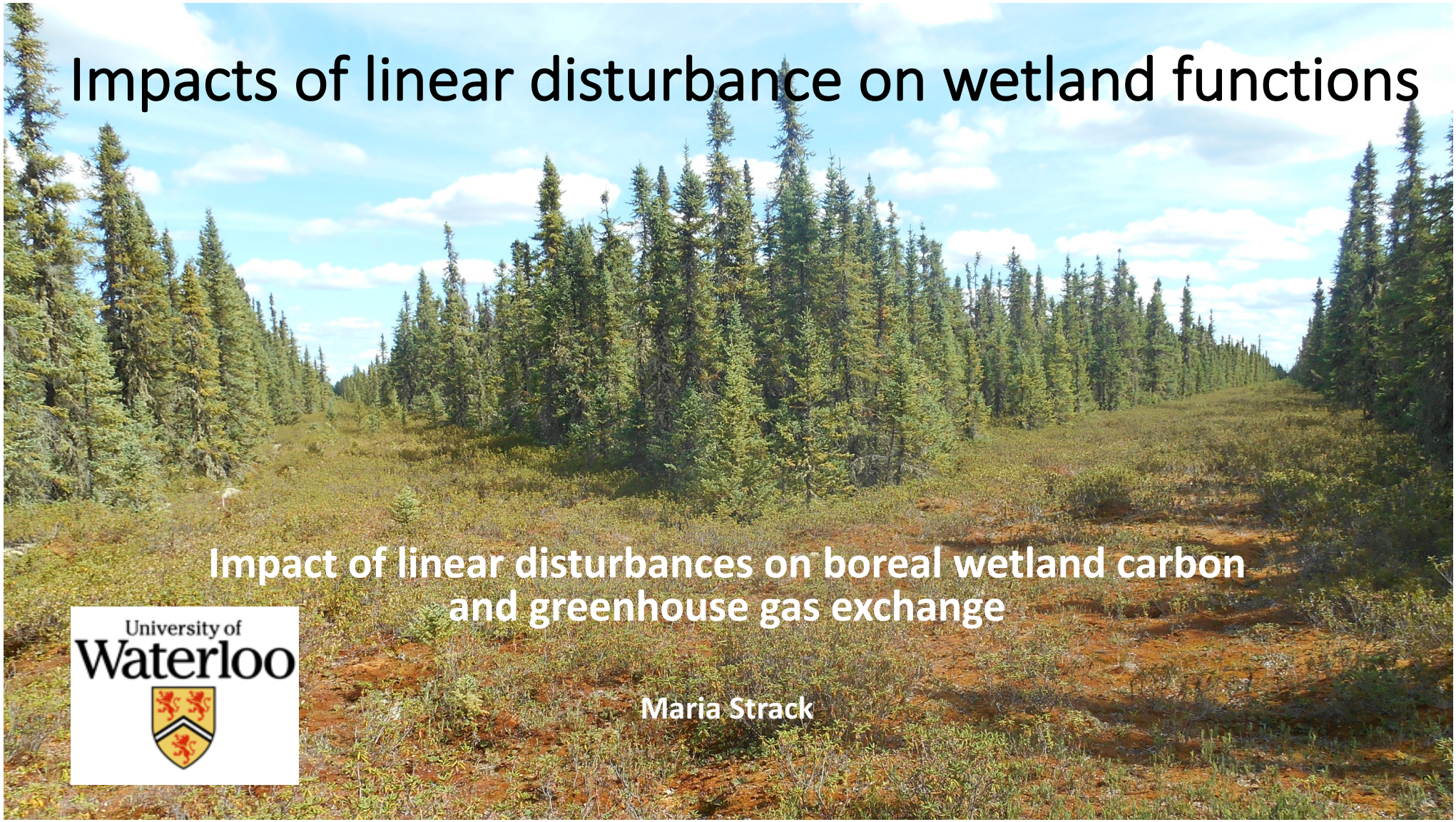
Impacts of linear disturbance on wetland functions



Impact of linear disturbances on boreal wetland carbon and greenhouse gas exchange

