

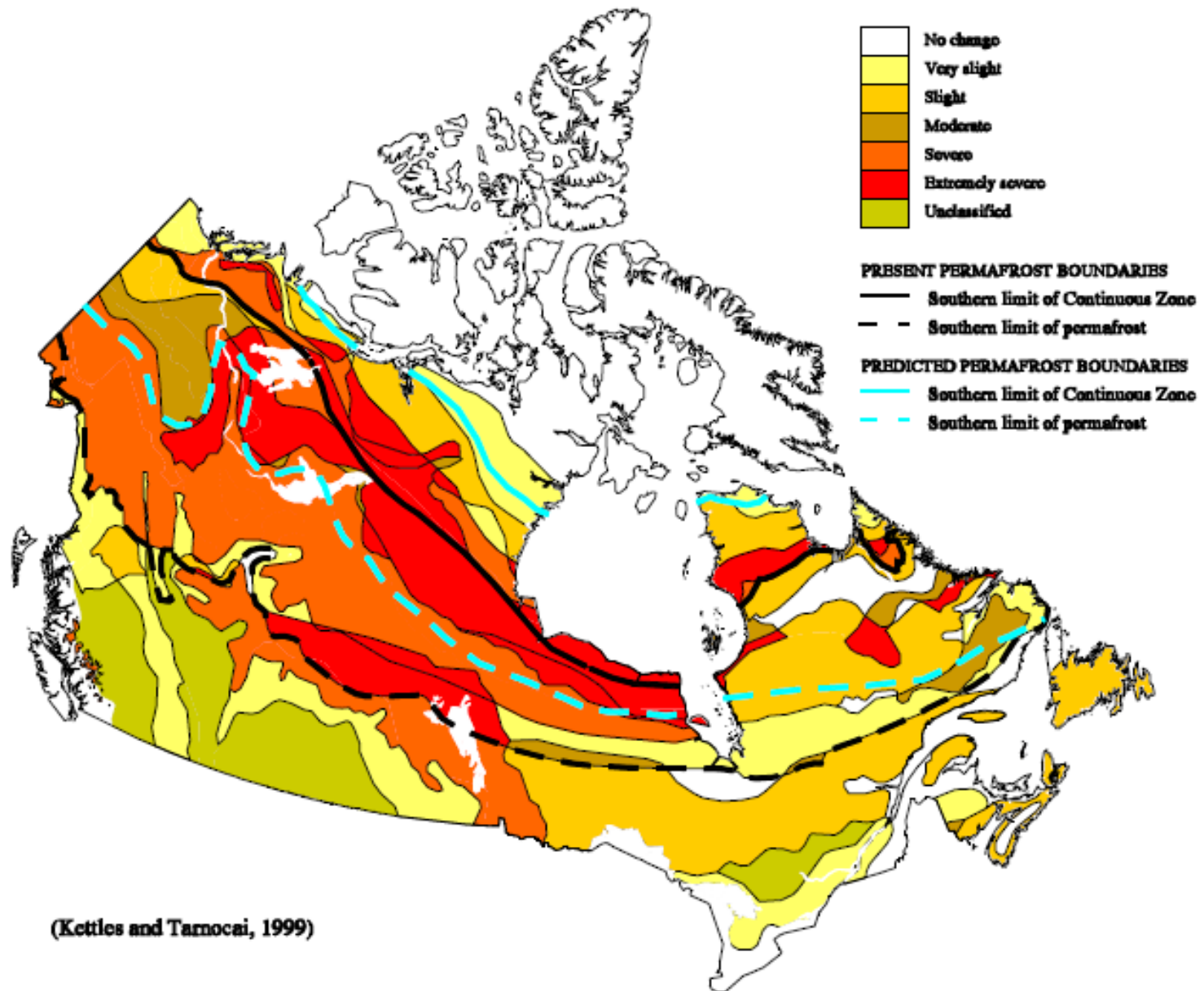


Northern Peat and Permafrost in a Changing Climate

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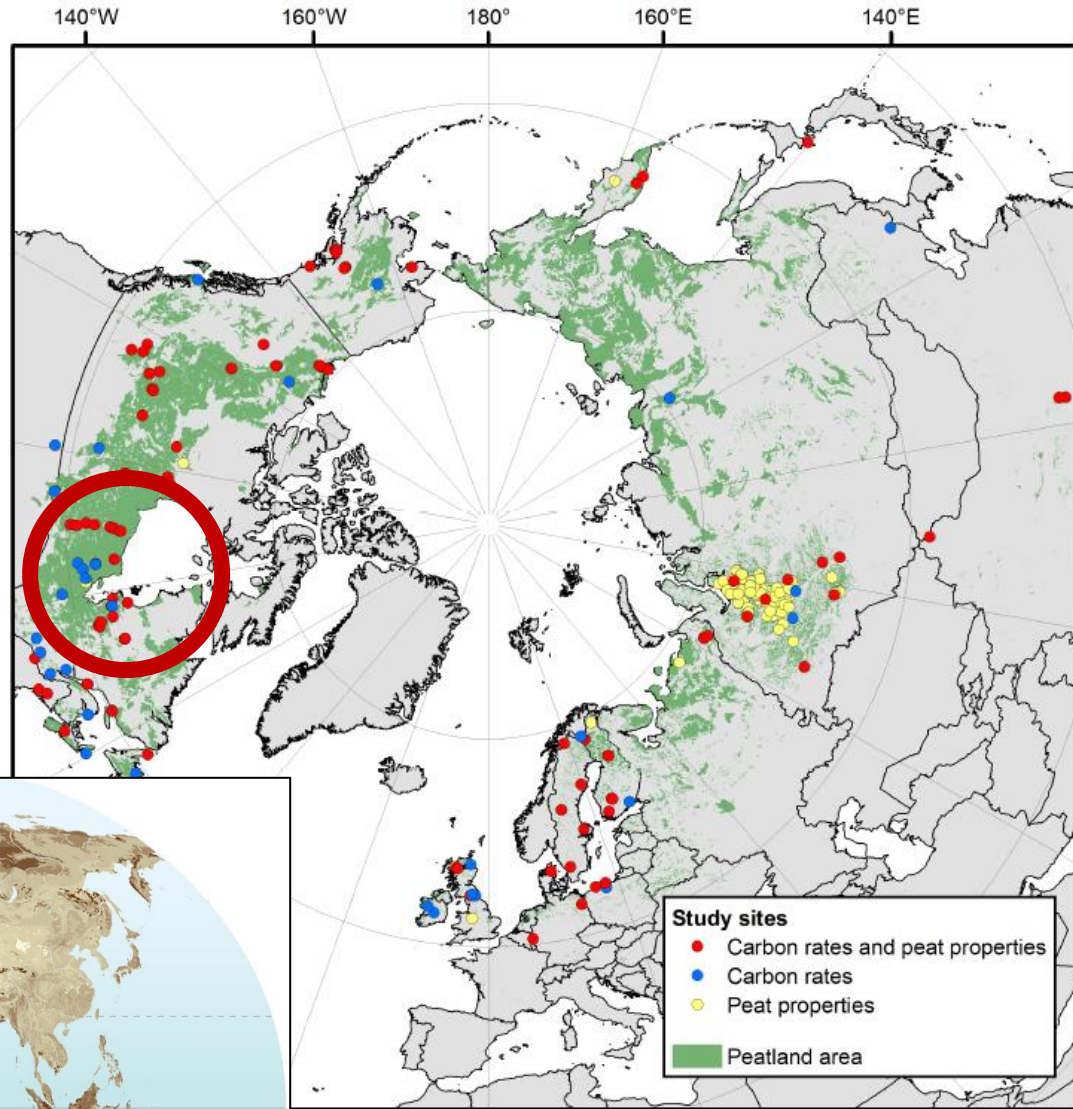
