Common pool resource management systems are complex to manage due to the absence of a clear understanding of the effects of users' behavioral characteristics. Non-cooperative decision making based on individual rationality (as opposed to group rationality) and a tendency for free ride due to lack of trust and information about other users' behaviors create externalities and can lead to tragedy of the commons without intervention by a regulator. Nevertheless, even regulatory institutions often fail to sustain natural common pool resources in absence of clear understanding of the responses of multiple heterogeneous decision makers to different regulation schemes. While modeling can help with our understanding of complex coupled human-natural systems, past research has not been able to realistically simulate these systems for two major limitations: 1) lack of computational capacity and proper mathematical models for solving distributed systems with self-optimizing agents; and 2) lack of enough information about users' characteristics in common pool resource systems due to absence of reliable monitoring information.

Recently, different studies have tried to address the first limitation by developing agent-based models, which can be appropriately handled with today's computational capacity. While these models are more realistic than the social planner's models which have been traditionally used in the field, they normally rely on different heuristics for characterizing users' behavior and incorporating heterogeneity. This work is a step-forward in addressing the second limitation, suggesting an efficient method for collecting information on diverse behavioral characteristics of real agents for incorporation in distributed agent-based models. Gaming in interactive virtual environments is suggested as a reliable method for understanding different variables that promote sustainable resource use through observation of decision making and behavior of the resource system beneficiaries under various institutional frameworks and policies.

A review of educational or "serious" games for environmental management was undertaken to determine an appropriate game for collecting information on real-agents and also to investigate the state of environmental management games and their potential as an educational tool. A web-based groundwater sharing simulation game "Irrigania" was selected analyze the behavior of real agents under different common pool resource management institutions. Participants included graduate and undergraduate students from the University of Central Florida and Lund University. Information was collected on participants’ resource use, behavior and mindset under different institutional settings through behavior observation and discussion with participants. Preliminary use of water resources gaming suggests communication, cooperation, information disclosure, trust, credibility and social learning between beneficiaries as factors promoting a shift towards sustainable resource use. Additionally, Irrigania was determined to be an effective tool for complementing traditional lecture-based teaching of complex concepts related to sustainable natural resource management. The different behavioral groups identified in the study can be used for improved simulation of multi-agent groundwater management systems.

Major: Civil Engineering

Educational Career:
Bachelor's of Civil Engineering, BS, 2012, University of Central Florida

Committee in Charge:
Kaveh Madani, Chair, Civil, Environmental, and Construction Engineering
Dingbao Wang, Civil, Environmental, and Construction Engineering
Peter Jacques, Political Science

Approved for distribution by Kaveh Madani, Committee Chair, on October 31, 2013.

The public is welcome to attend.