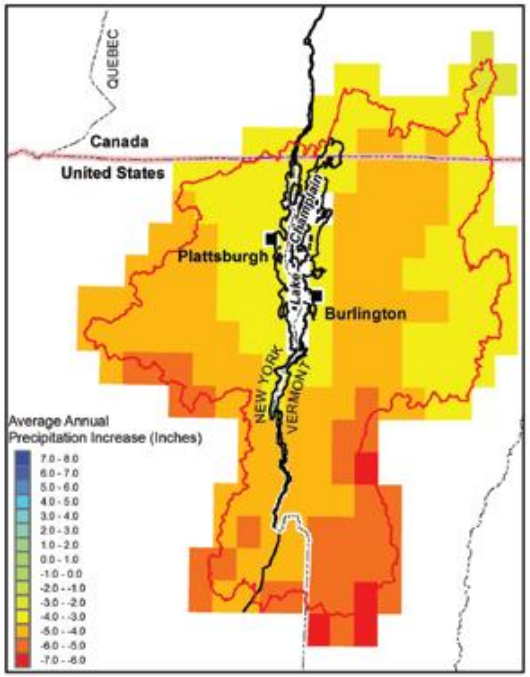
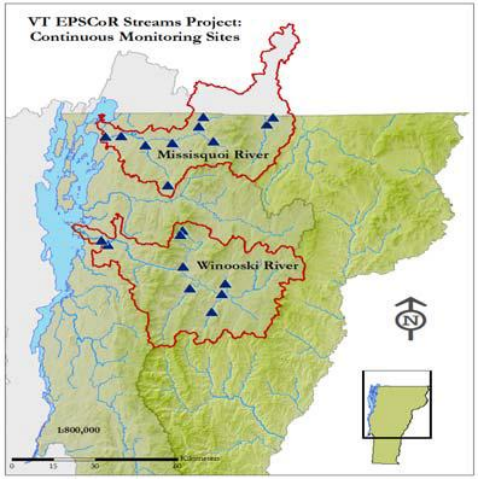
Research on Adaptation to Climate Change (RACC)

Science Goals

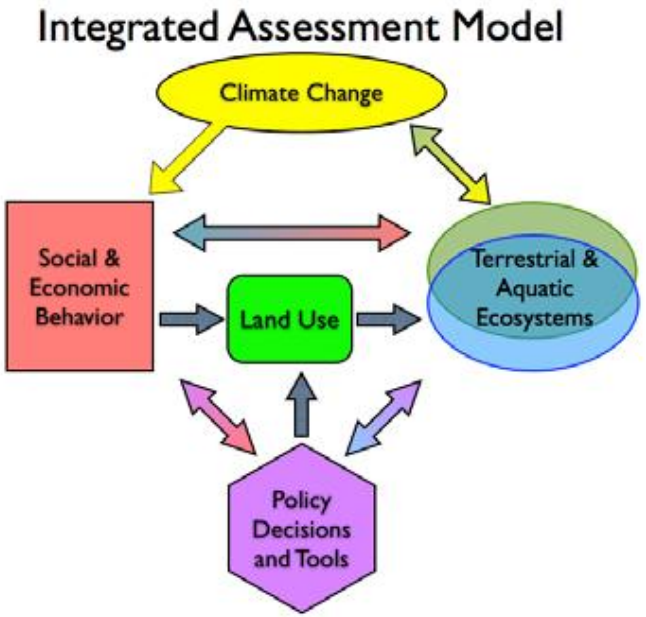


Predicted Change in Average Annual Precipitation from 2010 to 2099--Model MIROC3.2 (medres) for Emissions Scenario A2.