Sensitivity to Climate Change



(Kettles and Tarnocai, 1999)

Northern Peatlands

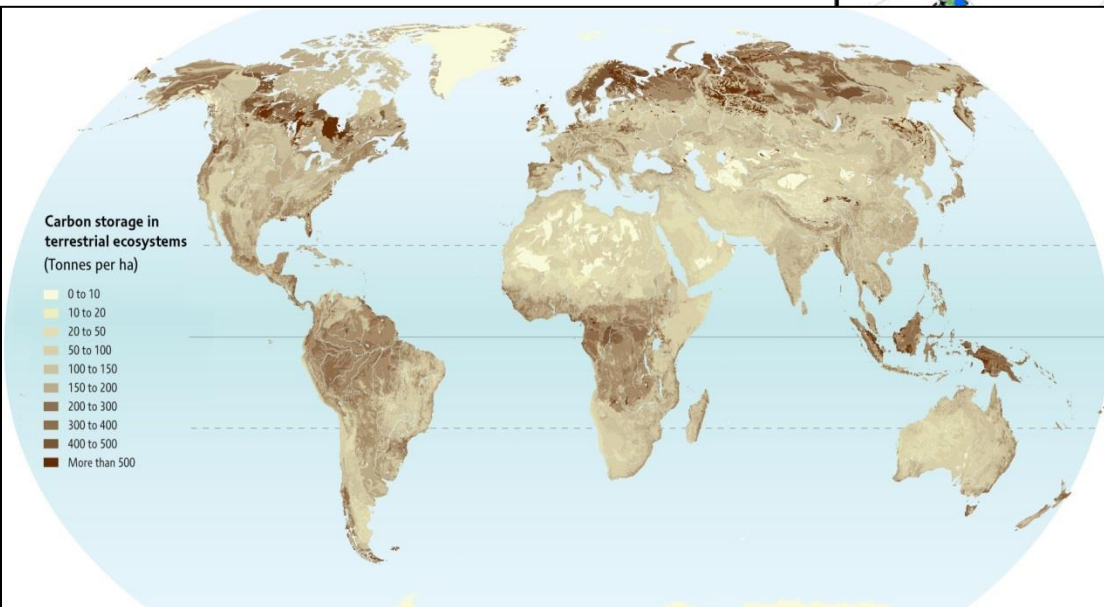
3% area
30% carbon store
mostly in Canada