University of Waterloo

Maria Strack

Acknowledgements

Bin Xu, Greg McDermid, Kisa Mwakanyamale, Martin Brummell, Melanie Bird, Divya Softa, Julie Lovitt, Saraswati, Mustafizur Rahman, Katie Lowey, Mireille Pruneau-Rodrigues, Ana Kostic, Ali Engering

NSERC CRSNG

EMISSIONS REDUCTION ALBERTA

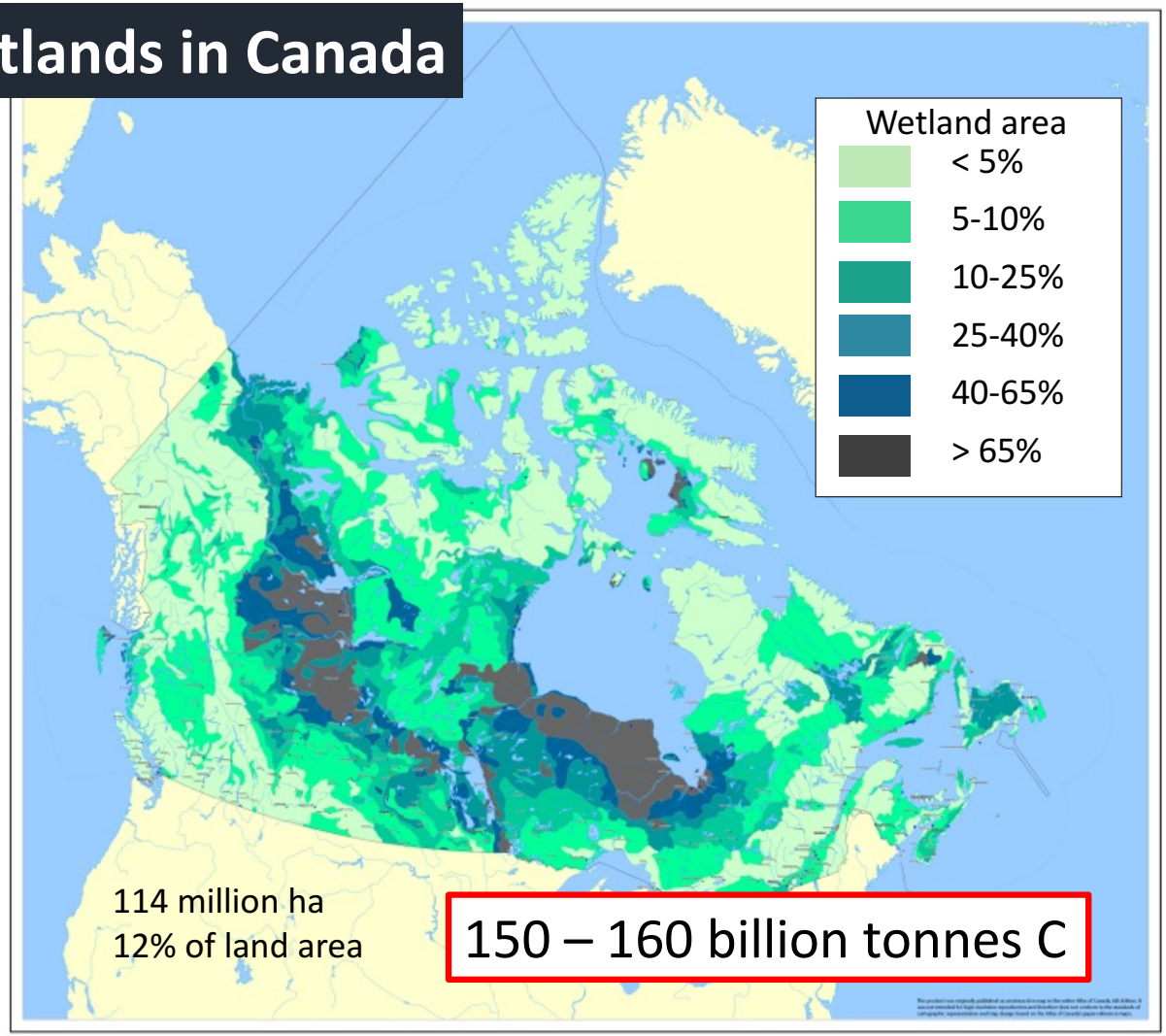
Canada Research Chairs program

