Evaluating the Lake Champlain Basin's Resilience to Extreme Events:

Identifying Scenarios of Land Use, River Corridor and Governance Change

Basin Resilience to Extreme Events

Vermont EPSCoR

November 30, 2018

PTAC Meeting

https://veniseenquebec.ca/en/directory/bay-missisquoi-basin-organization/

PTAC Activity Roadmap

Start

May 2018

Fuzzy cognitive mapping

Nov 2017

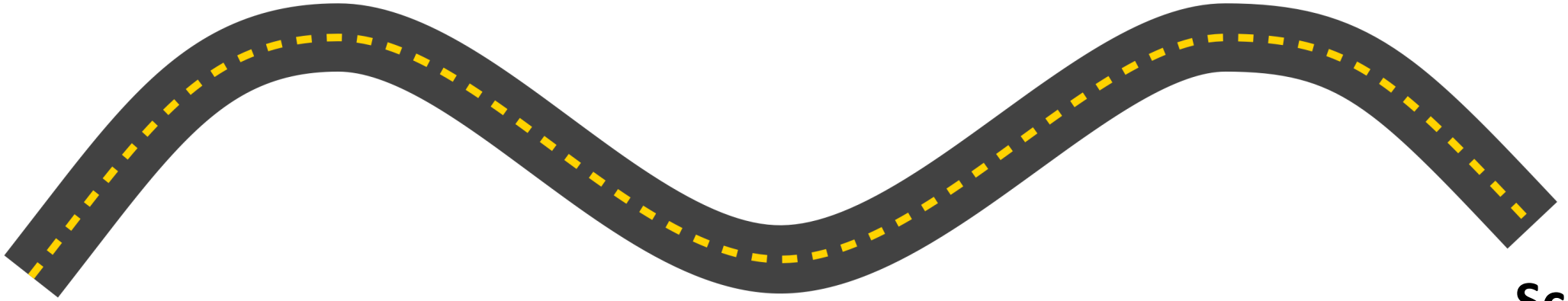
“Resilient perspectives” discussion

Nov 2018 – May 2019

Alternative states and levers

Nov 2018 - May 2019

Scenarios for IAM runs



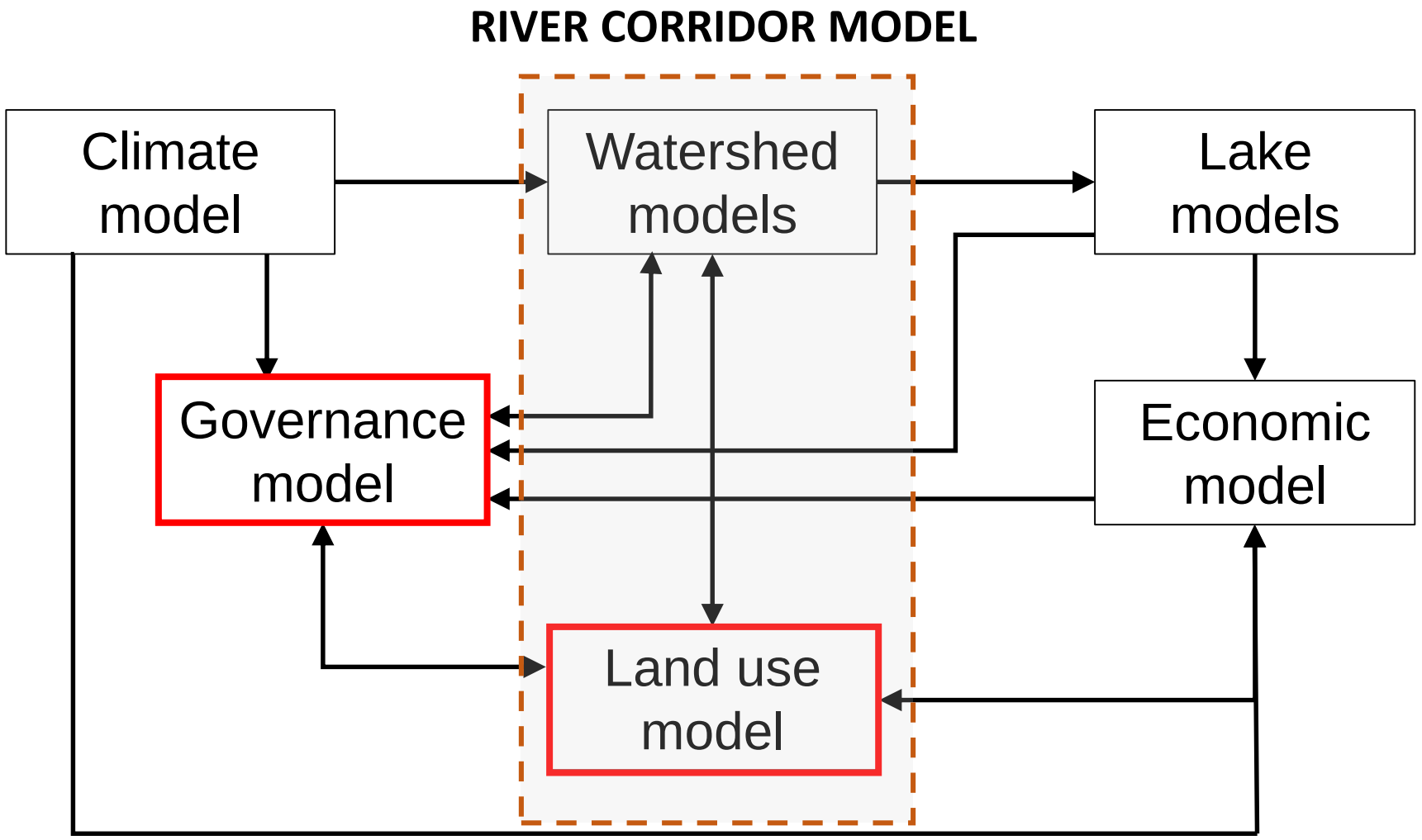
BREE uptake of last two PTAC activities

- **Resilience definitions – Nov 2017**
  - Encouraged broader definition of resilience beyond lake water quality
  - Will be used later for multi-criteria management problems
  - Scenario exercises can help us re-define and quantify resilience for specific questions later
- **Fuzzy cognitive mapping – May 2018**
  - Interest in channel erosion triggered focus on river corridor management in IAM
  - Includes conservation easements

TWO DEFINITIONS OF RESILIENCE FROM NOV 2017 PTAC

- The Lake Champlain Basin system should maintain *critical functions* after an event without significant post-event inputs
- Ability to provide for public safety and property for as many people as possible affordably

Integrated Assessment Model



Which land use, river corridor management changes should we consider given our modeling capabilities?

Overview of scenario development

- Evaluate changes in resilience to extreme events due to changes in watershed:
  - Management interventions
  - Some general societal changes
- Today, we'll focus on model components featuring some changes in our control:
  - Land use
  - River corridor management
  - Governance
- Must consider their robustness to changes largely out of local control, such as:
  - Climate
  - Federal policies
  - Population growth

Governance
(state, regional, local)

Landscape (land use)

River corridor (floodplain land use, channel stability)

Landscape (land use)

IAM scenario development plan

- Today, we'll start with a big-picture view of Lake Champlain bay systems (Missisquoi & St Albans)

- Do an exercise that elucidates questions about system responses to different changes in:
  - Land use
  - River corridors
  - Governance

- In future PTACs, we'll address specific questions regarding component models in more detail:
  - Identify performance metrics of interest
  - Determine most relevant scenarios

