Jun 27th, 3:40 PM - 5:20 PM

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Marthe Wens
marthe.wens@vu.nl

Mike Johnson
UCSB, mike.johnson@geog.ucsb.edu

iEMSs International Congress on Environmental Modelling and Software

9th International Congress on Environmental Modelling and Software
Fort Collins, Colorado, USA, Mazdak Arabi, Olaf David, Jack Carlson, Daniel P. Ames (Eds.)
https://scholarsarchive.byu.edu/iemssconference/2018/

Simulating dynamic drought adaptation behaviour of agricultural stakeholders using Agent-Based Models

Marthe Wens[1], Mike Johnson[2]
[1] *Institute for Environmental Studies, VU Amsterdam. marthe.wens@vu.nl*
[2] *Department of Geography, UCSB. mike.johnson@geog.ucsb.edu*

Abstract: Increasing climate variability and changing socio-economic conditions are expected to exacerbate agricultural drought risk in many parts of the world. Current risk assessments, however, do not elegantly incorporate emergent adaptation strategies and therefore fall short in their representation of vulnerability dynamics. Adopting a socio-hydrological framework allows modelers to simultaneously consider the temporal and spatial extents of meteorological and hydrological factors and dynamic human behavior. In our research, we use spatially-explicit agent-based models to investigate how humans respond to perceived drought risk and ultimately impact the hydrological system, in hopes of deriving a clearer understanding of future agricultural drought risk. Agent-based models offer a promising analytical tool to simulate autonomous, nonlinear, dynamic human decision making within an evolving hydrological or bio-physical model. Our research focuses on the application of three socio-hydrologic agent-based models: (1) in rural Kenya (2) in California's Central Valley and (3) in northern Italy. These case studies illustrate not only how this strategy can be implemented in unique locations with varying data accessibility, adaptive capacity, and institutional values, but also how explicit inclusion of local behavior results in widely variable adaptive strategies and resulting risk.

***Keywords**:* Agent-based model, Drought Adaptation, Water management, California, Kenya, Food Production