

**Deployment of a spatial information system for participatory monitoring
the productivity and agronomic efficiency of smallholder farming in
Haiti**

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Project Abstract

It is widely recognized that monitoring of basic agronomic input-output quantities such as crop yields and economic returns vis-a-vis inputs and costs of germplasm, fertilizer, water and labor will be needed to make significant gains in food security for a rapidly growing population (Sanchez, 2010). In response to this, the Earth Institute has developed a spatial information system that accumulates agronomic data and provides near-real time information services to smallholder farming communities. The first expected pilot to pioneer this technology for agriculture will take place in Malawi and will be based on the ongoing work of the Africa Soil Information Service (AfrSIS, see <http://africasoils.net>; Sanchez et al, 2009). In five years, the Earth Institute envisions smallholder farming communities throughout the developing world gaining near-real time access to farm management relevant information, enabling improvements in agricultural land, labor and capital productivity and reducing long-term agronomic production risks attributable to climate change and land degradation. The potential uses of this technology may be especially impactful in Haiti where farmers struggle with soil degradation, lack of access to finance for farm inputs and increased economic stress on rural families resulting from post-earthquake internally displaced people (IDPs).

Ict4Ag

Ict4Ag is a RapidSMS-based agricultural monitoring system, similar to the diagnostic advisory system in the health sector provided by ChildCount+. At present, geolocated time series of measurements of agricultural indicators and data are extremely sparse and/or dated, because most governments of developing countries, including the Haitian government, do not have the resources to invest in such monitoring activities. Also, there is currently no existing private or research sector initiative in Haiti that deals with agricultural data monitoring on a large geographical scale.

Ict4Ag is based on “participatory monitoring” enabled by smart phone data collection toolkits and statistically valid sampling plans that can be used to fill important agricultural information gaps. There have previously been gaps in information gathering and sharing: even in places where locally relevant and timely agronomic information was obtained, it was impossible for smallholder farming communities, who are largely not connected to the internet, to gain access the information to improve their productivity of their land, labor and capital and to reduce production risks, including those related to climate change and land degradation (Palm et al., 2010). However, emerging, open source frameworks such as RapidSMS may now be able to bridge this gap in Haiti, as all farming communities in Haiti have at least limited access to cellular phone services.

2.1 Inputs

Using standardized data collection templates on mobiles phones (see: Open Data Kit - <http://code.google.com/p/.opendatakit>), CAW's will register each farm within their

community and gather data to develop a georeferenced land, labor, i.e. resource capital profile for each farm. Once a given farm has been profiled, SMS based forms would be used by the CAWs to capture field-level measurements of crop types and yields, planting dates, fertilizer inputs, irrigation methods, post-harvest handling and prevailing farm gate prices for inputs and products.

2.2 Data Analyses

Data will be compiled in a web-based relational database where the CAW's and farming community's geospatially referenced farm and field-level data can be combined with results from continuously-updated remote sensing and ground-based samples. The data will be analyzed using multilevel and spatial statistical procedures and made available for crop modeling applications and calibration of remote sensing products.

2.3 Information Outputs

Output information available through mobile phones would include field-level crop yield and fertilizer use efficiency maps and, based on data collected over time, yield and use efficiency trend maps and reports, enabling farming communities to fine tune farm input expenditures and crop calendarization, access more transparent market price information and to gain access to services such as crop insurance and agricultural credit. When taken to scale, the system will have the capacity to generate policy relevant statistics and maps that could, for example, predict crop failure and food shortages. Anticipated outputs also include regional maps of below- and above- ground carbon stocks that, over time, could be used to inform carbon credit payments to provide additional income to farmers for sustainable land management.

2.4 Implementation – The Malawi Pilot

Within the next several months the program expects to launch an initial pilot in Malawi focused on AfSIS sentinel landscapes located in Malawi, where soil surveys have been completed and fertilizer response field trials are currently underway. The Malawi pilot primarily involves software development and testing for the collection and dissemination of data statistically valid case studies through a mobile platform. These studies allow the project to quantify factors that determine the “agronomic use efficiency” of seed and fertilizer in either yield, monetary and/or household food sufficiency units to help farmers increase food production. After the systems' initial field test, subsequent versions of the Malawi system will also include modules on plant pathology, pest and weed management, the use of organic materials, conservation tillage methods, crop insurance valuation, and carbon offset payments, etc., intended to test the functionality of the system for Malawi and other countries, including Haiti.

The Haitian Context

3.1 Background



Although agriculture is an important sector in the overall economy, Haiti does not

produce enough food crops and livestock to feed the population. The country imports 60% of the food consumed, including as much as 80% of the rice it needs. This is due to a number of different factors, including the still-prevalent use of the slash and burn method, the fact that the majority of arable land is planted with low-yield traditional crops, and the use of poor quality traditional seeds. The over-all picture of Haitian agriculture is one of low-income staple crop production, with marginal quantities of land used for tree and vegetable crop production. Although there are multiple organizations in Haiti working to increase crop production and farmer incomes, they lack the necessary wide-spread technical assistance, available data, and organization to make large-scale impact.