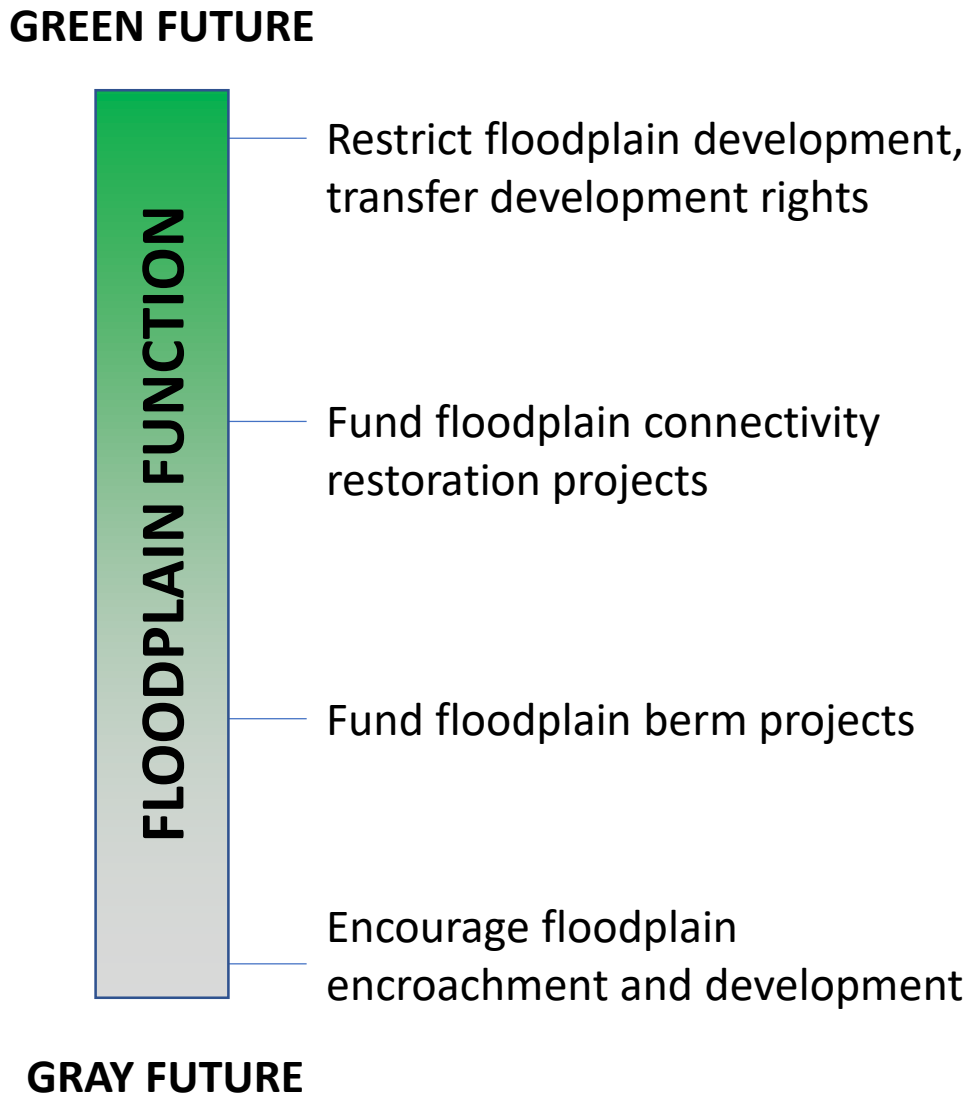
- Will consider cohesion of changes across IAM component models

Scenario Set	Land Use	River Corridor	Governance
Set 1	X		
Set 2		X	
Set 3			X
Set 4	X	X	
Set 5	X	X	X

Activity Overview

For each component model:

1. Identify multiple interventions and changes along thematic gradients
2. Identify intervals of change along change gradients, including bounds
3. Assess impacts and attributes of changes using semi-quantitative scales
4. Provide additional written description regarding impacts of change
5. Identify incompatible interventions as needed



River Corridors

Team #: ________

INSTRUCTIONS

1. For each intervention, please rate the overall importance of achieving the Prioritization Goal using the scale indicated at right.
2. Start with scoring just one row (Intervention), then address other interventions. Additional Prioritization Goals or Interventions can be added the worksheet
3. At the end of the session, please report if there was an important intervention that we missed.
4. (Optional) Describe how confident (e.g High/Low) you are for each score and add comments if desired

Scoring rubric:	
-2	Very Negative Impact
-1	Slightly Negative Impact
0	No Impact
+1	Slightly Positive Impact
+2	Very Positive Impact