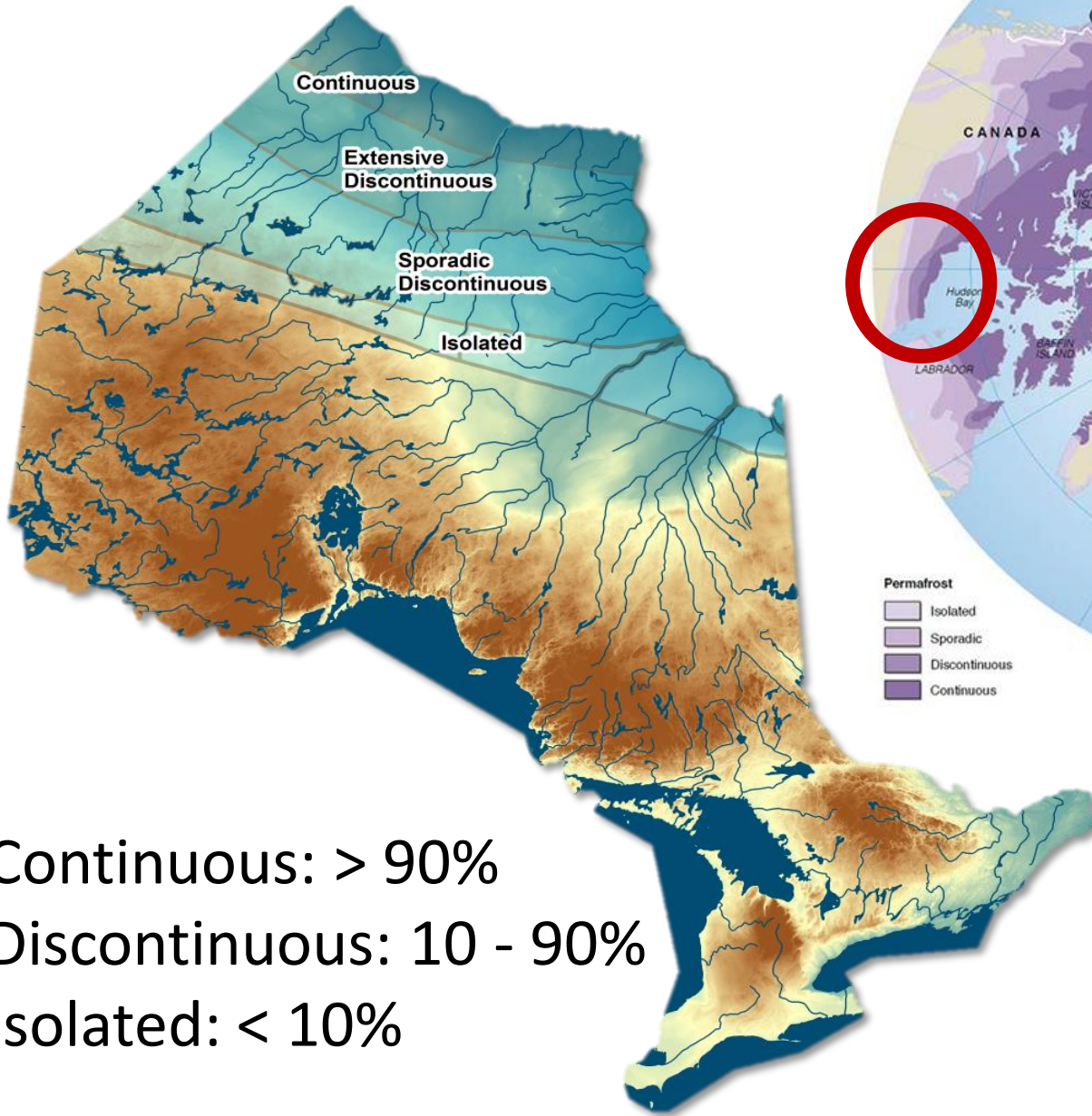
Study sites

- Carbon rates and peat properties
- Carbon rates
- Peat properties
- Peatland area

Loisel *et al.*, 2014 - The Holocene



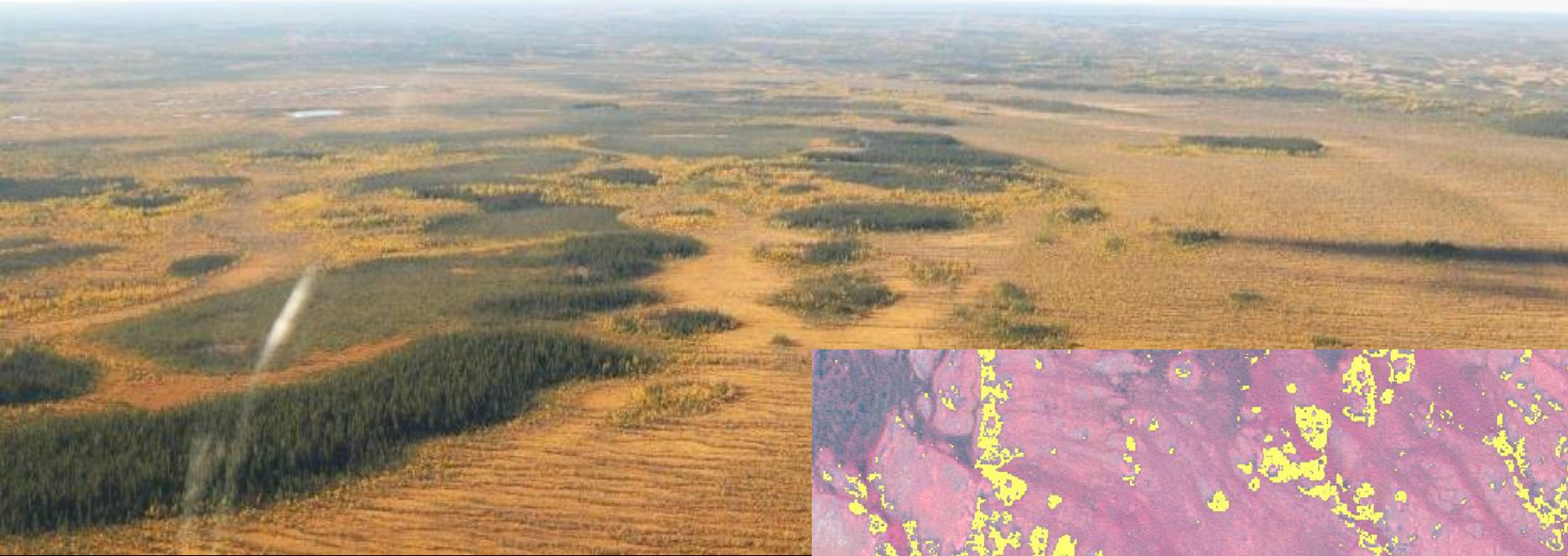
Permafrost Distribution



Source: International Permafrost Association, 1998. Circumpolar Active-Layer Permafrost System (CAPS), version 1.0.

