims to be replicated across Latin America. Given the FEMSA Foundation's strong backing for the pilot project, initial replication analysis is focused on other areas where FEMSA operates, and which meet the below criteria. Further research is needed to localize this review beyond the region-level, since water stress can be a hyper-local issue and the instrument is only viable when the water-stressed areas include both agricultural and urban users. Current replication criteria include:

- A large agricultural sector with high water usage per capita and a high percentage of smallholder farmers
- Low levels of irrigation efficiency and the potential for increased efficiency to generate water savings and positive environmental outcomes
- Existing or projected water stress over the next decade, and a consensus among local policymakers that action is necessary
- The presence and identification of a clear beneficiary or group of beneficiaries, e.g., a local utility, water fund, and other sectoral representatives interested in improving water conditions and potentially willing to invest or become the commercial off-takers of a portion the water savings
- The existence of a water rights system that allows for water rights transfers between users and does not allow for limitless extraction by an individual user

Based on an initial review of regions that are water-stressed and have high agricultural output, and countries with FEMSA operations[17], we have identified the following regions that would be good candidates for eventual instrument replication:

- Mexico: Aguascalientes, Querétaro, Jalisco
- Brazil: Ceará, Paraíba, Pernambuco
- Argentina: La Rioja, La Pampa, Cordoba

Replication sites could also be based on the presence of one of the 25 existing water funds in the Latin American Water Funds Partnership, which do not currently overlap with the regions above, although there are many water funds in the development phase right now.

5. ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACT

MWS will save approximately 3,500 cubic meters of water per hectare every year. For an average smallholder farm, this is equivalent to the volume of seven Olympic-size swimming pools

5.1 ENVIRONMENTAL IMPACT

MWS will deliver numerous environmental benefits, particularly related to reducing the water deficit in the region and contributing to long-term water security, assuming the challenges and risks identified are addressed.[18]

With improved irrigation efficiency, farmers would save 3,500 cubic meters / hectare. For an average farm of 5 hectares, this is equivalent to saving seven Olympic-sized swimming pools of water every year. When expanded to 4,000 farmers across Guanajuato in Stage 1, urban areas could gain access to up to 294 million cubic meters of water over a 6-year period, equivalent to 117,600 Olympic-sized swimming pools of increased water availability.

While these savings are not on their own sufficient to turn around Guanajuato's water crisis, they will make a substantial impact in each benefitting community by contributing to a water-secure future. As the climate changes, water scarcity will become an increasingly dire situation for many in the region, and these savings will help the entire region become more water efficient. Through MWS' implementation, farmer production and income can better adapt to the changing climate and become more resilient through increased water availability, improved soil quality, more integrated supply chains, flooding risk management, and potential crop diversification.

Increased water efficiency can result in reduced water extraction through diesel-powered well pumps by farmers. Our initial estimate shows that MWS has the potential to reduce associated carbon emissions by 92,472 metric tons each year in the 20,000 hectares pilot, equivalent to taking 20,103 cars off the road every year.[19]

[17] If the initial FEMSA Foundation-led pilot succeeds, their intention is to replicate the initiative in the other Latin American countries where FEMSA operates: Argentina, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Nicaragua, Panama, Peru and Uruguay.
[18] Unless otherwise noted, in this report these benefits are projected over six years given a one-year grace period and five-year repayment period for the farmers' loans.
[19] Up to 0.22 kg of CO_2 are emitted per cubic meter of water extracted (Scott 2013). The average car emits 4.6 metric tons of CO_2 per year (EPA).

In addition to modelled water savings and carbon emissions, there are additional environmental benefits related to NBS that we have not quantified. Based on the results of the proof of concept, these benefits will be evaluated during the Stage 1 expansion through Guanajuato. Depending on the area, the feasibility studies conducted by MWS might recommend NBS such as conservation agriculture, including riparian buffer strips and/or cover crops, which could: increase water efficiency and biodiversity; improve soil quality; provide an additional income source; mitigate the damage of flooding events on agricultural and urban sectors; increase water infiltration (Hoorman and Sundermeier 2017); and decrease fertilizer usage, thereby reducing pollution runoff and CO2e.

5.2 SOCIAL AND ECONOMIC IMPACT

MWS will improve economic outcomes for smallholder farmers by increasing yields, reducing costs, increasing potential market access, and improving resilience in the face of worsening impacts of climate change. MWS contributes to advancing the following SDGs: 6 (clean water and sanitation), 9 (industry, innovation, and infrastructure), 12 (responsible consumption and production), and 17 (partnerships for the goals). Additionally, through the usage of nature-based solutions, this instrument will meet SDG 15 (life on land: protect, restore, and promote sustainable ecosystems, sustainably manage forests).

The long-term success of MWS depends on empowering all parts of the community, and ensuring that these communities receive meaningful benefits from water availability and improved quality of life. Discussions with stakeholders continue to be built into project design. WRI is leading the development of Gender and Equity guidelines for NBS projects as part of the Cities4Forests (C4F) program[20], which could be applied to the pilot transaction.