Prioritization Goal or Attribute

Intervention/ Changes

	Prioritization Goal	Restore Biodiversity/ Ecology	Provide Flood Attenuation/Storage	Life Safey / Protection of Public Infrastructure	Reduce Nutrient Flux to Receiving Waters	Promote Hydropower / Snow-making / Irrigation	Protect Aesthetics & Cultural Value	Restore Connectivity of Rivers		
	Intervention									
Gradient										
Floodplain Function	Avoid development / transfer development rights in floodplain	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
	Restore floodplain wetlands	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
	Restore floodplain connection by lowering floodplain	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
	Revegete floodplain areas with native vegetation	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
	Conserve floodplain to support the channel's return to quasi-equilibrium state	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
	Clear floodplain vegetation & micro-topography	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
	Drain wetlands / hydric soils in floodplain	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
	Add berms to prevent flooding	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
	Increase encroachment / development of floodplain	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:	Score: Confidence: Comments:
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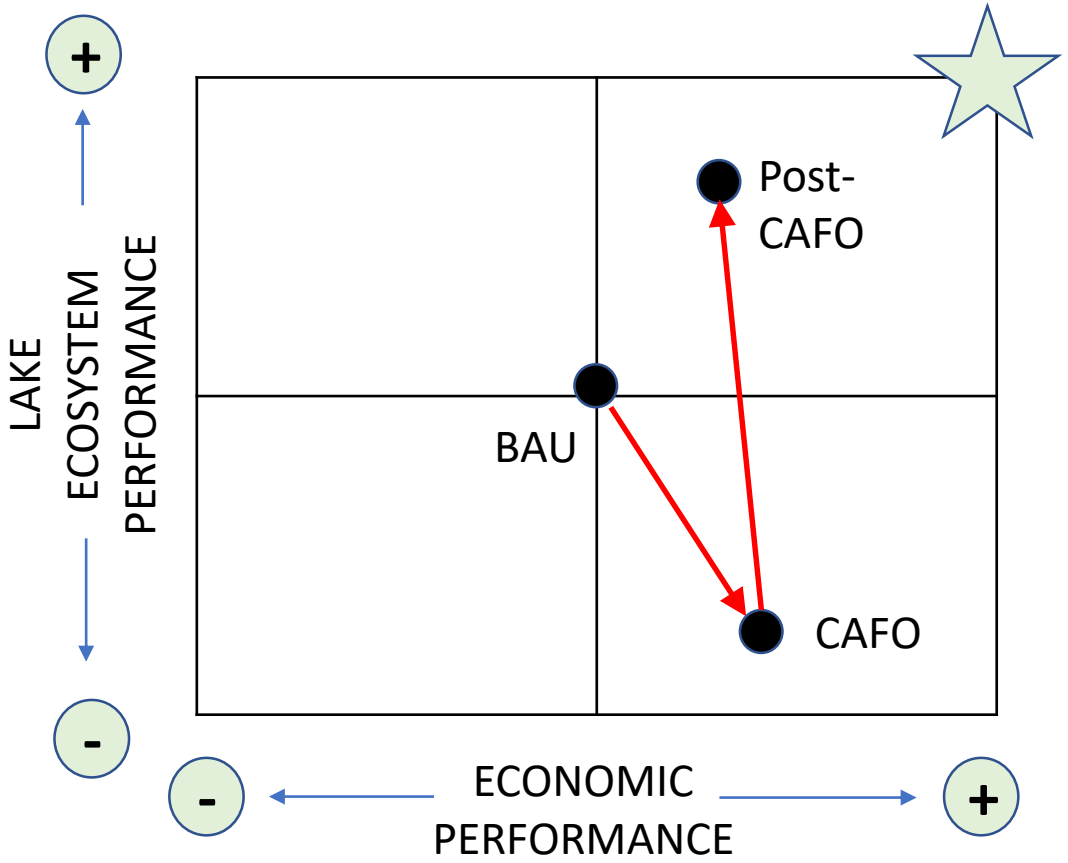
Future Directions I: Multi-criteria evaluation of system trajectories

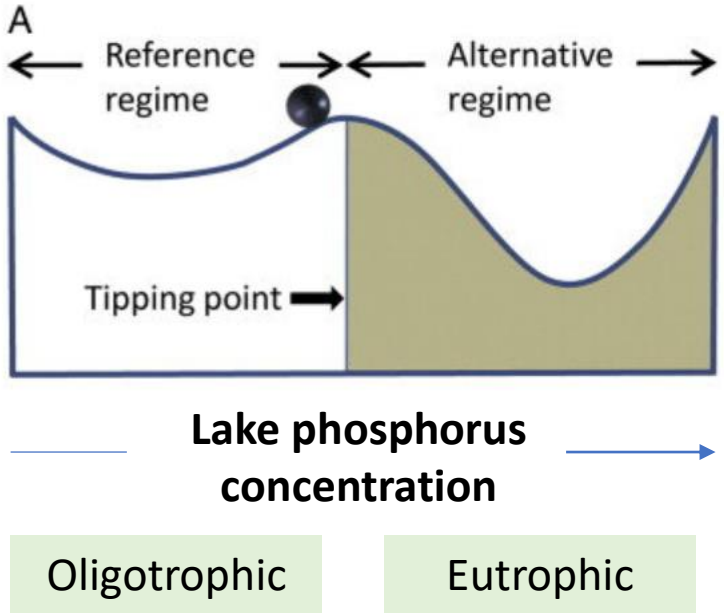


"St. Albans Bay Bounces Back: CAFO Ban a Success?"

- Stage 1: Dairy consolidation → CAFOs
  - Boosts local economy
  - Worsens water quality
- Stage 2: CAFO ban coincides with other water quality improvements
  - Improves ecological performance
  - Reduces agricultural economy
  - Revitalizes tourism since lake better than today
- Must also examine multi-sectoral impacts

Future directions II: Transformability and basins of attraction

- Lake eutrophication has been described in terms of basins of attraction
  - When seasonal eutrophication sets in, more difficult to return to oligotrophic conditions
- What combinations of system characteristics will keep us in the oligotrophic basin?
- Also will examine tipping points and basins of attraction for other system variables




Thank you!
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