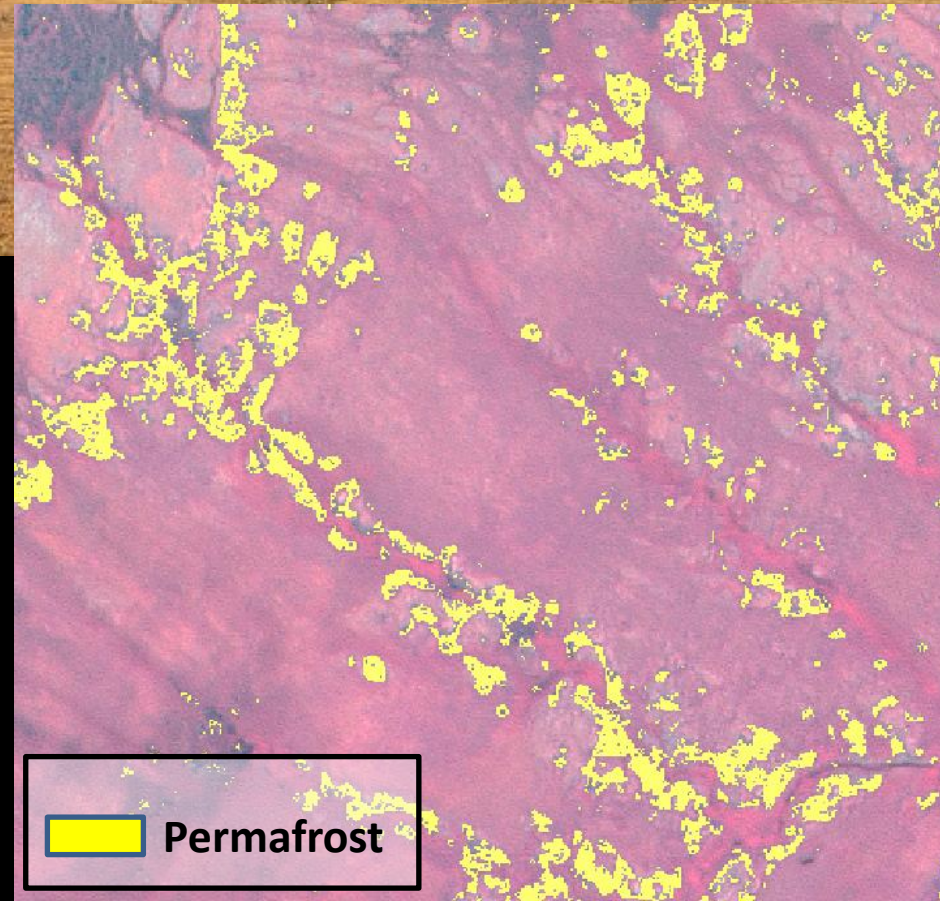
Continuous: > 90%
Discontinuous: 10 - 90%
Isolated: < 10%

Peat and Permafrost Research

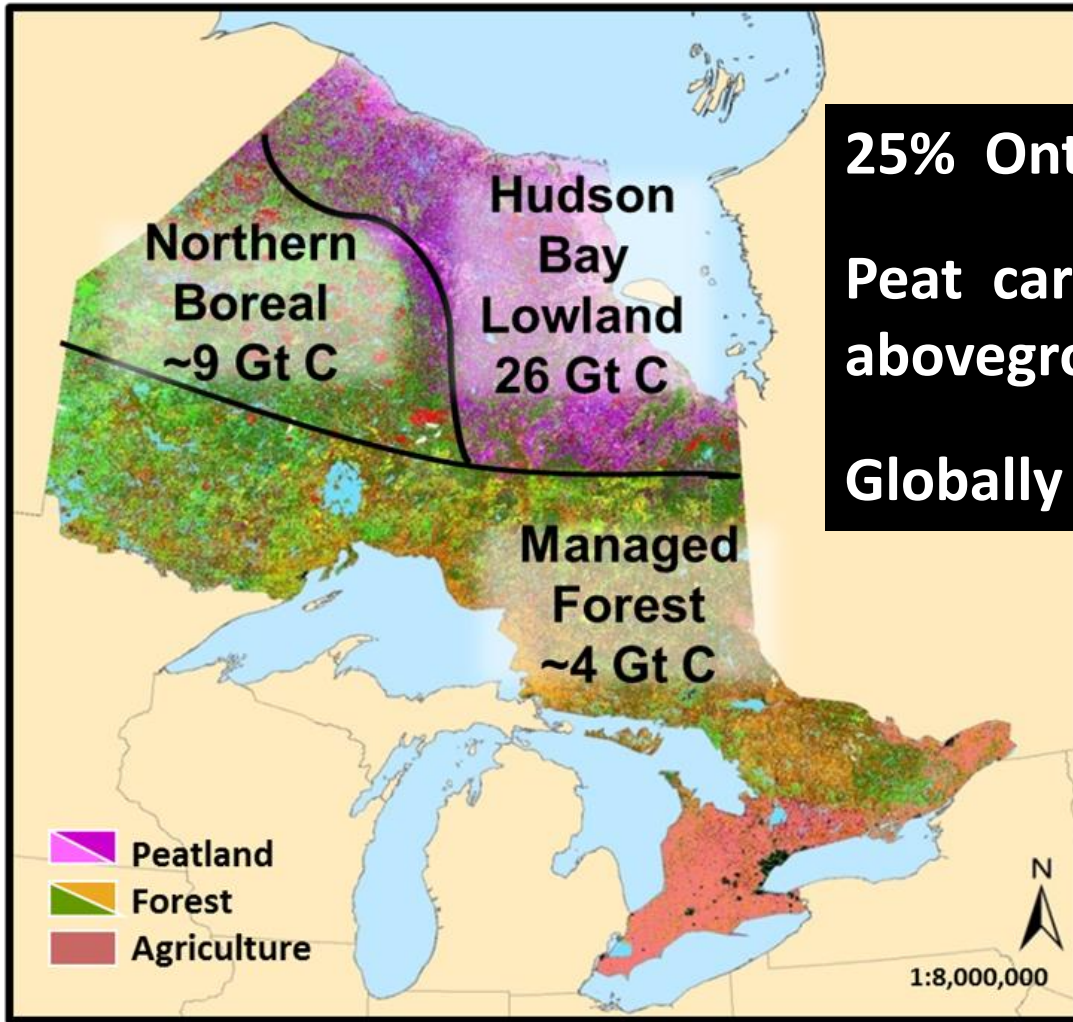


Integrative Research:

- Thermal monitoring
- Geomorphological change
- Permafrost mapping
- Physico-chemical peat analysis
- Hydrologic connectivity
- Climate and land use change
- Community-based monitoring
- Vulnerability, Adaptation, Resilience



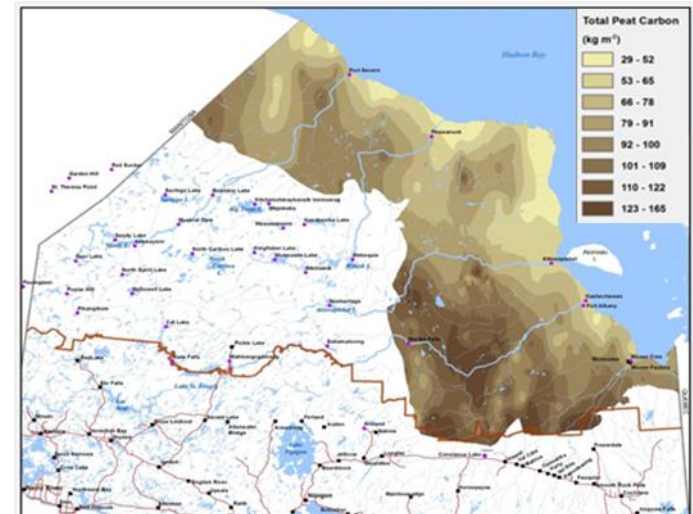
Peatlands in Ontario



25% Ontario land base

**Peat carbon storage 10x
aboveground in the Far North**

Globally significant carbon store



Wetlands in Ontario

Marsh (pond)



- pH: 6 – 8
- Shallow water table
- Plants: Sedge, brown moss
- C accumulation: High

7000 - 5600

Fen (wet peat)



- pH: 4.5 – 8
- Shallow/deep water table
- Plants: Sedge, *Sphagnum*, tall/low shrub, larch/spruce
- C accumulation: High to low

5600 - present

Bog (dry peat)



- pH: < 4.5
- Deep water table
- Plants: *Sphagnum*, low shrub, spruce
- C accumulation: Med. to low

2400 - present

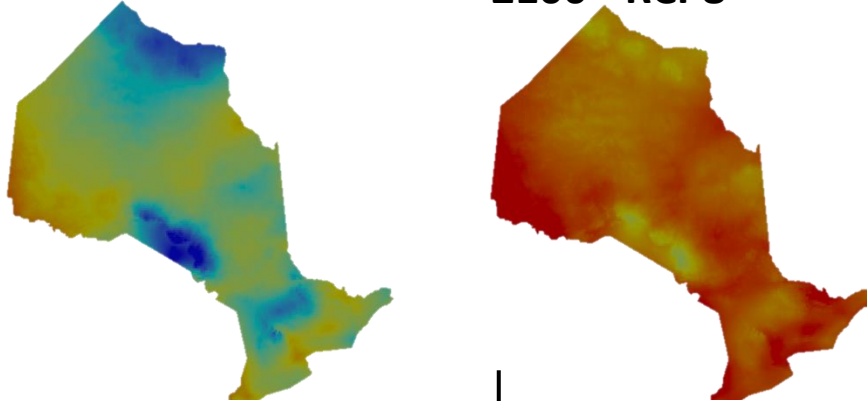
Approximate Timeline

Potential Climate Change in Ontario

Moisture Index

1971-2000 Normal

2100 - RCP8



Moisture Index

2.2 2.0 1.8 1.6 1.4 1.2 1.0

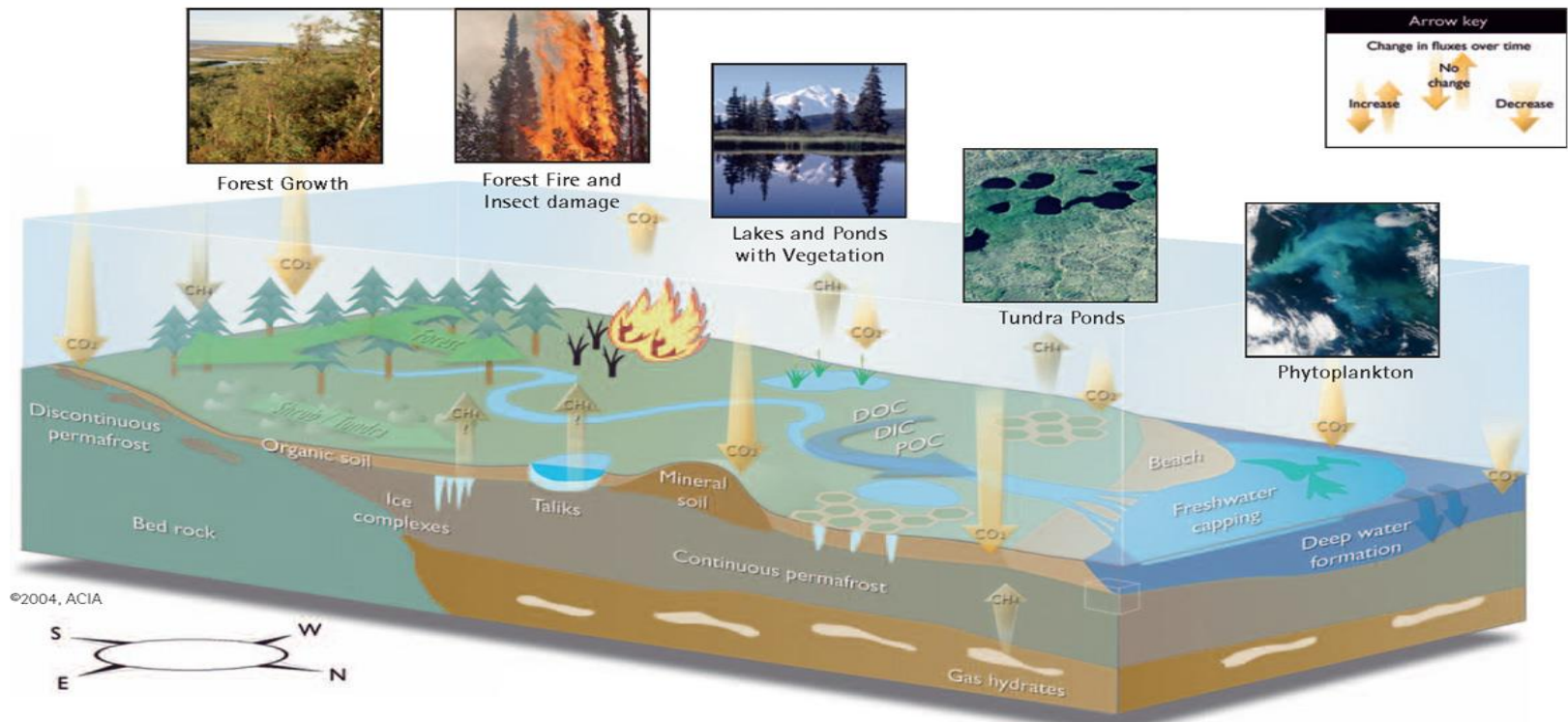
By 2100:

- **Large temperature and net moisture balance shifts**
(McKenney et al. 2010; Packalen et al. 2016)
- **16 – 67% loss of permafrost**
(Gagnon and Gough 2005; Zhang et al. 2008)
- **75 – 118% more area burned**
(Flannigan et al. 2005)

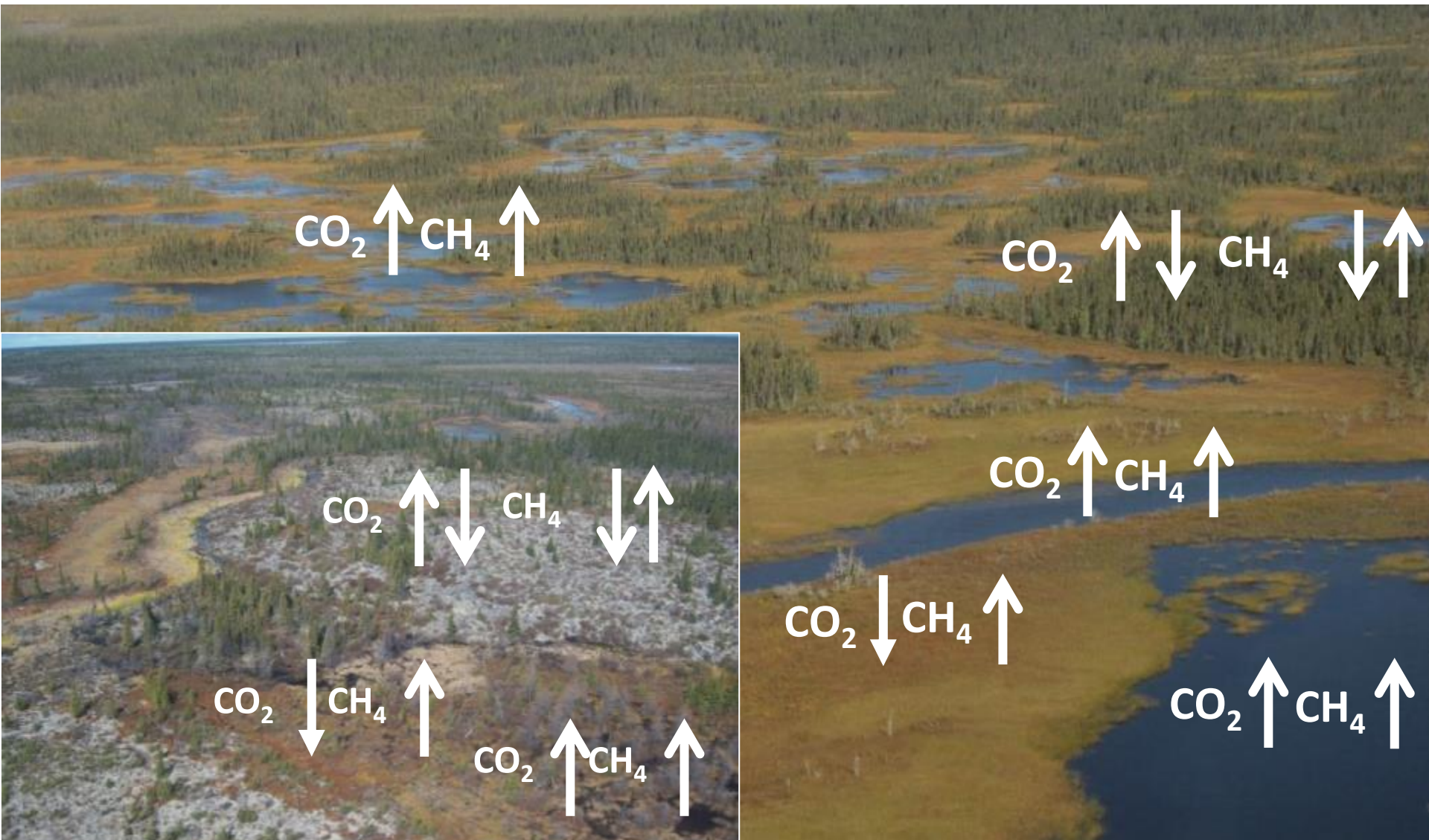


Services, Risks, Adaptations

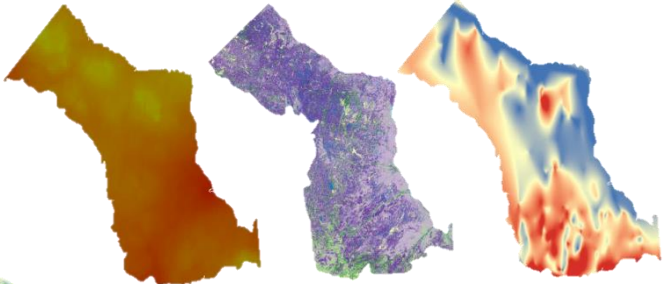