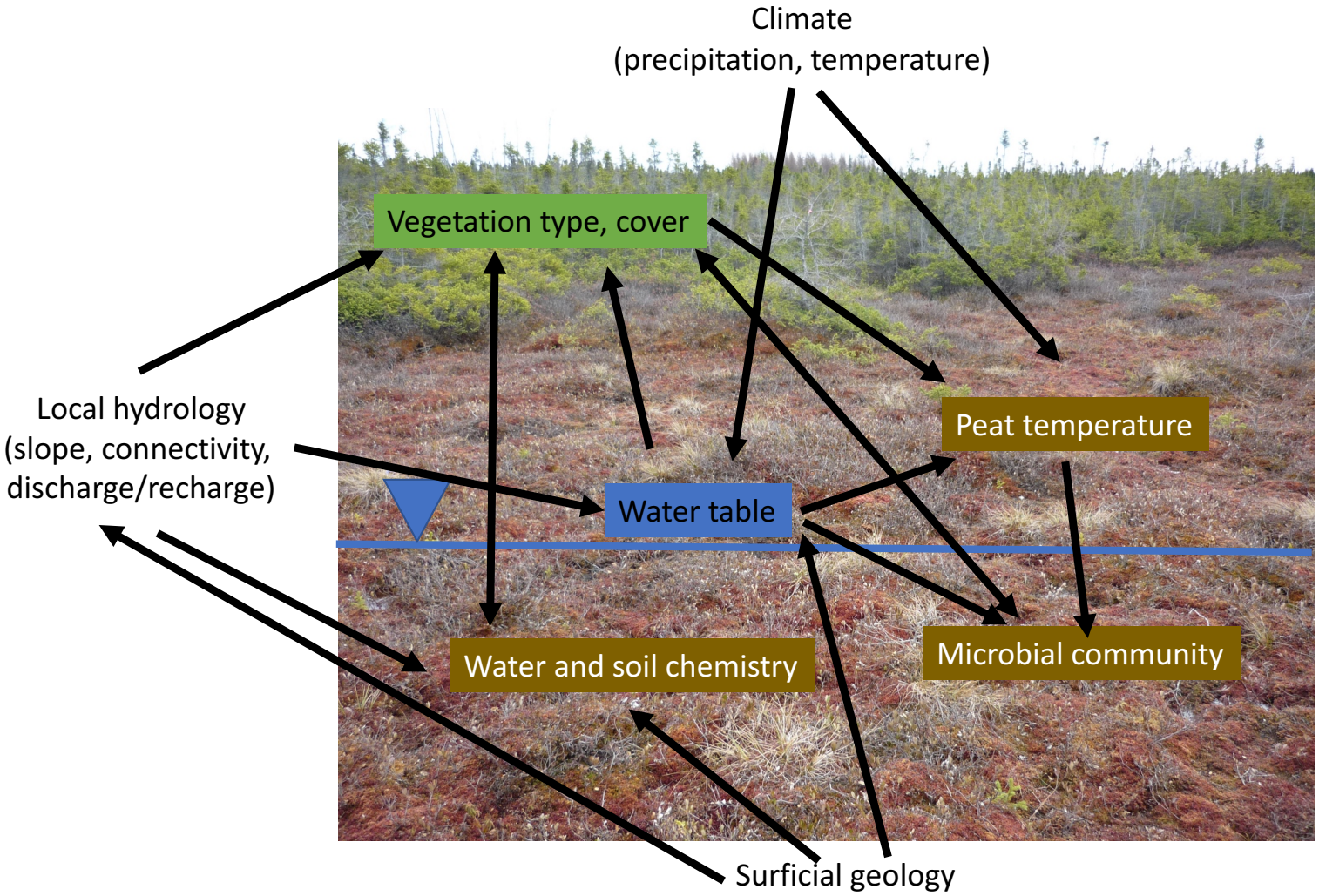
Shell

Environment and Climate Change Canada

Environnement et Changement climatique Canada

Peatlands in Canada




Climate
(precipitation, temperature)
Vegetation type, cover
Local hydrology
(slope, connectivity,
discharge/recharge)
Peat temperature
Water table
Water and soil chemistry
Microbial community
Surficial geology

