Extended Abstract: Building Climate Information in Central America: Agroclimatic Forecast Interpretations for the 2004 Season

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Central America suffers from extremes of climate variability, with a limited societal capacity to mitigate these effects. Many rural people practice subsistence rain fed agriculture as a basic livelihood strategy, and as such are vulnerable to the impacts of drought or flood that can diminish or destroy a harvest. Furthermore, the drop in world coffee prices has led to the widespread loss of employment opportunities on the coffee plantations, which would otherwise mitigate dependence on subsistence agriculture. The heightened state of vulnerability in the region creates an opportunity for the effective application of climate information. This proposal describes an application that will: i) interpret probabilistic climate forecasts into downscaled point estimates of seasonal precipitation and maize water requirement satisfaction index (WRSI) values, ii) update the forecasts with observed precipitation as the season progresses, iii) disseminate these results as agro-climatic outlooks before and throughout the season, iv) evaluate the forecast and dissemination procedures, and v) produce a final report detailing the success and failures of the forecast interpretation and dissemination process. By using station data, rather than interpolated gauge data, this application process can quickly reproduce successful techniques currently being used in Africa. This project will combine the efforts of the Comité Regional de Recursos Hidraulicos del Istmo CentroAmericano (CRRH) with Famine Early Warning System Network (FEWSNET) researchers at UCSB and in Guatemala.

We briefly describe the four stages of this work: forecast interpretation, updating, dissemination and evaluation.

Forecast Interpretation: UCSB researchers[1] have developed a forecast interpretation method that uses Monte Carlo resampling to translate probabilistic forecast terciles into a matching probability distribution function (pdf). The method begins with a 2 or 3 element vector of parameters, _, which typically define either a normal or conditional gamma distribution. The theoretical distribution is then resampled in accordance with a set of forecast probabilities. If a forecast calls for a 45%, 35%, 20% probability of rainfall within the wet, middle and dry terciles, the method might draw 45, 35, and 20 samples from the highest, middle and lowest terciles of the theoretical probability distribution. A new set of parameters is calculated and stored. The resampling process is repeated many times, and the median parameter values are used to define a new distribution (_'). The new theoretical pdf described by _' can be used to estimate the seasonal rainfall associated with the median (50^{th} percentile). These median values can then be used to estimate crop water satisfaction.

The water requirement satisfaction index (WRSI) was originally developed by the FAO (1977, 1979, 1986) and can be used as a proxy for crop yields in water-limited crop growing regions. The end-of-season WRSI is a cumulative ratio of required and available crop water (W_r,W_a):

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SOS and EOS denote the start-of-season and end-of-season, respectively. While the WRSI has been shown to be an effective indicator of yields in water-limited crop growing regions (Verdin

[1] Greg Husak and Joel Michaelsen

and Klaver, 2002; Senay and Verdin, 2003), it requires observations of rainfall throughout the season. One component of this research project will examine and utilize a seasonal WRSI value:

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The forecast interpretation and seasonal WRSI calculations will be embedded as visual basic functions within an excel spreadsheet. Since the quality of the forecast interpretation will depend on the quality of the gauge observation dataset, the project will also seek to augment and improve this basic resource.

Forecast Update: This project will build closer links between climate forecasting and monitoring activities by numerically combining observed monthly station rainfall accumulations with forecast precipitation values. So, for example, in the first weeks of July, June station data will be combined with July-August forecast median rainfall and used to estimate end-of-season SWRSI values. While simple in concept and execution, combining forecast and monitoring information to produce timely mid-season estimates of end-of-season crop water satisfaction is a new and useful innovation.

Forecast Dissemination: Effective information reaches decision makers. This proposal therefore asks for a small amount of support to disseminate agroclimatic outlooks to key personnel. The dissemination process will begin with the identification of targeted individuals in business, government and academia. Copies of the original and updated agro-climatic outlooks will be sent over the Internet.

Forecast Evaluation: Updating the forecast throughout the season ensure that process is almost self-evaluating. Since each station for each month in the season will have an observed and forecast precipitation value, validation is a simple exercise in excel. While any validation based on a single climate event should be used cautiously, the forecast interpretation will allow quantitative analyses of the probabilistic forecast to be carried out operationally. The validation and evaluation results will be combined in a 25 page final report, in English and Spanish.

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