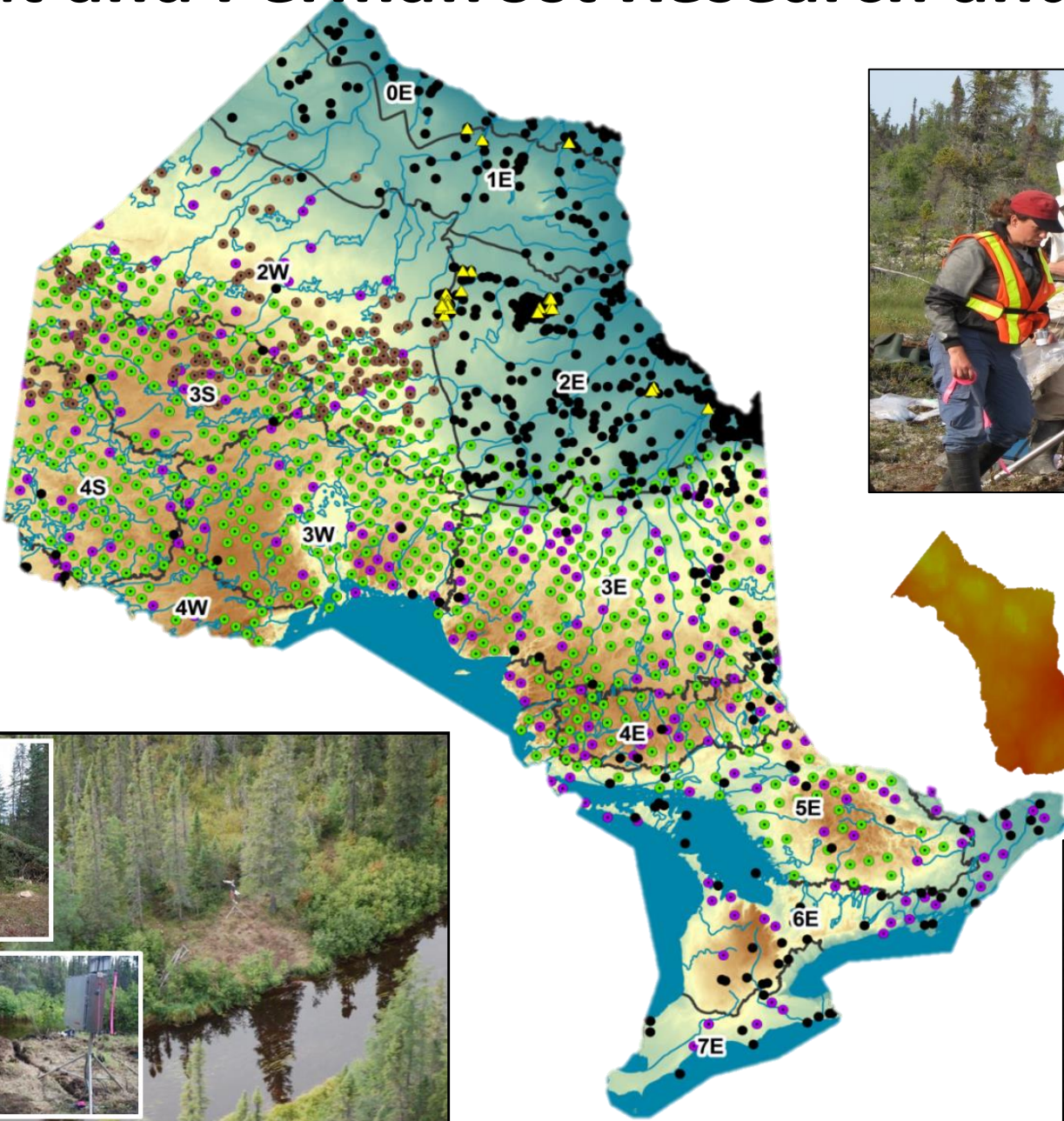
- **Climate and water regulation**
- **Biodiversity**
- **Ecological processes and functions**
 - **Key processes**
 - ✓ **Watershed hydrology**
 - ✓ **Permafrost conditions**
 - **Key functions**
 - ✓ **Carbon storage and sequestration**
 - ✓ **Mercury cycling and fluxes**