Linear disturbance in wetlands alters local controls on ecosystem function

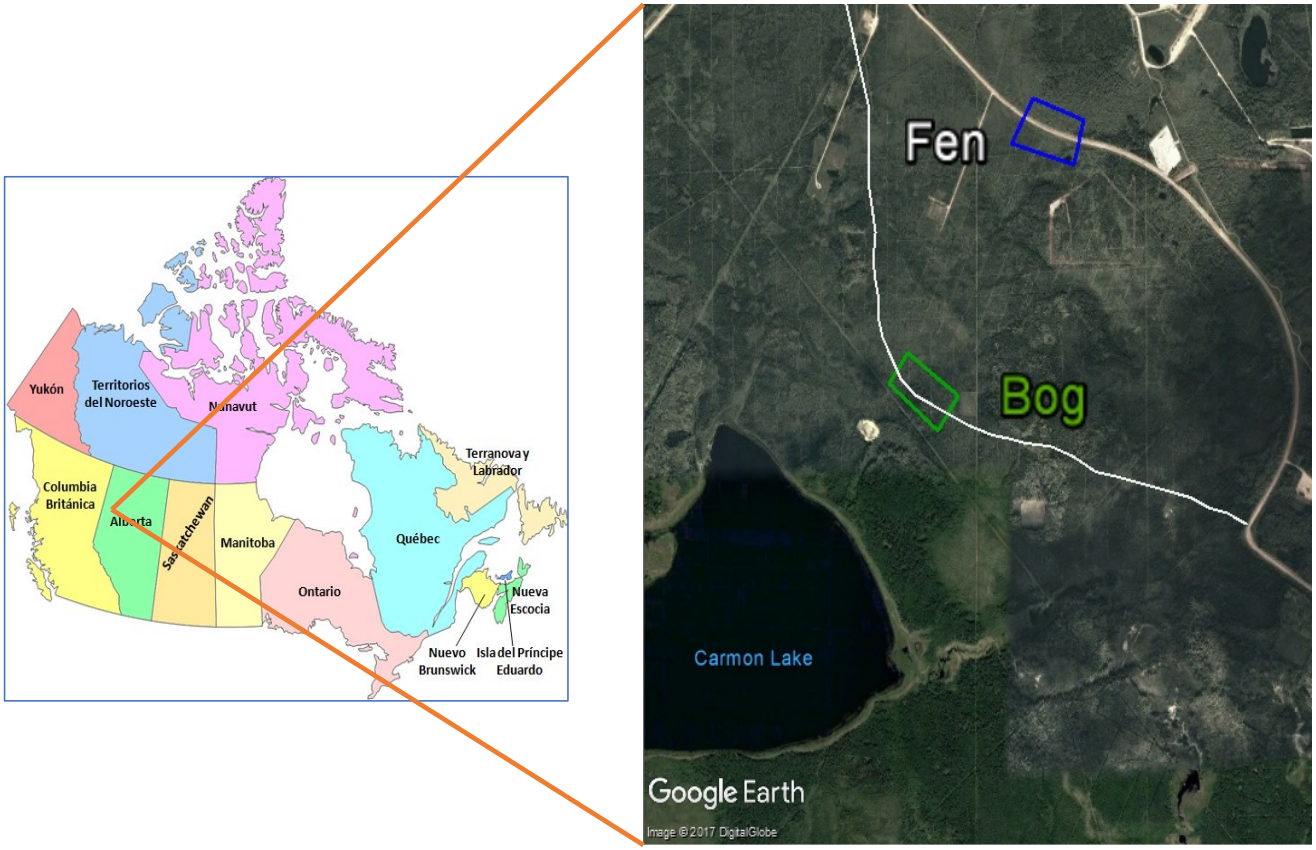
- Edge effects: Anna Dabros
- Habitat impacts: Stuart Slattery
- Cumulative effects– in the context of climate change: Hedvig Nenzen

