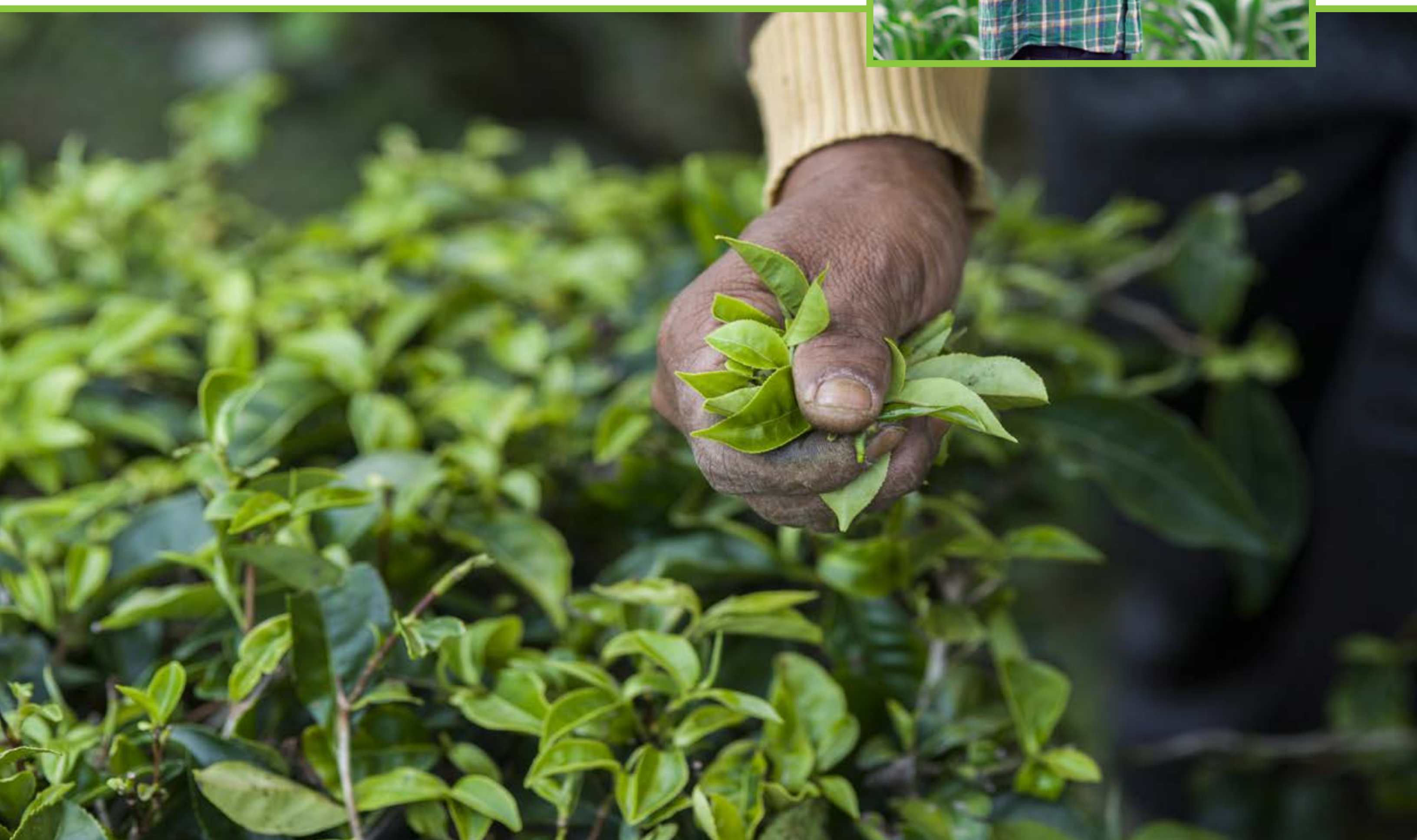
TETRA TECH

Enabling Crop Analytics At Scale

ENABLING CROP ANALYTICS AT SCALE (ECAAS)

Next-Generation Crop Production Analytics

Introduction



Introduction

Timely information on crop type, growth, and productivity — collectively called crop analytics — can provide critical insights for food security decision-makers. At the institutional level, potential applications of crop analytics include tracking food production, detecting any potential issues early, and intervening to avert or minimize supply disruptions. At the field scale, producers, including smallholder farmers, use the information to monitor crop productivity, manage potential agricultural risks, and help inform farming decisions. Indirectly, farmers can benefit from digital agriculture service providers (e.g., private agri-tech companies) that use crop analytics to tailor their services and generate actionable insights at highly granular scales. There is increasing evidence that demonstrates the broad potential benefits of timely and reliable crop analytics for smallholder farmers, ranging from farm management decision supporting services (e.g., provision of agro-climatic, market trend and prices, and management advisory information) to digital finance and risk management services (e.g., crop insurance and alternative credit ratings).

However, crop analytics is also highly challenging to generate at scale. Here we have identified two key bottlenecks. (1) Although satellite remote sensing-based geospatial analytics have shown the potential to predict crop production over a large area, their practicality and accuracy are largely constrained by the availability of quality, representative ground-truthing data for model calibration and validation of estimates. (2) Second, the lack of sufficient ground-truthing data impedes the use of remote sensing datasets, especially in the context of smallholder farming, where fine spatial resolutions are required. Even when ground-truthing data are available, their measurement accuracy is not always reliable. Available data from a survey or crop cuts are often considered biased and insufficient to account for the highly heterogeneous crop production in smallholders' farming. To address these two interlinked challenges, this project piloted a two-stage approach designed to expedite crop analytics development in Odisha, India.

- Work Stream 1 piloted a new approach to improve sampling frames using high spatio-temporal resolution satellite remote sensing data combined with seasonal weather patterns dynamically. This new approach, the Dynamic Area Sampling Frames, **improves the representativeness of field data over space and time** and increases data utility given limited resources for field operation. Together with enhanced ground-truth data methods (see Work Stream 2), Dynamic Area Sampling Frames can result in a game-changing approach to obtain information about field-level crop statistics.
- Work Stream 2 developed a new, **non-destructive yield estimation method to rapidly collect ground-truth data** using 3D modeling of sorghum panicles based on smartphone-captured video streams. In addition, new open-source software and the yield estimation workflow have been developed to demonstrate the application. Such enhanced ground-truthing approaches can provide critical inputs to further improve the reliability of sampling frames (see Work Stream 1).

We anticipate that these two complementary approaches can be synergistically applied in new areas and contribute to the scaling of crop analytics. For example, when crop production statistics need to be developed rapidly with limited resources available for data collection, an expedited crop yield measurement method can be incorporated in crowdsourcing campaigns with citizen scientists and rapidly scale the ground-truth data collection effort deployed throughout the region. Dynamic Area Sampling Frames can guide the most cost-effective way to target such data collection efforts based on the seasonal weather patterns and crop growth conditions. In addition, more ground-truth data made available can help refine the sampling frames and improve the performance of crop analytics for the following seasons, potentially spurring more innovations in the synergistic workflow of planning ground-truth data collection campaigns and their rapid implementations on the ground iteratively.

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The Enabling Satellite-based Crop Analytics at Scale (ECAAS) Initiative is a multi-phase project that aims to catalyze the development, availability, and uptake of agricultural remote-sensing data and subsequent applications in smallholder farming systems. The initiative is funded by The Bill & Melinda Gates Foundation and implemented by Tetra Tech.

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Final report

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Introduction for the Final Report

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