In early 2010 Catholic Relief Services conducted a rapid assessment of seed availability, food security and the affect of IDPs in the southern department of Haiti. They found that 78% of households reported hosting an average of 5.6 IDPs. These IDPs have put an enormous strain on already-poor households and these households have necessarily adopted coping strategies that include households eating less, selling off possessions, selling off livestock, selling grain reserves, selling labor, changing the diet, and felling trees to make charcoal. The economic pressure has also resulted in shifts in agriculture. Farmers are reducing some inputs such as fertilizer and hired tillage, shifting to short season crops, and also shifting from high cost seed (such as bean) to lower cost seed (such as maize). Additionally, many families want to take out loans to purchase farm inputs, but vendors are more reluctant to offer credit, knowing that the risk of nonpayment is high during crisis. Overall, land cropped remains the same, but land cropped per household member has dropped dramatically.

These trends could result in striking drops in household income and food security. The added presence of IDPs on rural farms increases the urgency of a large-scale intervention that will assist rural farmers combat the threats of diminishing soil quality, variable planting seasons and poor market information. The situation in Haiti now also begs good soil and agricultural information that will facilitate acquisition of loans for agricultural inputs.

3.2 Operations

The Haiti system will be designed around existing networks of Community Agricultural Workers (CAW's). In Haiti's southern department these CAWs will be drawn from those already working with Organization for the Rehabilitation of the Environment (ORE), an NGO based outside of Les Cayes working with farmers in the region to increase yields and introduce high-value crops. Each of ORE's CAWs has access to several hundred farm households throughout the southern department and will leverage this penetration to access the leadership of farmer associations and cooperatives to begin ict4Ag program activities.

Each of these CAW's will be equipped with smart phone based data collection toolkits (see for example the Open Data Kit at: <http://code.google.com/p/.opendatakit/>). The toolkit would include facilities such as a Global Positioning System (GPS) and a digital camera, and will also be linked to affordable external sensors such as leaf chlorophyll and soil moisture meters. The

CAWs will enter data to complete electronic survey forms that capture the required variables. Data will then be posted to a central geospatial database. Variables and information to be collected will include:

- Plot sizes
- Crops grown
- Crop yield
- Calendarization of crops
- Post-harvest processing
- Irrigation practices
- Fertilizer inputs
- Market prices
- Hybrid seed input quantities
- Soil moisture levels
- Soil texture
- Tree crops, number of trees, average age of trees
- Seeding rates for all seeds that are being used (hybrid or not)
- Rain gauges – farmers reading these gauges and track this.
- Plant date
- Harvest date

The ict4Ag program will be rolled out in four phases.

Phase 1: In phase 1, the system will be piloted on a small scale, collecting only basic data from the EI tropical agriculture demonstration plots. CAW working with the demonstration plots will use GPS and smart phones to record: 1) plot location 2) planting date 2) harvesting date 3) seeding rate and 4) fertilizer. This phase will begin with the initiation of demonstration plots in the watershed, scheduled to begin January, 2011. Simultaneously, the in-country program manager will begin trainings with CAWs and farmers groups in the southern region.

Phase 2: In phase 2, CAWs working together with MVP and ORE will expand the coverage of the tool to other agricultural cooperatives and associations throughout the watershed. At this point, the tool will broaden beyond the basic model and begin collecting all of the distinct data points listed above (plot sizes, crops grown, crop yield, calendarization of crops, post-harvest processing, irrigation practices, fertilizer inputs, market prices, hybrid seed input quantities, soil moisture levels, soil texture, tree crops, number of trees, average age of trees, seeding rates for all seeds that are being used (hybrid or not), rain gage readings, plant date and harvest date.) Phase 2 will begin shortly after phase 1.

Phase 3: In phase 3 the system will scale beyond the Port a Piment watershed to the rest of the Southern region and it would begin to offer real-time feedback to farmers. By this time, the system will be wide-spread throughout the watershed region, and there will be meaningful data to disseminate to farmers. Phase 3 will begin one year into the program.

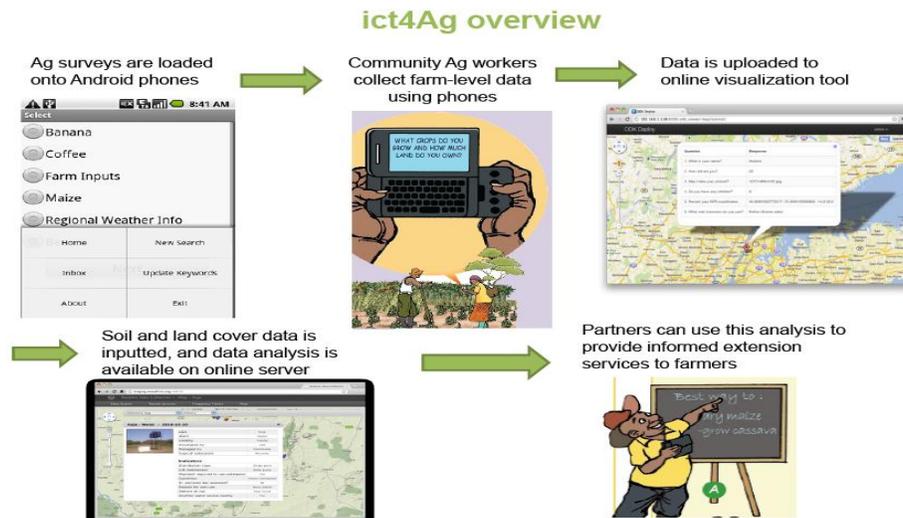
Phase 4: Phase 4 is an option for the medium and long term. Phase four includes