Linear disturbance and C exchange: Access roads

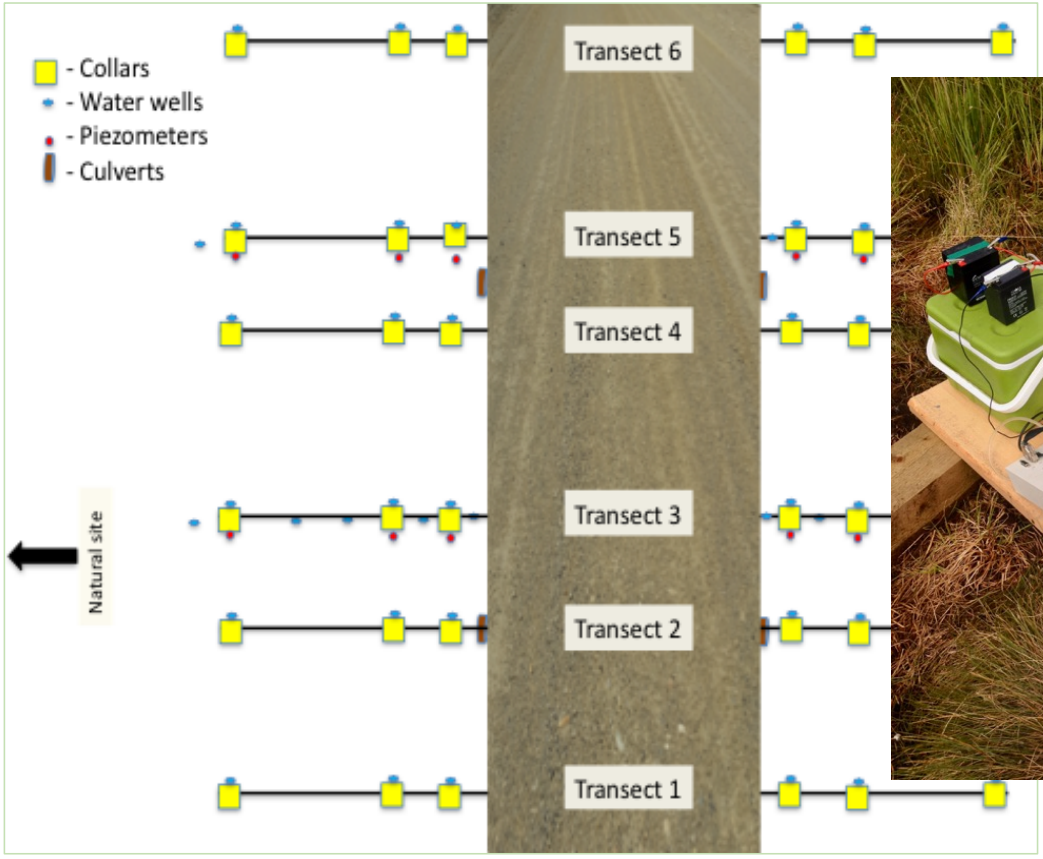
How to build better roads – Bev Gingras

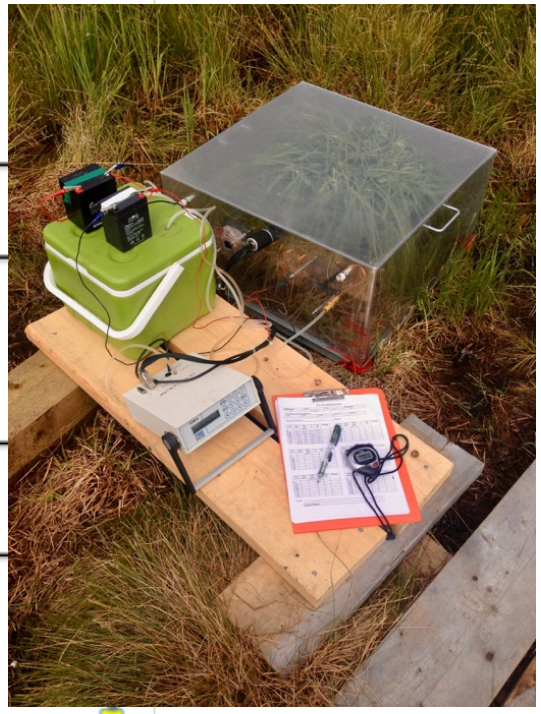
Access roads: impacts on GHG emissions?