5.3 SECTORAL IMPACT: NATURE-BASED SOLUTIONS

The main goal of the NBS stream of the Lab is to identify innovative approaches to catalyze private sector investment into the protection, sustainable management, and restoration of natural or modified ecosystems. Creating a viable market for nature-based solutions contributes to climate resilience, emissions reductions, and biodiversity benefits,

MWS' focus on monetizing water conservation and improving soil quality through natural approaches offers a new solution to improve the resilience of arid and semi-arid agricultural hotspots around the world.

In Mexico, MWS will contribute to reaching the country's adaptation objectives in its Nationally Determined Contribution (NDC) which include: i) "The protection of communities from adverse impacts of climate change, such as extreme hydro meteorological events related to global changes in temperature; as well as the increment in the resilience of strategic infrastructure and of the ecosystems that host national biodiversity;" and ii) "guarantee food security and water access in light of growing climate threats through integral watershed management, biodiversity and land conservation" (Seddon et al., 2019).

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[20] https://www.wri.org/our-work/project/cities4forests

NEXT STEPS

FEMSA Foundation, WRI and their partners will continue to work towards implementation of the pilot transaction in Guanajuato and continue to address and further develop details that remain unclear. The monetization of water savings at the utility level may take different forms as discussed in Annex I, one of which, the pay for performance scheme, is possible but dependent on vigorous metrics and causality links that at the moment are not yet developed. Further legal review is required to understand the full potential for transferring water allocations between users.

Other key aspects that require more on the ground research are i) acceptance from farmers and water utilities, ii) reviewing the NBS options in various regions and iii) assessing the potential of NBS beyond the farmed lands, including restoring degraded or unused lands.

While there are several steps to take before implementing a pilot and scaling the instrument more broadly, MWS has reached a number of milestones that demonstrate a promising path forward. For example, the MWS team has already identified a preliminary pilot location and enlisted the key stakeholders required for the instrument to be successful. The Lab has confirmed the existence of significant economic, social, and environmental impacts and laid out a pathway to scale the instrument across Latin America. The COVID-19 pandemic has delayed the implementation and scoping timeline, but the instrument continues to be able to address key local issues, including water scarcity, cost reductions, and risk mitigation, and provides a path to improving economic outcomes consistent with a sustainable recovery from this economic shock. With development funding in place, the experienced team of WRI and FEMSA Foundation, and engaged local stakeholders, MWS is poised for success.

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ANNEX I: SCENARIOS REGARDING WATER AVAILABILITY AND SOURCES

Depending on the regional regulations and geography, there are a variety of potential scenarios that MWS could face. Each scenario comes with distinct opportunities and challenges, and the structure of the instrument will need to accommodate these differences.

1. Urban centers and farmers rely on different water sources; urban center water source is at a deficit, and the **farmers'** source is stable or at a surplus. The savings from the farmers can be transferred to the urban center. Investments in new infrastructure are required to achieve the actual transference. The types of infrastructure and investments needed will vary depending on the geographic and territorial characteristics of the systems. For example, if the urban center requires water of a different quality than the farmers, then investments in treatment systems will need to be made. This scenario is the case in the La Purisima district that is being evaluated for the proof of concept.

2. Urban centers and farmers rely on a common source, which is at a deficit. In this situation, the water transference from farmers to utilities should not be promoted as this would continue to exacerbate water scarcity. Instead, the SPV could aim to generate revenue from a conservation fee. In this case, a public beneficiary could pay for the water savings to remain unused in the aquifer, such that over-extraction is reduced and the deficit is reversed. The types of beneficiaries that may be candidates for this type of model are those that are willing to subsidize or pay for deficit reversal, such as the federal government, a state or local government, a water fund, or even urban users through a tariff. Further research and development would be needed to determine the specifics of how this would work, who could be interested in paying for and funding it, and how local policies affect the payments. If feasible, this scenario could still meet MWS' water security goals and provide economic surplus for the region.

3. Urban centers and farmers rely on different sources; farmers' **source** is at a deficit and the urban center**'s source** is stable or at a surplus. The applicable model is similar to #2. MWS should create incentives and charge a water conservation fee as opposed to transferring water volume. Water savings are higher in this scenario since none or little of the savings are used by other users, resulting in a higher impact of sustainable agriculture and NBS.

4. Urban centers and farmers rely on a common source, which is stable or at a surplus. The farmers' water savings can be virtually transferred to the urban centers, with less infrastructure likely required than in #1, although there could be fewer incentives for water utilities to be interested in the instrument in this scenario.

