

Lerma/Toluca Basin Agriculture Project

Lerma/Toluca Basin, Mexico

Background

Lerma/Toluca Basin

The Lerma/Toluca Basin is located in the central and northwestern zone of the State of Mexico, in the Valleys of Toluca and Ixtlahuaca-Atlacomulco. It covers an area of 5,354 km², representing 24% of the state territory comprising 33 municipalities of the entity (Comisión de la Cuenca del Río Lerma,2023).

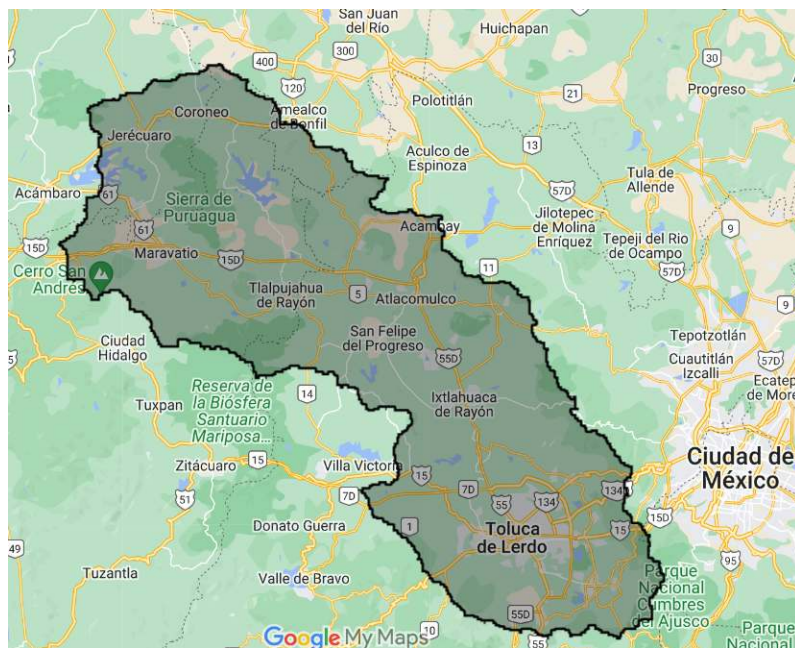


Figure 1. Lerma/Toluca basin (FAO, 2023)

There are 15 aquifers in the state of México, of which 9 of them are considered over-exploited. The municipality lies over the Valle de Toluca aquifer, which comprises a total area of 2,738 km² and is limited by the parallels 19° 35' 4.1" and 19° 3' 50.4" N and the meridians 100° 0' 11.5" and 99° 16' 44.9" W, containing (entirely or partially) 27 different municipalities (CONAGUA,2020).

The main uses of the aquifer are: Public-Urban uses, Industries, Agriculture, and services. There are 136 irrigation units with a total of 16,724 users and a surface of irrigation of 21,233 ha (CONAGUA,2020).

Water scarcity is a major concern in the Lerma basin. Demand for water out-grew the replenishment capacity of the river basin in the 1980s, and the basin now experiences an aggregated deficit between supply and demand of 1.6-1.8 billion cubic meters per year (The World Bank, 2006). This issue is exacerbated by inefficient water use, particularly in the agricultural sector. The water deficit is often made up by over-pumping groundwater or over-exploiting lakes, which is unsustainable in the long run.

Scaling up precision irrigation using Internet of Things (IoT) technology in the Lerma basin of Mexico could help improve agricultural productivity while helping close the water supply deficit in the basin. Project partners at Kilimo are preparing to deploy IoT irrigation technology with farmers in the Lerma basin, and there is widespread interest from farmers to scale up technology to conserve water with irrigated agriculture, particularly for water-intensive crops like avocado, asparagus, vegetables and berries (Kilimo, 2022a).

Project Description

The goal of this project is to increase agricultural water use efficiency and productivity, to reduce water demand, and protect groundwater and surface water resources in the Lerma/Toluca Basin of Mexico.

A farmers retention plan centered on adopting and renewing irrigation management practices has been devised throughout the project's implementation, scheduled to conclude in 2028. As part of this program, farmers are encouraged to participate in ongoing training sessions and receive economic incentives for reducing their water consumption. Each year, a record of active farmers who utilize our service will be maintained.

The project will support expanded applications of IoT satellite moisture and irrigation management systems on 1,300 ha of private irrigated family farms to decrease water pumping/diversion. The [Kilimo](#) project team uses a Big Data solution that includes a web-based app, annual subscription fee, satellite data, crop soil moisture tests, and measurement of precipitation and irrigation inputs to provide real time irrigation demand information. The technology does not require any hardware to be installed at the farm level and supports tailored irrigation scheduling for a variety of high value crops.

The following selection criteria were used to identify farmers who were best suited to participate in the program to meet specific use requirements for Kilimo's irrigation monitoring platform and support comparison of water use rates before and after deployment:

- Fields must be located in the Lerma/Toluca basin (Figure 1).
- The farmer must possess irrigation records.
- The farmer must be available to meet with Kilimo's agronomy team.
- The farm must have a dependable source of water available for irrigation.

Following the steps outlined in Figure 2, Kilimo will deploy the IoT irrigation management system on 1,300 total ha over four irrigation seasons starting in July 2023.