How do roads affect peatland GHG exchange and can culverts mitigate induced emissions?



Access roads: impacts on GHG emissions?





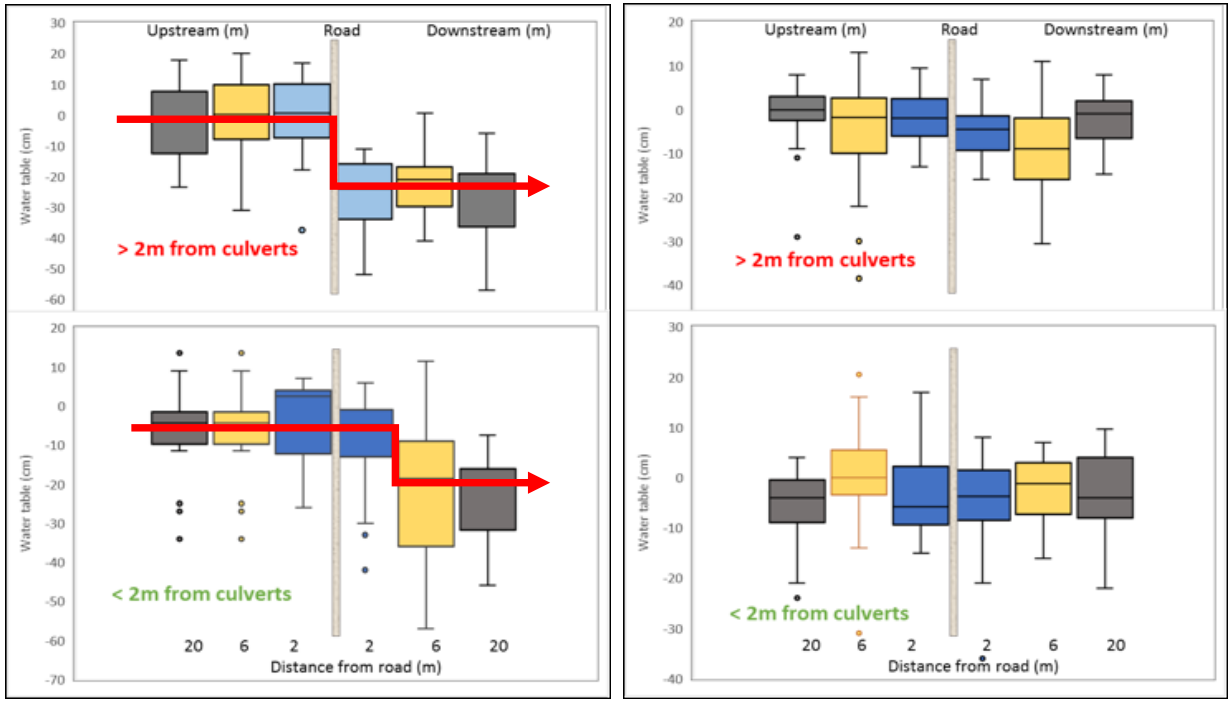
Plant community, water table position, hydraulic gradients, hydraulic conductivity
CO_2, CH_4 exchange, soil enzyme activity and phenolics, DOC concentration, biomass/NPP