the development of a franchise model, which allows small entrepreneurs to take over the role of the CAWs, collect the farmer's data, and provide them resulting information - for a small fee. This would not be rolled out until it became clear that farmers value the information they are receiving, that it helps them to increase their incomes, and that they are willing to pay for it. This may happen sometime in year 3.

Ict4Ag Haiti Overview

Overview: Ict4Ag is a RapidSMS-based agricultural monitoring system that can be used to collect field-level information about farmers that can be aggregated on a regional or national level, and will eventually have the potential to provide real-time feedback to farmers. At present, geolocated time series of measurements of agricultural indicators and data in Haiti are extremely sparse and/or dated, because the government does not have the resources to invest in such monitoring activities. Also, while there is agricultural information collected throughout the country by disparate NGOs on small scales, there is currently no existing private or research sector initiative that we know of that deals with agricultural data monitoring on a large geographical scale.



Program in CSI: The Haiti system will be designed around existing networks of Community Agricultural Extension (CAEs) in Haiti. In Haiti's southern department these CAEs will be drawn from those already working with Organization for the Rehabilitation of the Environment (ORE), an NGO based outside of Les Cayes working with farmers in the region to increase yields and introduce high-value crops, and any others employed by the government or NGOs. Each of ORE's enumerators and government-supported CAEs have access to multiple smallholder farmers throughout the southern department and will leverage this penetration to access the leadership of farmer associations and cooperatives to begin Ict4Ag program activities.

Each of these CAEs will be equipped with smart-phone based data collection toolkits. The toolkit will include facilities such as a Global Positioning System (GPS) and a digital camera, paired with a phone-based survey. The CAEs will enter data to complete electronic survey forms that capture the required variables. Data will then be posted to a central geospatial database accessible to all partners.

Data Collection: In year 1 of the CSI Ict4Ag program, the tool will collect data from 10 communes and will be used to inform the Agricultural team's planning and program implementation on a watershed scale. Unlike other survey tools used for data collection that occur during a planned period and have a set end date, Ict4Ag is an iterative process of collecting dynamic data through CAEs during planned extension visits. CAEs will collect multiple data points from the same household when returning for additional extension visits, allowing changing data to be more

Ict4Ag Haiti Overview

easily tracked over time. While several of the questions asked of farmers in the ict4Ag form might be similar or identical to those asked in MVP-style household surveys, the style and span of data collection of ict4Ag will make its scope broader (though less detailed) than household surveys, and give it wide applicability across multiple partners.

Program Rollout: The ict4Ag program will be rolled out in phases. The first two phases will be rolled out in year one of the project.

Phase 1 (October-March, 2011-2012): In phase 1, ORE will use the phone-based surveys collect 45 observations from each of the 10 communes in the CSI. Baseline / registration surveys will be collected for each of the households between October – December, 2011, and follow-up planting and harvesting modules will be completed in January and March respectively. The primary goal of this phase is to provide baseline and preliminary data to all CSI partners, including for the EI agricultural team and ORE for future analysis on programming choices.

Phase 2 (January - March, 2012): In phase 2, MVP and ORE will work together to train other CAE at CRS and the Ministry of Agriculture to expand the coverage of the tool to other agricultural cooperatives and associations throughout the watershed and across the CSI. At this point, the tool will broaden beyond just the 45 observations ORE will originally collect and expand to a larger sample in the southern region (including information from all of the households visited by the CAWs). The primary purpose of this phase will be to scale the tool to other organizations working in the Southern region and begin wider-scale collection of farmer information. Data collected during this phase will be used to inform the CSI's agricultural project planning for the region.

In project years 2 and beyond, the project has the potential to offer real-time feedback to farmers and the flexibility to consider different dissemination options, for example a franchise model that allows small entrepreneurs to take over the role of the CAWs, collect the farmer's data, and provide them resulting information – for a small fee.

Progress and Updates: As of the end of October, 2011 the following have been completed:

- Ict4Ag farmer baseline/registration form designed by EI and ORE
- Ict4Ag farmer baseline/registration form piloted in the field by ORE
- Field feedback provided to EI, form revised, finalized and loaded onto phones
- Online tool for data visualization finalized and available online to partners ([demo](#))
- ORE Agronomists trained in ODK Collect, usage of the phones and ict4Ag baseline form
- ORE will launch ict4Ag surveys at the beginning of November