ANNEX II: EXAMPLES OF COMPARABLE INSTRUMENTS

Instrument	Attributes	Geography / sector	How MWS is different
Brandywine-Christina Revolving Water Fund	Fund pays for green infrastructure to reduce water pollution, city repays costs after regulatory approval (TNC, 2019)	NBS in Delaware	Focused on water scarcity, not pollution; multiple beneficiaries and revenue streams
DC Water Environmental Impact Bond	Investors fund green infrastructure to avoid $2 billion investment by DC Water, utility pays back over time with option for higher repayment based on project success (Quantified Ventures, DC Water)	Stormwater runoff infrastructure in Washington D.C.	Water savings monetized by utility; implementation is at the farmer level
Freshwater Trust	Trust implements NBS near rivers; sells benefits of improved water quality and reduced pollution to corporations and governments seeking regulatory compliance (Freshwater Trust, 2020)	River management in Western U.S.	Implementation is at the farmer level; focus on water scarcity as well as quality
Saginaw Bay Watershed Groundwater Recharge Pay-for-Performance	Pays farmers to implement conservation practices and NBS; payments are based on quantity of implementations and modelled expected groundwater recharge (TNC, 2017)	Sustainable agriculture in the U.S. Midwest	Farmers are aggregated into cooperative for additional benefits; inclusion of utility and corporate beneficiaries
Soil and Water Outcomes Fund	Fund provides capital to farmers to implement best management practices; beneficiaries (cities, utilities, corporations) pay for verified environmental outcomes (Quantified Ventures, Soil and Outcomes Fund)	Sustainable agriculture in the U.S. Midwest	Corporation has additional benefits of simplified / integrated supply chain

ANNEX III: FINANCIAL MODELLING DETAILS

Geography: While the final pilot location is still being evaluated, and selection will depend on the results of feasibility analyses, for the purpose of this report and modelling, the pilot transaction area selected is in Module 11 (La Purisima) of Guanajuato's Irrigation District 11, which comprises about 5,000 hectares and is located just outside Irapuato (Haros et al 2018).

Monetization of water savings: Investments to transfer and treat water from the La Purisima dam to Irapuato are not currently included in the instrument costs and for our model are assumed to be made by the water utility or another public entity (e.g. state or federal government). Even if this capital investment is delayed or does not take place for the proof of concept, the proof of concept could still provide excess economic value from the increase in farmer revenues and benefits to the corporate partner. Depending on the scenarios discussed in Annex I, in future replications, utilities may need smaller investments to secure the water savings or the payments might be structured instead as conservation fees with no water allocation transfers. Based on the details of these scenarios, the instrument could generate short-term cost savings for utilities as well as water benefits.

Assumptions: The model has three aspects: farmer income, water flow, and fund performance. The farmer income calculation is: net income of two crop rotations, including a summer and winter crop (in our model assumed to be corn and barley), an infusion of upfront capital to purchase and install an irrigation and seeding system, and then repayments of that capital over a 5-year period, starting after a one-year grace period. The water system benefits calculation is estimated for the proof of concept project, since the main benefit to Irapuato is an alternative source of water and not necessarily lower costs of water acquisition. In future replications, however, the water benefit will ideally involve the avoided cost of groundwater extraction and treatment for farmers and the urban center. Other key modeling assumptions include:

- 20% of the instrument cost is for technical assistance, and 80% is allocated to the provision of loans. A small amount is additionally allocated to the fund's operating expenses. Technical assistance provide training on i) how to use the drip irrigation systems, ii) how to implement conservation practices, and iii) additional ongoing support related to project financing.
- A farmer repayment rate of 95%
- Technification loans:
    - 50% of the system financing is a loan with 12% interest, re-paid semi-annually over five years
    - 40% of the system financing is an interest-free subsidized loan, re-paid annually over five years
    - 10% of the system financing is a farmer downpayment
- For each irrigation system: upfront purchase cost of $2,500, installation cost of $1,250, and direct seeder cost of $42. Bi-yearly maintenance charges of $625 are assumed to be covered by the technical assistance arm of the SPV
- Crop switching scenarios (which may be recommended to some farmers) are not modeled, since the fund outcomes are not dependent on this portion of the implementation
- All farmer benefits are due to increased yields, and we did not model any of the numerous other potential farmer benefits, including:
    - Cost decreases due to the installation of the fertilizer system
    - Shares in the SPV and corresponding dividends

- Access to a secure long-term buyer
- Direct payments for water savings

Results: The model projects annual water savings of 3,503 cubic meters per hectare per year. Over six years, which is how long it will take for farmers to pay off their loans, this equates to roughly 5.25 million cubic meters in the 250-hectare pilot project and 420 million cubic meters in Stage 1 across Guanajuato (20,000 hectares). After accounting for a 30% efficiency loss of transporting and treating the water before it is used by a water utility, the pilot area would increase availability for urban users by 294 million cubic meters over six years. This could help fully offset Irapuato's annual groundwater extractions and potentially reduce the aquifer's annual deficit by 60%.[21] These savings would reduce the 1 billion cubic meter aquifer deficit for all of Guanajuato by 5% annually (CEAG, 2020). While this number is small relative to the dire situation in Guanajuato, the gains would be highly localized and significant in regaining the hydrological balance of specific aquifers that are currently being overexploited and at risk of depletion. Therefore, MWS has the potential to contribute to the long-term ecological health of multiple aquifers and thus, to provide water to areas that would not otherwise have a secure water future.

[21] Irapuato's annual water deficit is 71.5 million cubic meters per year (CONAGUA 2018). Irapuatuo's current annual groundwater extractions are approximately 42.5 million cubic meters of water (JAPAMI 2018).