Access roads: Water table

PhD candidate, Saraswati

BOG

FEN



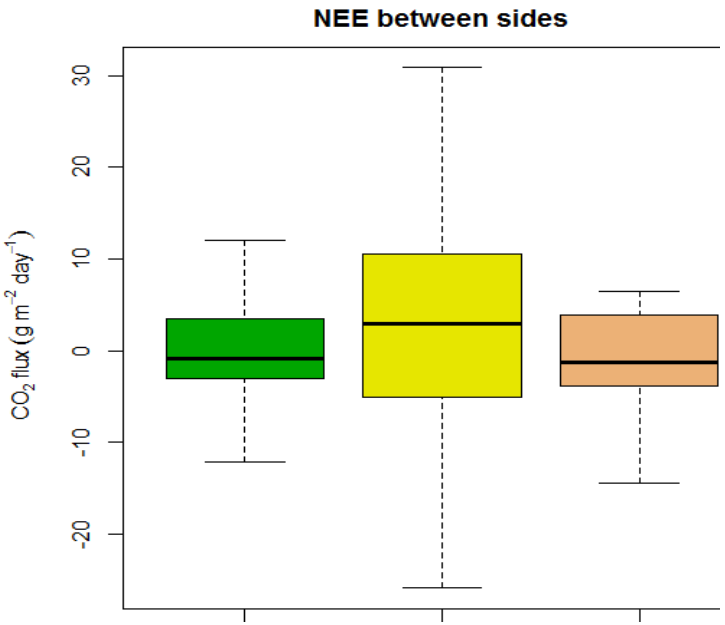
Vegetation community will also be affected -see poster by Jorden Fanson

WT position between upstream and downstream areas

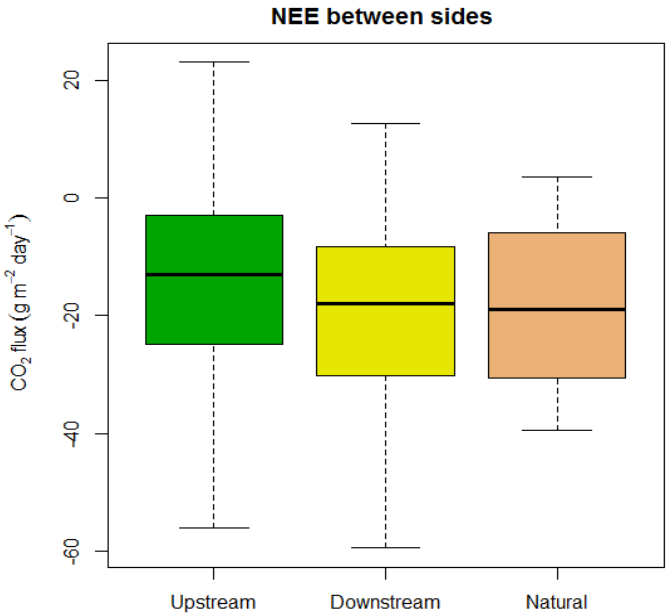
- Bog: downstream WT (-18 cm) was significantly ($p < 0.05$) lower than -4 cm and -13 cm in upstream & natural areas.

