

Digital Farm



Summary:

Smallholder farmers are integral to global food security, yet face climate change and often lack actionable real-time data and information. The Digital Farm team, in partnership with the International Centre for Tropical Agriculture (CIAT), Climate Edge, and four coffee and tea cooperatives/ Producers Organisations in East Africa, set out with an ambitious target to identify, generate, integrate, and share multiple sources of data, empowering smallholders with information and knowledge to make climate-smart decisions. Key achievements included:

- Training Lead Farmers on the prototype of a digital record-keeping app, installation, and use of the NEXO Weather stations.
- Development of farmer-friendly training materials and upskilled Lead Farmers, Smallholders, and Youth Agents on how to use and scale-out digital logbooks.
- Digital Farm's user-centered developer based in Nairobi liaised with a network of Youth Leaders to ensure logbooks are accessible and share relevant data with smallholders.

Data Innovation:

Climate data were collected via the NEXO weather stations. IoT M2M SIM cards were utilized to maximize the ability to send data in remote environments. To validate producers' perceptions about observed climate changes, CIAT developed bioclimatic variables with trends

in coffee regions that could potentially have a biophysical impact. Terraclimate was used to interpolate monthly climate data for temperature, precipitation, and potential evapotranspiration.

For each cropping year, 31 bioclimatic variables were derived that described annual and seasonal patterns. The cropping year was defined to start with the three months that are the driest of the year on the multi-decadal average and the following nine months.

At a Glance:

SDGs: 12 - Responsible consumption & production, 13 - Climate Action, 15 - Life on Land, and 17- Partnerships for the Goals

Project Objective: To share and integrate past, current, and future climate, sensor, satellite, farmer generated, and farm-level data to produce comprehensive datasets and farmer-friendly, dynamic dashboards, and visualizations.

Geography: Kenya, Tanzania, Uganda

Technologies: IoT M2M SIM Cards, NEXO Weather Stations, Web Applications developed using Laravel Framework (backend), and Vue.js (front end).

The Producers Direct team worked with the Climate Hazards Group Infrared Precipitation with Stations (CHIRPS) data set to better understand more detailed perceptions of farmers, such as the length and onset of the rainy season. CHIRPS uses satellite estimates of precipitation to improve interpolation skills in sparsely gauged locations. This data set provides daily estimates of rainfall that can be used to describe fine-scale shifts over the last three decades.

FarmDirect is built as a Progressive Web Application developed using Laravel Framework (backend) and Vue.js (front-end). FarmDirect's database is SQL supported and the entire

Digital Farm, submitted in response to the 2017 call for proposals by the World Bank's Development Data Group and the Global Partnership for Sustainable Development Data, was supported by the World Bank's Trust Fund for Statistical Capacity Building III with financing from the United Kingdom's Foreign, Commonwealth & Development Office, the Department of Foreign Affairs and Trade of Ireland, and the Governments of Canada and Korea, from April 2018 to January 2020.

infrastructure is in a Virtual Private Hosting to support DevOps.



Lessons Learned:

- Data literacy is limited, thus investment in ensuring digital tools and data can be used effectively is needed. Digital tools were dependent on agent-based models (youth agents), to support smallholders to understand and utilize the data for smarter decision making.
- More needs to be done to ensure the data that is generated, analyzed, and integrated into dashboards and visualizations is accessible and relevant to smallholder farmers. All lessons learned and data collected should be shared back to promote behavior change and improve in-person training systems for resilience and climate-smart decision making.
- Employing Human-Centered Design (HCD) is paramount when developing and utilizing digital tools intended to benefit smallholder farmers. Tools developed in isolation don't work which is why HCD is key to ensure systems respond to the user's needs.
- NEXO weather stations are easy to set up and use for smallholders, and the data produced is relevant and helpful. The key lesson learned here is that although NEXOs are easy to set up and use, it is a struggle to relay data linked due to limited connectivity.

Results:

The FarmDirect app has dynamic dashboards that smallholders and Producer Organizations can use to strengthen decision making and build resilience to changing climates. To date, 394 smallholders are using the dashboards in analog and digital form. Farmers involved in the pilot have already been able to identify specific issues on costs and prices that helped better manage their overall profitability.

Producers Direct and Climate Edge installed 20 on-farm NEXO weather stations in Kenya and Uganda, recording real-time climate data. In 2019, 4,126 smallholders were directly trained (indirectly benefiting 16,504 people) in Kenya, Uganda, and Tanzania.

For example, the training included pairing crop quality and yields (tea, coffee) with climate-smart agricultural practices. The combined training was in response to lessons learned from the logbooks, NEXO weather stations, and key information from the 5Q calls, PICSA workshops, and historical data from CIAT, ensuring relevance to both smallholders' needs and climatic trends.

Data collected using NEXO was linked to specific plots and formed the basis of integrating high scale data with the high-resolution data on on-farm financial and farming activities, collected in the FarmDirect app.

References:

[CIAT policy paper](#)

[CIAT PICSA shared Google Drive](#)

Blog: [How Producers Direct utilizes Human-Centered Design](#)