

BREE IAM Research Question and Proposed Model Structure

In the face of exogenous shocks driven by extreme events and endogenous socio ecological processes in the Lake Champlain Basin, what strategies for resilience can be implemented to manage the risk from extreme events and what are the trade-offs for prioritizing public sector investments?

Intellectual merit:
Exploration of SES
couplings and
feedbacks through
novel application of
deep learning and
agent cognition!

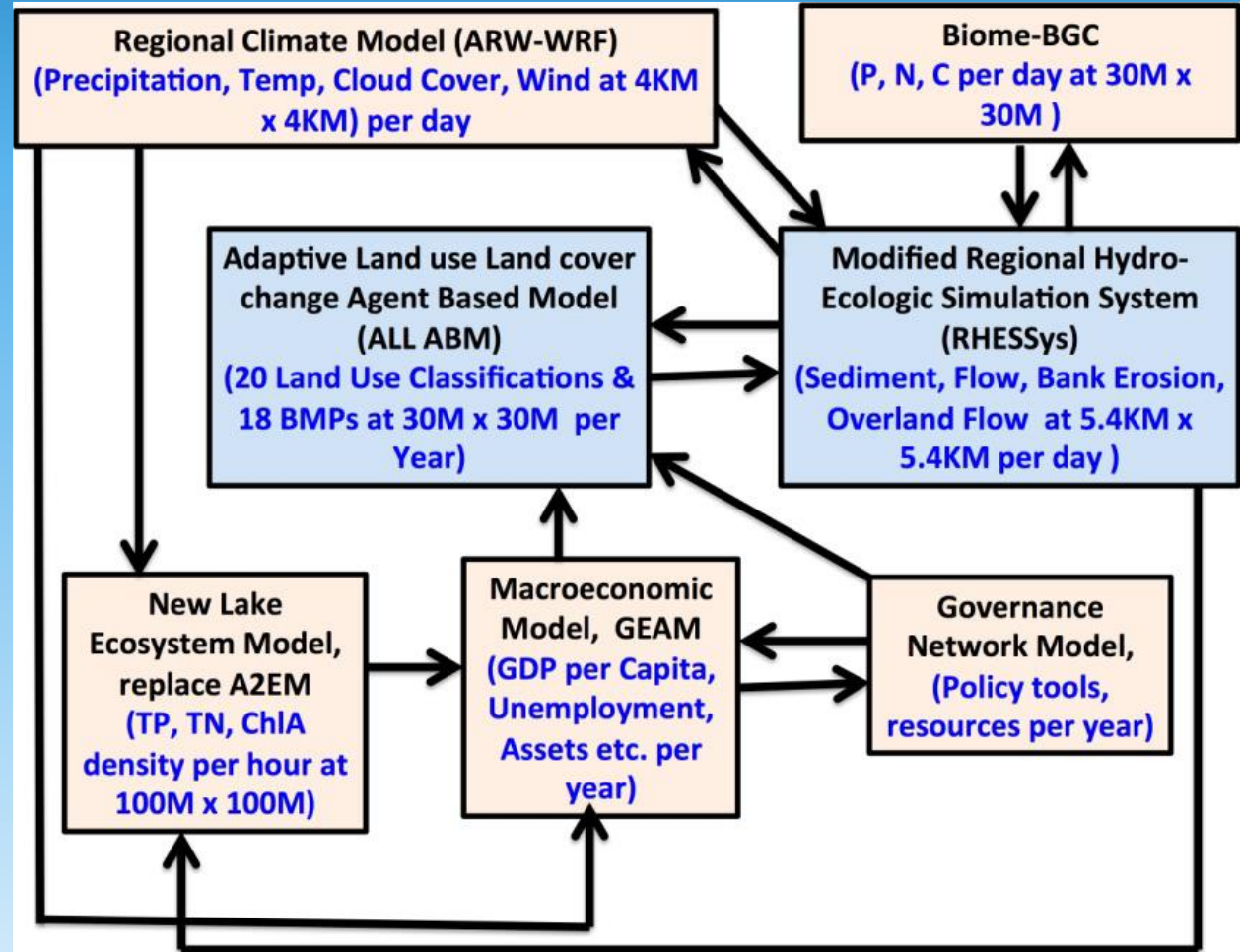


Figure 7: The BREE Integrated Assessment Model (IAM) of coupled social ecological systems for understanding the cascading impacts of climate change induced extreme events at watershed scales; tan = new model; blue = expanded existing model; WRF: Weather Research and Forecasting; ALL: Adaptive Landuse Land cover agent based model; GEAM: General Equilibrium Analysis Model

BREE IAM Scenario Development Plan

Methods: The **BREE IAM** will be employed to identify and test portfolios of robust infrastructure design strategies that achieve resilience in the face of climate-initiated extreme events and the complex interactions manifested within and across hydrological, ecological and social systems. We will engage a targeted group of decision makers (Climate Cabinet and Lake Champlain Basin Program Technical Advisory Committee) in two stakeholder workshops per year to iteratively narrow the range of interventions (Table 2, first column). (See list of BMPs and policy tools above.) In addition, we will identify decision makers' goals and values for the purpose of constructing realistic objective functions (minimize pollution, maximize economic welfare). The BREE IAM will simulate and identify effects of these interventions on water quality, social behavioral response and net economic damage from extreme events in the light of a series of Hypothetical Scenarios (two examples A and B with hypothesized responses in italics in Table 2). We will identify a subset of policy interventions that promote resilience (e.g. Intervention 1, Scenario A or B in tan) in the Basin for scenarios that include climate projections, changing macro-economic conditions and dynamic governance network regimes.

Table 2 Examples of Policy Interventions from Workshops	Hypothetical Scenario A High emission climate scenario leading to more frequent and intense extreme events; centralized governance network; high economic growth rate	Hypothetical Scenario B Low emission climate scenario leading to no change in the frequency and intensity of extreme events; decentralized governance; low economic growth rate
1. Incentivize green infrastructure investments through subsidies and tax exemptions	<i>Increased agriculture and urban BMP adoption rate; Lower net damages from extreme events; moderate water quality</i>	<i>Moderate increase in agriculture and urban BMP adoption rate; Minimal net damages from extreme events; high water quality</i>
2. Strengthen wetland, riparian and forest conservation regulations	<i>Lower agriculture and urban BMP adoption rate; higher net damages from extreme events; poor water quality</i>	<i>Lower agriculture and urban BMP adoption rate; lower net damages from extreme events; poor water quality</i>

Proposed IAM Milestones

Integrated Modeling Research Question: In the face of exogenous shocks driven by extreme events and endogenous socio ecological processes in the Lake Champlain Basin, what strategies for resilience can be implemented to manage the risk from extreme events and what are the trade-offs for prioritizing public sector investments?	Y1	Y2	Y3	Y4	Y5
Stakeholder workshops for development and testing of scenarios (two per year)	X	X	X	X	X
Integrate climate projections in IAM	X	X	X		
Integrate GEAM feedbacks in IAM		X	X	X	X
Integrate ALL ABM in IAM		X	X	X	X
Integrate expanded RHESSys in IAM	X	X	X	X	X
Integrate new lake model in IAM		X	X	X	X
Validate IAM for Missisquoi and Winooski		X	X	X	X
Validate IAM for Shelburne Pond and Lake Iroquois		X	X	X	X