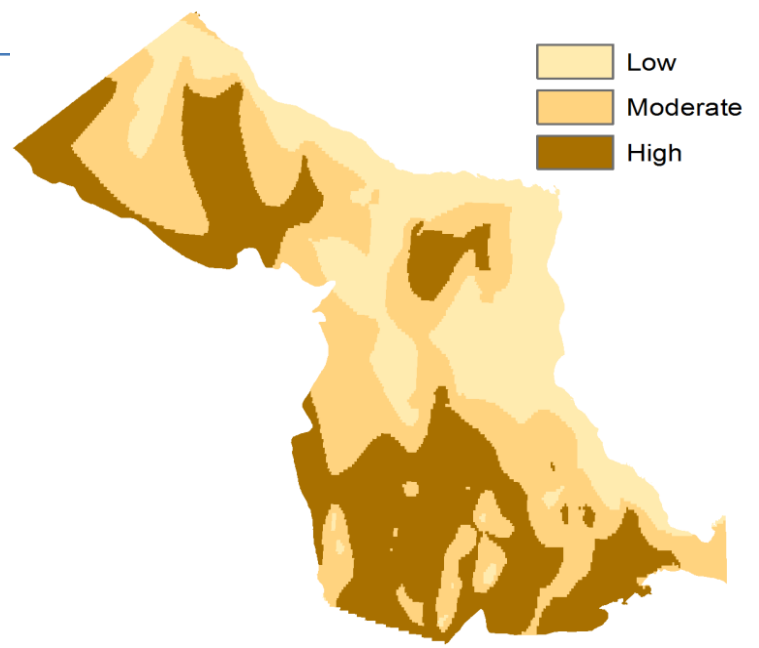
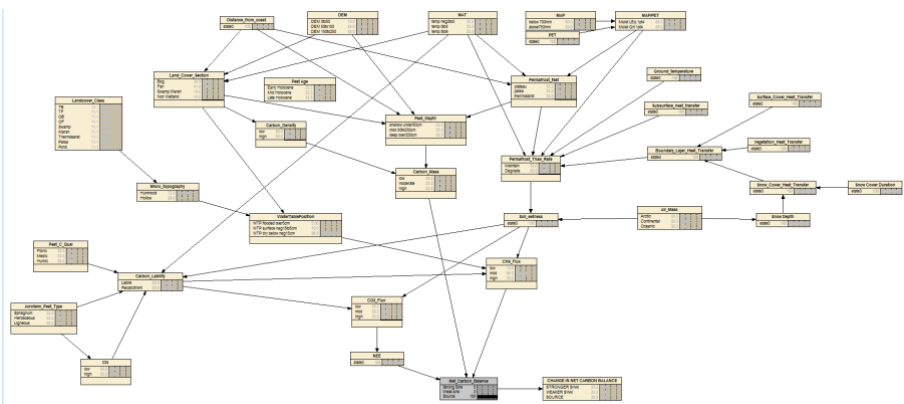
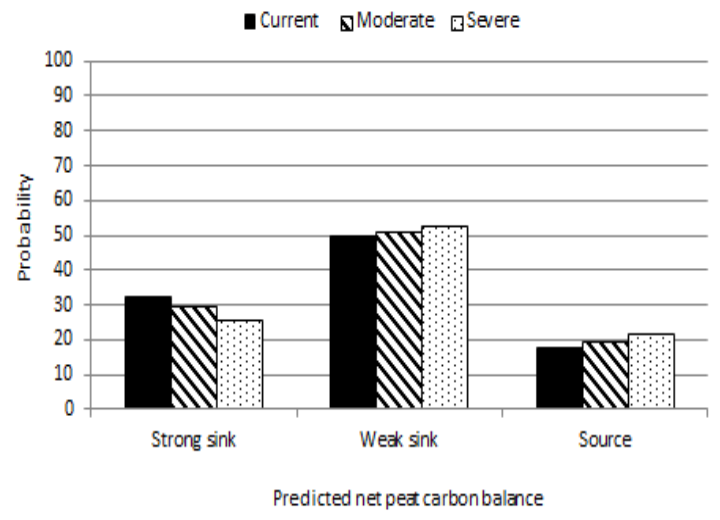
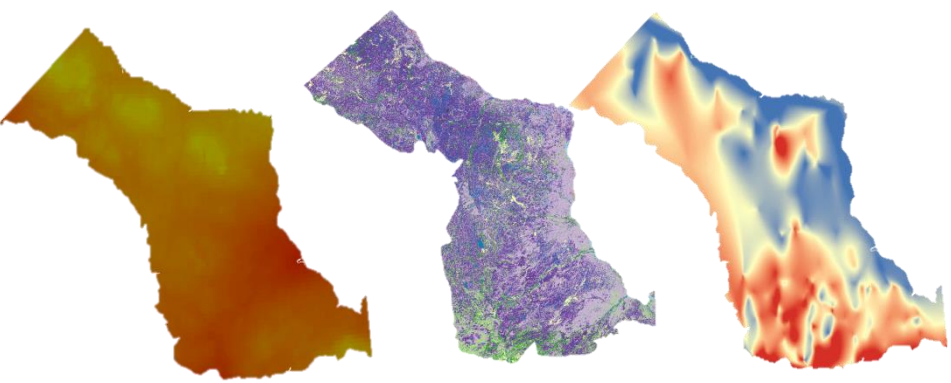
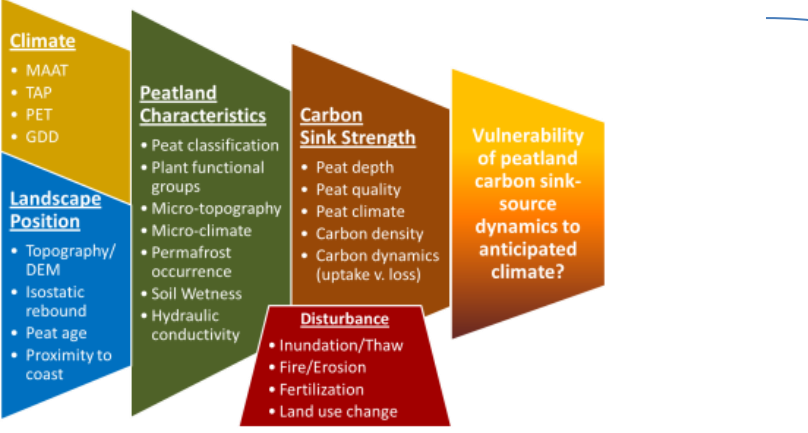
Peatland Carbon Gains and Losses: Wet and Dry Features



Peat and Permafrost Research and Monitoring



Climate Change Vulnerability Assessments



Peat and permafrost climate change concerns?



Acknowledgements



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