Population growth, climate change, dietary shifts, agricultural intensification, and market globalisation are responsible for changes to the global food system. With an increasingly interconnected global food system the consequences of individual, institutional and governmental decisions can resonate across a variety of locations and scales. Coupled with increasing food demand, this gives rise to systemic risks, i.e. a lack of resilience. Shocks to the system, e.g. supply shocks in one or more major production regions, can be communicated geographically. A notable example of this was the 2007/08 food price spike, as well as the continued price volatility in food markets. Shocks, in the form of tipping points, also have the potential to generate irreversible changes in the food system state. To explore interactions occurring in the food system, no one part of the human-environmental system can be assessed in isolation. Coupled modeling efforts represent a potential strategy in this regard. Here we present the modelling approach and initial results of an effort to couple a new global food security model, PLUMv2, with a biologically-representative vegetation and crop production simulator, LPJ-GUESS, and the climate emulator IMOGEN. The coupled model will be used to better understand the resilience of food systems to a range of shocks and trends. Examples of this include governmental behaviours such as trade policies, changes in dietary patterns, extreme weather events, and crop pestilence. The food system's resilience is measured by the effect of shocks on food prices and food availability. Furthermore, the spatially explicit nature of LPJ-GUESS-PLUM-IMOGEN allows for the resilience to shocks to be investigated at sub-national, national, and global scales.

Monday, 21 August - Room 33 (30) - 11:30 - 13:00

Understanding social-ecological systems through best practices in participatory modeling

Contributed session - Approaches and methods for understanding social-ecological system dynamics

Chair/s: Laura Schmitt Olabisi

The popularity of participatory modeling (PM) has grown in recent years with the acknowledgement that the inclusion of stakeholders and a variety of scientific perspectives are required to improve our understanding of the complexity of social-ecological systems. However, there are still questions about how different software tools common to PM can be used to facilitate learning among diverse groups and which approaches are more or less suitable given the nature of a community or issue. We suggest a "4P framework" for the field of PM and provide an overview of a range of tools available for socio-environmental modeling with stakeholders.

Contributed session oral presentation:
Purpose, Processes, Partnerships, and Products: 4Ps to advance Participatory Socio-Environmental Modeling

Steven Gray [1], Alexey Voinov [2], Pierre Bommel [3], Christophe LePage [4], Laura Scmitt-Olabisi [1]

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Including stakeholders in environmental model building and analysis is an increasingly popular approach to understanding ecological and social change. This is because stakeholders often hold valuable knowledge about socio-environmental dynamics and collaborative forms of modeling produce important boundary objects used to collectively reason about environmental problems. Although the number of participatory modeling (PM) case studies and the number of researchers adopting these approaches has grown in recent years, the lack of standardized reporting and limited reproducibility have prevented PM's establishment and advancement as a cohesive field of study. We suggest a four-dimensional framework (4P) that includes reporting on dimensions of: (1) the Purpose for selecting a PM approach (the why); (2) the Process by which the public was involved in model building or evaluation (the how); (3) the Partnerships formed (the who); and (4) the Products that resulted from these efforts (the what). We highlight four case studies that use common PM software-based approaches (fuzzy cognitive mapping, agent-based modeling, system dynamics, and participatory geospatial modeling) to understand human-environment interactions and the consequences of ecological and social changes, including bushmeat hunting in Tanzania and Cameroon, agricultural production and deforestation in Zambia, and groundwater management in India. We demonstrate how standardizing communication about PM case studies can lead to innovation and new insights about model-based reasoning in support of natural resource policy development. We suggest that our 4P framework and reporting approach provides a way for new hypotheses to be identified and tested in the growing field of PM.

Contributed session oral presentation:

Fuzzy Cognitive Mapping with Mental Modeler: A software tool for collecting and standardizing stakeholder knowledge to understand social-ecological systems
Steven Gray

Michigan State University, East Lansing, United States

There is a growing interest in the use of fuzzy cognitive mapping (FCM) as a participatory method for understanding social-ecological systems (SESs). In recent years, FCM has been used in a diverse set of contexts ranging from fisheries management to agricultural development, in an effort to generate transparent graphical models of complex systems that are useful for decision making, illuminate the core presumptions of environmental stakeholders, and structure environmental problems for scenario development. This increase in popularity is because of FCM's bottom-up approach and its ability to incorporate a range of individual, community-level, and expert knowledge into an accessible and standardized format. This presentation will include 2 parts which include: (1) a brief overview of FCM as a participatory modeling approach and (2) a hands-on demonstration of the architecture and various uses of an FCM-based software program called Mental Modeler. By providing workshop participants with sample data and web-based access to the software on their computers, we will create models, run scenarios, discuss software functionality and discuss the benefits and limitations to FCM as a participatory modeling approach compared to other participatory modeling approaches available.

Contributed session oral presentation:

Playing with models. How to use Agent-Based Models with stakeholders for understanding social-ecological systems
Pierre Bommel [1, 2], Marie-Paule Bonnet [4, 5], Grégoire Leclerc [1], Emilie Coudel [1, 3], Christophe Le Page [1]