Early Warning for Food Security in Ecuador

Abstract

Malnutrition affects one fifth of the population of Ecuador, and droughts, floods, the El Niño phenomenon, frosts, and general climate variability exacerbate the problem. The proposed project for Ecuador aims to improve the understanding of climate variability and its effects on agriculture as it impacts this problem. The weather and climate knowledge and information acquired is used to improve decision making by agricultural scientists, policymakers, extension agents, and farmers themselves to increase food security and reduce malnutrition. An interdisciplinary team of geographers, agricultural scientists, nutritionists, and climatologists will carry out the project.

Problem

Weather variability related to El Niño, variable rainfall and temperature, frosts, droughts, and floods all contribute to low crop yields, creating hardships and food security problems in the agricultural sector (Podesta et al., 1999; Tacio, 2002). A sampling of news articles in Ecuador's newspapers demonstrates the numerous weather- and climate-related threats to rural livelihoods in the country.

1. **Warnings about weather fail for lack of a network**. Lack of resources reduces capacity of government to provide early warning. *El Comercio, Feb. 9, 2006*
2. **Drought lays siege to 3 provinces**. Drought reduced milk production by as much as 50%. *El Comercio. 2002a.*
3. **The humid summer will affect the maize crop in Los Rios**. Rains of May 2003 produced a low quality crop. *El Comercio. 2003d.*
4. **Fruit production falls in the Central Sierra**. 400 fruit producers experienced a 30% reduction in available irrigation water because of the 2002-03 drought. Fruit harvests reduced by as much as two thirds. *El Comercio. 2003a.*
5. **Drought affects cattle en Flavio Alfaro county**. 271 communities lacked water. 2000 cattle died. Cattle were 70% of their normal weight. Economic losses of US$30 million. *El Unverso, Dec. 17, 2005*
6. **Rain and floods continue relentlessly**. Floodwaters covered rice and vegetable crops. Farmers harvested crops before maturity to avoid plant disease. *El Comercio, Feb. 20, 2006*
7. **Emergency decree for drought and frosts in agricultural sector**. Government signed order to provide US$58 million dollars to aid affected populations. *Hoy, Dec. 17, 2005*

Increased malnutrition in coastal Ecuador between 1990 and 2001 is believed to be associated with crop failures associated with El Niño (Figure 1).

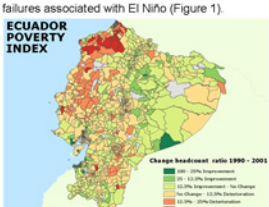

Figure 1. Change Headcount Ratio 1990 – 2001

Proposal

The project will combine satellite imagery and ground measurements needed for analyzing weather and climate during the growing season in Ecuador. Our goal is to understand the spatial and temporal distribution of three key variables for crop growth - solar radiation, rainfall, and temperature.

Vegetation Indices for Weather Monitoring

Figure 2 shows the difference in the Enhanced Vegetation Index (EVI) between two dates. Green areas are wetter and red areas are drier.

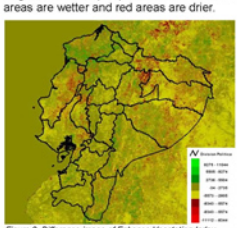

Figure 2. Difference image of Enhance Vegetation Index values between September and October, 2003 for Ecuador

10-day Rainfall from Satellites

Rainfall will be estimated from the National Aeronautics and Space Administration (NASA) 5-km resolution Tropical Rainfall Measuring Mission (TRMM) data set (NASA 2004), and from our network of INAMHI and INIAP field stations. TRMM produces daily estimates of rainfall that are calibrated with some ground stations (Figure 3).

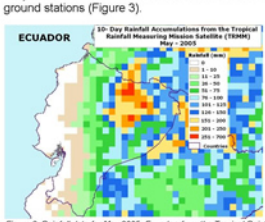

Figure 3. Rainfall data for May 2005, Ecuador, from the Tropical Rainfall Measuring Mission (TRMM). Source NASA – TRMM – USGS – CIAT.

Ground Network of Weather Stations

Additional calibration of these data will be carried out for 42 stations in Ecuador (35 INAMHI meteorological stations and 7 INIAP agricultural experiment stations) (Figure 4).

Figure 4. Map of Ecuador showing location of meteorological and agricultural field stations.

A Network of Food Security and Environmental Professionals

Figure 5. Ecuadorian Food Security Network (REDPESA)

The key element of the project is sustained participation of the Ecuadorian Food Security Network (REDPESA), including 15 organizations with more than 45 food security experts (Figure 5). This network will be expanded to include others as the project develops.

The project will produce four direct outcomes:

1. Research that compares ground truth information and remotely sensed and secondary information.
2. Public domain geographic and satellite information for agricultural and food security decision making.
3. Information compiled and shared by a community of food security experts working in Ecuador.
4. Training of Ecuadorian partners to use the system.

Groupware for Knowledge Management

Figure 6. Prototype web site includes communications tools and interactive maps.

This prototype web site (Figure 6) demonstrates how the network of food security professionals will interact. The site includes communication tools such as forums, chat, frequently asked questions, file and image galleries and interactive maps.

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REDPESA