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With NASA's Endorsement and Satellite Technology, IPN Aims to Contribute to Food Sovereignty

- **IPN scientists monitor soil moisture using physical-mathematical algorithms and field sampling to boost agricultural production.**
- **IPN specialists received training from NASA to carry out monitoring and sampling efforts, to replicate the process in Mexico.**

With guidance from the National Aeronautics and Space Administration (NASA) and support from the space agencies of Canada and Mexico, the Instituto Politécnico Nacional (IPN) has developed a research project that utilizes satellite technology, microwave-spectrum sensors, physical-mathematical algorithms, and field sampling to monitor soil moisture. The purpose is to identify climate patterns and temperature changes to increase agricultural productivity in Mexico and support national food security and sovereignty programs.

Alejandro Monsiváis Huertero, a scientist from the Escuela Superior de Ingeniería Mecánica y Eléctrica (ESIME), Ticomán Unit, leads the project titled LOSRUSAT: Achieving Rural Sustainability through the Application of Satellite Technology. The initiative began in 2014 as a collaboration between NASA and the space agencies of Canada and Mexico, aimed at monitoring the effects of climate change and studying soil moisture in agricultural regions across the three countries.

Monsiváis explained that the main goal of LOSRUSAT is to determine the amount of water available for agricultural activities, thereby ensuring food sustainability and contributing to food self-sufficiency and rural poverty alleviation programs, such as Sembrando Vida and other food sovereignty initiatives promoted by the Government of Mexico.

Thanks to a cooperation agreement between NASA and the Mexican Space Agency, a team of IPN scientists — consisting of two faculty researchers and two master's students — received one month of training in Iowa, United States, with support from NASA experts.

The training focused on learning how to monitor soil moisture conditions in agricultural

fields to validate satellite data. During the fieldwork in Iowa, Monsiváis noted, satellite imaging, an aircraft, and several drones were used to assess soil moisture patterns. “We were also taught how to collect samples and process them in the laboratory so we could replicate the procedures here in Mexico,” said the expert, who holds a PhD in Applied Electromagnetism from Paul Sabatier University in Toulouse, France.

“Satellite technology,” he added, “offers a broader perspective, allows for faster work, and delivers high precision. Microwave-spectrum sensors can penetrate vegetation cover and reach the soil, enabling observing certain characteristics. From this, we obtain a variable known as emissivity, which is key to understanding the energy emitted by the Earth's surface. This variable is then processed using physical-mathematical algorithms to estimate the amount of water present in the soil.”

The IPN scientific team carried out the first implementation of this technology in Huamantla, Tlaxcala, one of Mexico’s main corn-producing regions. Research was conducted across five fields with different soil types throughout the entire crop cycle.

"We subsequently attended meetings with NASA experts, who validated the information and verified the surveys, as well as the process of implementing the protocols. They gave us the green light. We also applied the methodology in the Central Valleys of Oaxaca, a region highly dependent on agricultural production. As a result of this field work, we were able to achieve accurate soil moisture estimates for our country," said Monsiváis.

He added that the IPN team has installed five monitoring stations in Oaxaca equipped with soil moisture, temperature, and rainfall sensors. Over three years, these stations have collected valuable data, providing solid evidence of how rainfall patterns have been changing in the region.

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