It has been shown that less than 10% of farmers worldwide use (or have access to) technology to guide water application. Using Kilimo's technology, farmers have reduced their water withdrawal from the surface and groundwater sources by at least 13%. Additionally, less water withdrawal represents less pumping costs and energy for farmers and, therefore, a reduction in carbon emissions from electric power use.



Figure 2. Diagram of project steps (Kilimo, 2022b).

Project Timeline (Preliminary)

- July 2023: the project is confirmed by the corporation.
- August 2023 - February 2024: Kilimo signs contracts with the farmers that will be involved in the project.
- March 2024 - December 2024: The Kilimo IoT irrigation management system would be deployed starting at the beginning of the winter 2024 crop season.
- The year of initial volumetric benefit claim is expected to be 2024
- Monitoring and Maintenance: Kilimo will verify the deployment of the IoT irrigation management system on the farms in the Lerma/Toluca basin. They will monitor the water savings based on the baseline water usage from the previous five crop seasons (2018-2023), effective rainfall, and water usage after project implementation. Confirmed water savings for the previous crop season will be available in December of the following year.
- 2028: Project completion

Cost of the project

- Total Project Cost: \$436,557 USD to implement IoT irrigation technology on 1,300 ha for four irrigation seasons .

KIPs summary and Payment Schedule

Summary								
Location	Mexico							
Basin	Lerma Toluca							
Company	Waterplan							
	Temporada	2023	2024	2025	2026	2027	2028	Total
Hectáreas	has	150	250	300	300	300		1.300
Ahorro potencial x ha	m3	400	400	400	400	400		
Ahorro potencial total	m3		60.000	100.000	120.000	120.000	120.000	520.000
Costo m3	USD/m3		0,75	0,79	0,83	0,87	0,91	
Costo del proyecto	USD		\$45.000	\$78.750	\$99.225	\$104.186	\$109.396	\$436.557
Fecha estimada de realización de ahorros de agua			dic-2024	dic-2025	dic-2026	dic-2027	dic-2028	

Payment Schedule

	%	USD
At the time of contract signing	20%	87.311
dic-23	14%	61.118
dic-24	14%	61.118
dic-25	13%	56.752
dic-26	13%	56.752
dic-27	13%	56.752
		436.557

Notes:

(a) The proposal was designed based on the information gathered. This may need to be modified based on additional customer needs.

(b) The proposal considers July-2023 as the maximum contract closing date. After that date, terms need to be renegotiated as acquiring hectares takes time.

(c) Prices don't include VAT.

(d) The number of hectares is a reference based on our historic savings per has.

(e) There is a potential for inflation to impact the project budget. If costs were to increase, the total project budget for the work described in this pre-project Benefit Summary would increase and could affect final

volume accounting. Furthermore, if the project were to extend beyond the dates of the initial contract (e.g., to cover subscription fee costs beyond the initial three-year period), the cost would increase.

Restore Volumetric Benefit Calculation

Method

The volumetric water benefit is calculated based on the reduced withdrawal by individual farmers in the Lerma basin due to the elimination of over-irrigation and associated losses as a result of improved irrigation regimes. This volume of water can be made available for other water uses, which will contribute to basin water resilience.

Data & Assumptions

Input data and assumptions supporting the volumetric benefit calculation, which are listed below, were provided by BEF in partnership with Kilimo and obtained through literature.

- Projects are expected to conserve 400 cubic meters of water per hectare per crop season with Kilimo IoT irrigation management system, based on analysis of pilot projects.
- 1,300 ha will be outfitted with Kilimo IoT irrigation management systems. These systems will operate over five crop seasons, starting in March 2024.
- Data from the five previous crop seasons to project implementation will be used to calculate baseline rainfall and irrigation rates. Post project rainfall and irrigation data will be compared to the baseline rates to quantify changes in water consumption that take place as a result of the project.
- In the event that a farmer is not able to provide all the information needed to calculate the water savings, Kilimo will use standard regional crop, precipitation, and weather data to perform annual calculations.

Calculation

Kilimo will determine a baseline and post-project monitoring data to calculate the total volumetric water benefit of the project. The expected total volumetric water benefit from the project is shown below.

Use of Kilimo's IoT irrigation management system on 1,300 ha of farmland each crop season.

Area of precision agriculture improvements = 1,300 ha

Water savings for farmland with Kilimo IoT irrigation management system = 400 m³/ha/crop season

Reduced withdrawal = Water savings = 1,300 ha * 400 m³/ha/crop season = 520,000 m³

Volumetric Benefit (Preliminary)

The irrigation season in the Lerma/Toluca basin occurs over four calendar years. Therefore, the volumetric benefits in the project start year (2023) and project end year (2028) will be proportional for the portion of the irrigation season falling within that calendar year (Table 1).

Table 1. Projected annual volumetric water benefits.

Year	Farm Area with Kilimo System (Area and number months)	Annual Water Volume Conserved
		cubic meters
2024	150 ha	60,000
2025	250 ha	100,000
2026	300 ha	120,000
2027	300 ha	120,000
2028	300 ha	120,000

Notes

- This is a pre-project evaluation of estimated volumetric benefits and is based on information available at this time.
- The potential impact of inflation on project costs is included in this summary, but it is an estimate.

References

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*CONAGUA is a decentralized, administrative, normative and technical agency of the Ministry of the Environment and Natural Resources