

### **Title of Presentation**

Agricultural Decision-Making in the Argentine Pampas: Modeling the Interaction between Uncertain and Complex Environments and Heterogeneous and Complex Decision Makers

### **Authors and Affiliations**

Elke Weber<sup>1</sup>, Guillermo Bernaudo<sup>2</sup>, Federico Bert<sup>3</sup>, Kenny Broad<sup>4</sup>, Graciela Caputo<sup>5</sup>, Alejandra Celis<sup>5</sup>, William Easterling<sup>6</sup>, Hilda Herzer<sup>5</sup>, Cecilia Hidalgo<sup>3</sup>, Richard Katz<sup>7</sup>, Carlos Laciana<sup>3</sup>, David Letson<sup>4</sup>, Angel Menéndez<sup>3</sup>, Claudia Natenzon<sup>3</sup>, Liliana Núñez<sup>8</sup>, Silvia Núñez<sup>8</sup>, Donald Olson<sup>4</sup>, Roger Pulwarty<sup>9</sup>, Guillermo Podestá<sup>4</sup>, Balaji Rajagopalan<sup>10</sup>, Mariano Re<sup>3</sup>, Fernando Ruiz Toranzo<sup>2</sup>, Emilio Satorre<sup>2</sup>, Maru Skansi<sup>8</sup>, Carlos Villanueva<sup>8</sup>

<sup>1</sup> Center for Research on Environmental Decisions, Columbia University; <sup>2</sup> AACREA, Argentina; <sup>3</sup> Universidad de Buenos Aires; <sup>4</sup> University of Miami; <sup>5</sup> CENTRO Estudios Sociales y Ambientales; <sup>6</sup> Penn State University; <sup>7</sup> National Center for Atmospheric Research; <sup>8</sup> Servicio Meteorológico Nacional, Argentina; <sup>9</sup> NOAA Cooperative Institute for Research in Environmental Sciences; <sup>10</sup> University of Colorado

### **Abstract**

Agricultural ecosystems play a central role in world food production and food security. Agroecosystems combine the complexity, multiplicity of scales, and feedbacks of biophysical interactions in natural ecosystems with the additional intricacies of human decision-making. Here we describe a project that aims to understand and model the dynamic interactions of natural and human components in agroecosystems. Emphasis is placed on (a) the impacts of interannual and inter-decadal climate variability and the use of climate information, and (b) agricultural decision-making in the light of climate variability, probabilistic climate information (e.g., seasonal forecasts or decadal projections), and other contextual factors (economic, social, technological). The geographic focus is the Argentine Pampas, a major agricultural area. For brevity, we describe only the project components that will be described in detail at this meeting.

Actual use of climate information in agricultural decisions and the production decisions themselves most likely deviate from frequently used prescriptions (e.g., maximization of expected utility, EU). For this reason, we are exploring the effects of different objective functions on optimal farm management strategies both without and with the availability of seasonal climate forecasts. In addition to EU maximization (as a benchmark), we examine the maximization of EU corrected for anticipated regret, and the maximization of the expected value associated with prospect theory. Preliminary results show differences in optimal actions for the various objective functions and for different combinations of parameters. Our next step is to estimate the value of climate information as derived from each of the objective functions. We compare the optimal management for predicted ENSO

phases (El Niño, La Niña, neutral years) with management optimized over the entire historical climate record (i.e., the naïve case) and consider different levels of forecast skill (i.e., once a given ENSO phase is predicted, how often does that phase actually occur?).

The project combines a rich set of methodologies, including (a) linked modeling approaches for generation of climate scenarios and simulation of decision outcomes, (b) controlled experiments on farmers' decision-making and behavior, and (c) participatory research that draws on stakeholders' experiences and preferences. As illustrated by the authors' list, the project involves a diverse, yet cohesive and well-balanced team of investigators from a range of disciplines. The project also benefits from access to farmers and technical advisors from AACREA, a non-profit group of Argentine farmers with a mandate for dissemination of technological innovations. The project is funded by a NSF-DMUU grant to the Center for Research on Environmental Decisions (CRED), an NSF-Biocomplexity award, and NOAA's Office of Global Programs.