Integrating dynamic climate forecast for crop yield and production estimates at seasonal scales.

The big idea:

The principle of CCAFS Regional Agricultural Forecasting Toolbox (CRAFT) builds on a pilot project undertaken with 300 maize/sorghum growers in Mali where ICRISAT and the University of Florida designed CRAFT as a guide for location specific decision making such as, selection of crops, varieties and sowing time, in season management inputs considering seasonal climate information at the start of the season, providing policymakers and researchers to monitor in-season crop yields and help with food security planning.

Climate variability is a major source of risk for food production in the developing semi-arid tropics (SAT), host to about 2.5 billion people including some 644 million of the world's poorest people. Agricultural productivity and profitability, therefore, depend on how well farm activities are planned and executed. Many farming decisions are taken before the season starts, without much knowledge about how the season will materialize. To date however, farmers only have access to fragmented information on rainfall forecasts from the met services that are not specific to their location; contingency planning from the Dept. of Agriculture that rarely considers crop management recommendations that are mostly generalized for all soils and seasons without information on risks and returns. Recent developments in the ICT sector, including infrastructural investments (e.g. FiberNet in Ethiopia) have opened new opportunities for the provision, at scale, of location-specific and individually tailored information. The overall objective of this proposal is to deploy CRAFT in one of the CCAFS sites Borana, Ethiopia for a peer-to-peer exchange on "Effective Climate Information Services for Agriculture" by establishing a robust IT platform to (i) rigorously benchmark advisories for yield and value benefits; (ii) monitoring in-season tactical decision support using downscaled seasonal climate forecasts; and (iii) package climate information advisories with a view to enhance the adaptive response of smallholder farmers.

Hypothesis: In Ethiopia, 80 % of rural dwellers depend on agriculture for their livelihoods with approximately 60% living in semi-arid agro-ecologies. Multiple strategies are required to cope better with climate risk at both the individual farm and the whole value chain levels. The inability of farmers to adequately manage climate risk through more informed decisions is one of the major constraints to food security and profitable farming. The proposed work builds on the successful piloting of CRAFT, a decision aid to assist farmers in making planting decisions and aims to develop a more comprehensive tool with actionable information. It adds value to the ongoing massive public and private investments to bridge the digital gap between urban and rural areas and enhance the use of ICTs for social and economic transformation in rural areas. In 2013 (https://ccafs.cgiar.org/blog/new-tool-helps-monitor-crops-real-time#.Wa-NprKg-Uk) CRAFT was introduced in South Asian countries (Bangladesh, India and Nepal). CRAFT is successfully piloted in Nepal as part of the Nepal Food Security Monitoring System (NeKSAP) and is a new initiative to incorporate crop yield forecasting in Nepal with technical support from CCAFS South Asia. CRAFT was used to estimate paddy production in Nepal over the 2015 season (http://documents.wfp.org/stellent/groups/public/documents/ena/wfp281459.pdf?_ga=2.107862789.625058907.1504677589-1282878090.1504677589).

Pilot study: This project will develop, evaluate and operate a framework for monitoring and forecasting impacts of seasonal climate on crop yield and crop production at different temporal scales. The CRAFT framework, which is based on process based crop simulation models, will serve as a powerful and flexible

platform to account for the complexity and diversity (both resources and management) that exist in the smallholder farming systems, which are normally ignored or poorly considered in usual average estimates. These protocols, when linked with seasonal climate predictions at different time scales, will significantly enhance the quality and relevance of crop production forecasts and serve as objective and scientifically sound basis for advanced planning and decision making. The project will achieve this by establishing high quality database of historical climate, soil, crop and management parameters at 10X10 km pixel for all agriculturally relevant areas. The yield forecasts will be analyzed and mapped to identify areas for potential interventions aimed at managing both the positive and negative impacts of the forecasted weather. Further, this assessment allows us to identify climate sensitivity of the various components of the farming systems and thereby identify components vulnerable to different types of climate extremes and in developing and targeting various adaptation strategies that meet the local requirements and needs.

Budget: ICRISAT, University of Florida and EIAR will jointly work on development and deployment of CRAFT in Ethiopia. CRAFT will offer initiative a rare combination of institutional skills, collaborative experience and innovation capacity building on a successful pilot. ICRISAT will be the lead agency and responsible for the development of the database required for implementation of CRAFT for the Borana region in Ethiopia. The University of Florida will provide support for CRAFT and the underlying crop simulation models. EIAR will be responsible for communication with the local farmers and other stakeholders and implementation of CRAFT at the local level. Partners have also agreed to deploy in kind contributions to ensure that project meets its overall deliverables with the $100,000 funding.

Essential data generated during this pilot: We will involve an initial refinement and adaptation for maize and sorghum of the CRAFT alongside its development of new datasets for other crops in Borana of Ethiopia, To achieve this, the existing CRAFT will be adapted to implement in Ethiopia using high resolution historical weather data, combined with locally calibrated crop models, decision trees which define the various management options before, at the time of, and after sowing. This will support the dissemination of an intelligent advisory system that incorporates adjustments based on crop maturity group, local and recommended practice regarding other inputs (e.g. fertilizer applications), and feedback from farmers on the value of the advisory, which will in turn allow a rigorous verification of the impact of seasonal forecasts on crop performance and yield outcomes across a variety of management and environments.

Next Steps: After successful pilot study of CRAFT in Borana we will involve other regions of Ethiopia and expand CRAFT applications to ESA region to offer a range of climate risk management information that will empower farmers to make management decisions that better consider climate risk, the return on investment for inputs, yield forecasting etc. This version will incorporate state-of-the-art meteorological and sub-seasonal to seasonal (S2S) climate forecasts generated by the National Meteorological services and Dept. of Agriculture.

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