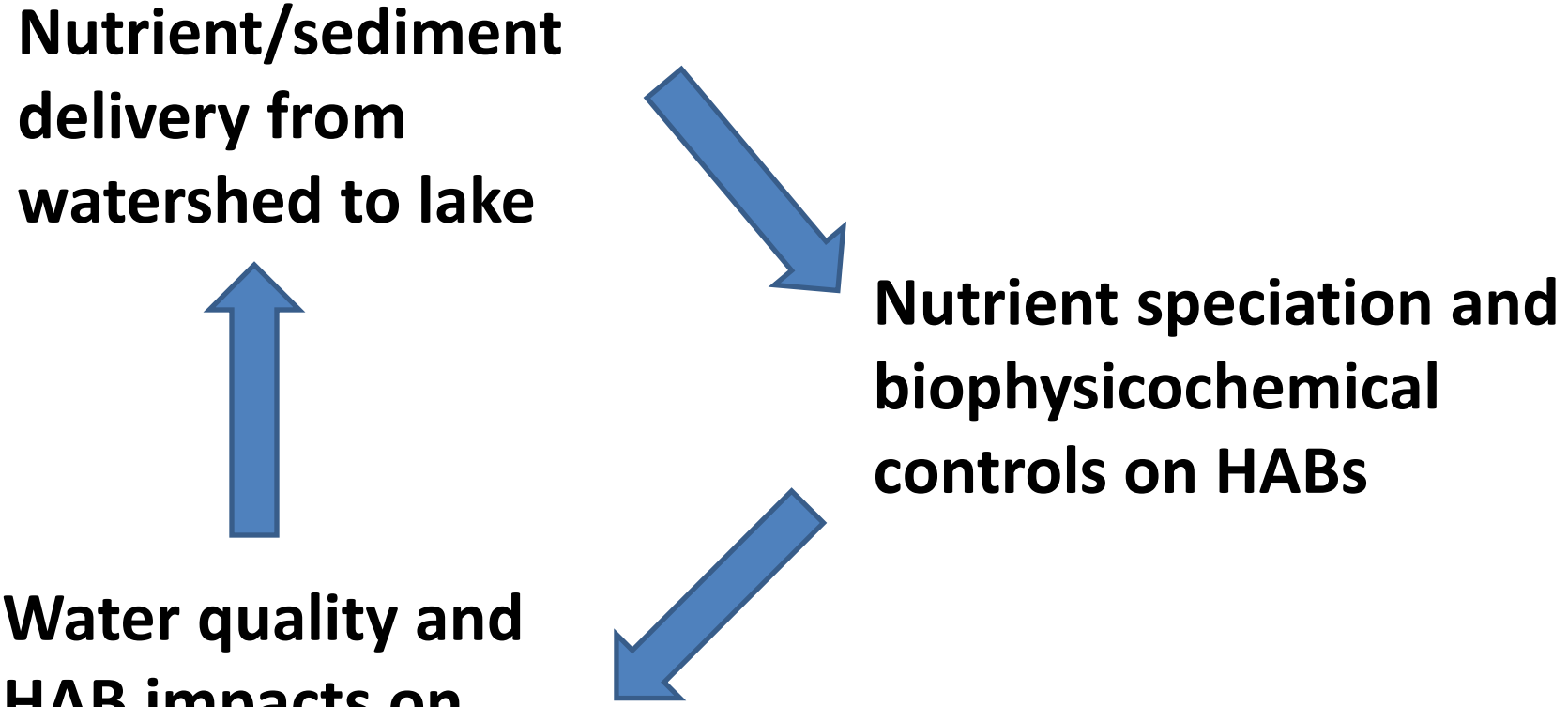


Overarching Science Question

How will the interaction of climate change and land use alter hydrological processes and nutrient transport from the landscape, internal processing and eutrophic state within the Lake and what are the implications for adaptive management strategies?



Linking to watershed, socio-economic-policy components



3 integrated questions

- Question 1: What is the relative importance of endogenous in-lake processes (e.g. internal loading, ice cover, hydrodynamics) versus exogenous to-lake processes (e.g. land use change, snow/rain timing, storm frequency and intensity, land management) to lake eutrophication and algal blooms?
- Question 2: Which alternative stable states can emerge in the watershed and lake resulting from non-linear dynamics of climate drivers, lake basin processes, social behavior, and policy decisions?
- Question 3: In the face of uncertainties about climate change, land use and lake response scenarios, how can adaptive management interventions (e.g. regulation, incentives, treaties) be designed, valued and implemented in the multi-jurisdictional Lake Champlain Basin?

Q1: What is the relative importance of endogenous in-lake processes (e.g. internal loading, ice cover, hydrodynamics) versus exogenous to-lake processes (e.g. land use change, snow/rain timing, storm frequency and intensity, land management) to lake eutrophication and algal blooms?

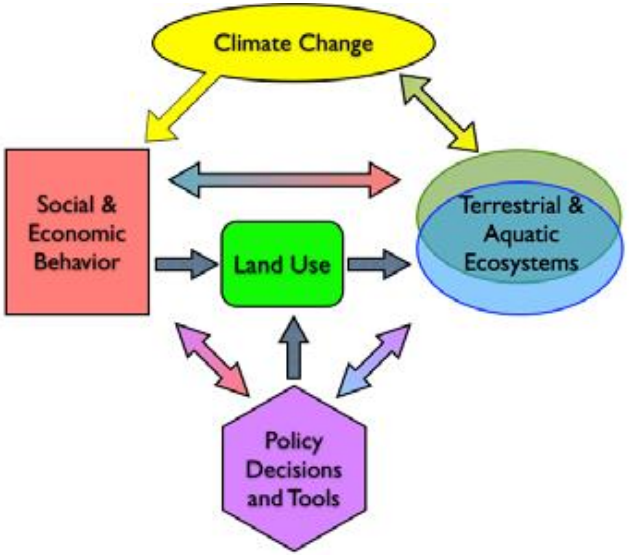
- Data collection needed at a much higher frequency to ‘catch’ triggering processes
- Detailed chemical work to better address bioavailability
- Coupled chemical-physical-biological processes and their importance

Question 2: Which alternative stable states can emerge in the watershed and lake resulting from non-linear dynamics of climate drivers, lake basin processes, social behavior, and policy decisions?

- Data-driven modeling to address the level of change that may alter a system enough to go into a different state – how much change might push any system into a new paradigm of function?
- In the watershed – a need to understand how landscape changes may affect nutrient transport under different climate change scenarios

Question 3: In the face of uncertainties about climate change, land use and lake response scenarios, how can adaptive management interventions (e.g. regulation, incentives, treaties) be designed, valued and implemented in the multi-jurisdictional Lake Champlain Basin?

- How do people – individuals to governments – react to changes in watershed and lake 'state' and how do their decisions then affect land use and nutrient transport?

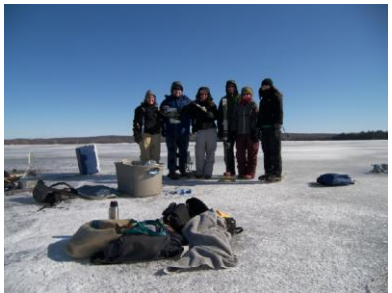


Integrated Modeling Platform

- All 3 research questions will gather data, test specific hypotheses, and develop mathematical models to further understanding of nutrient cycling and biological responses in the watershed and lake, behavior of the physical-chemical-biological systems, and the interchange between people and the watershed-lake system.
- ARIES Platform is our tool to tie all of these together to develop a framework where hypothesis testing of physical-chemical-biological-human interactions will be possible

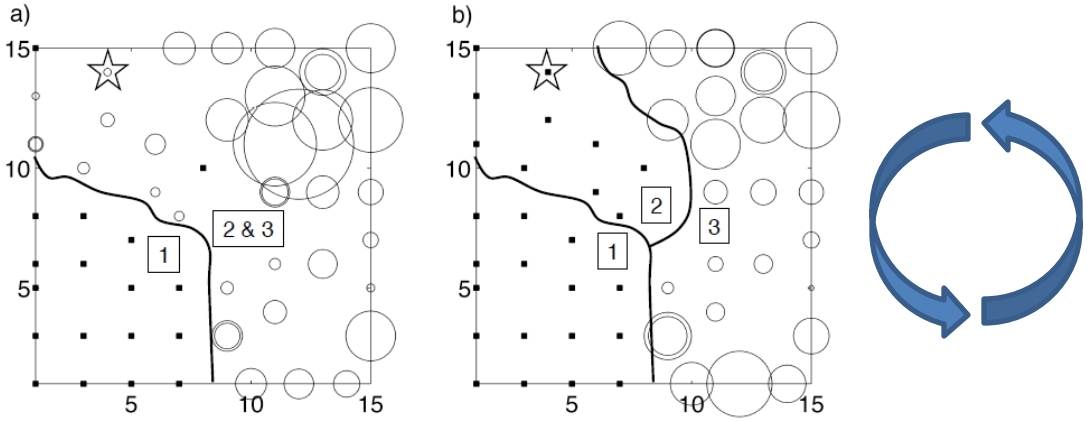
Who is involved?

- 20 PIs representing all universities/colleges in Vermont
- 3 dedicated postdocs
- 6 dedicated Ph.D. students
- 2 dedicated technicians
- 38 undergraduate summer researchers
- 18 high school teams
- Consultants and Collaborators across the US and Canada – Academic, State & Federal Agencies, Private Consultants



Empirical and Modeling Science

- **An approach to problems where modeling and field data collection & experimentation occur in tandem/concurrently/iteratively, not sequentially**
- **Feedback loops of thinking – what data is needed to model a system better? What hypotheses can we develop from empirical observation that can be tested with a model?**



Integrated Assessment Model