Access roads: CO_2 exchange

BOG



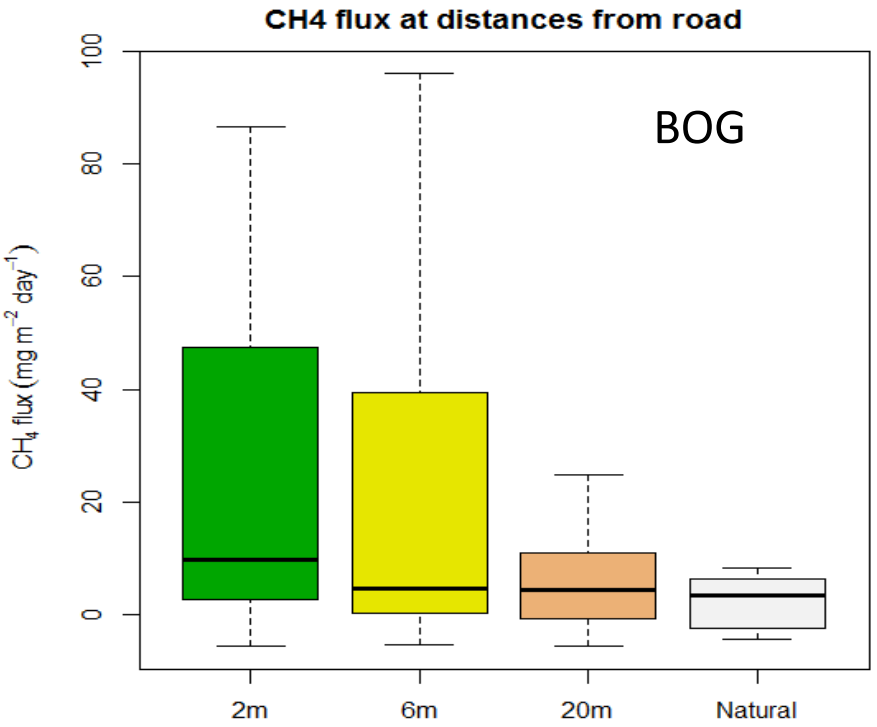
FEN



Saraswati, PhD candidate

See poster on enzymatic activity

Access roads: CH_4 exchange

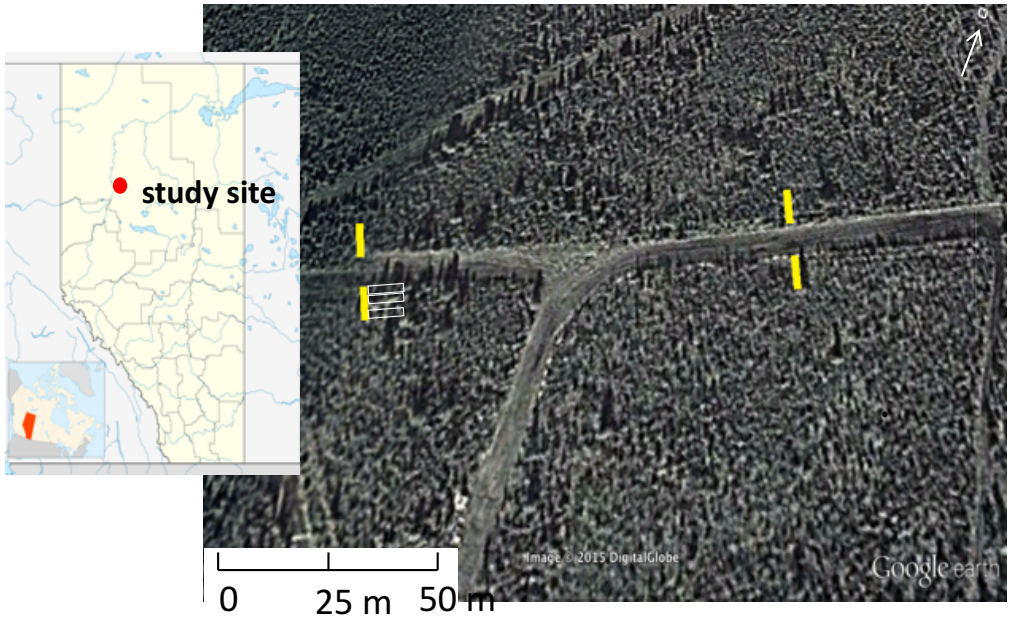


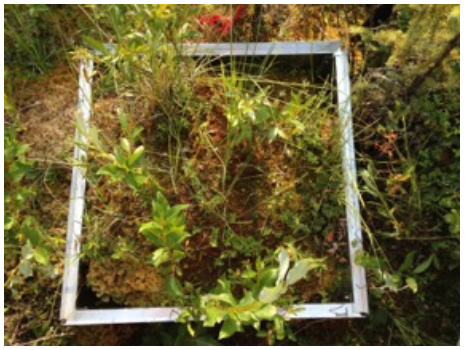
Blockage of water flow and changing plant and soil conditions may also alter dissolved organic carbon pools

-see poster by Michael Wrubleski

Linear disturbance and C exchange: Cutlines

Linear disturbance and C exchange: Cutlines

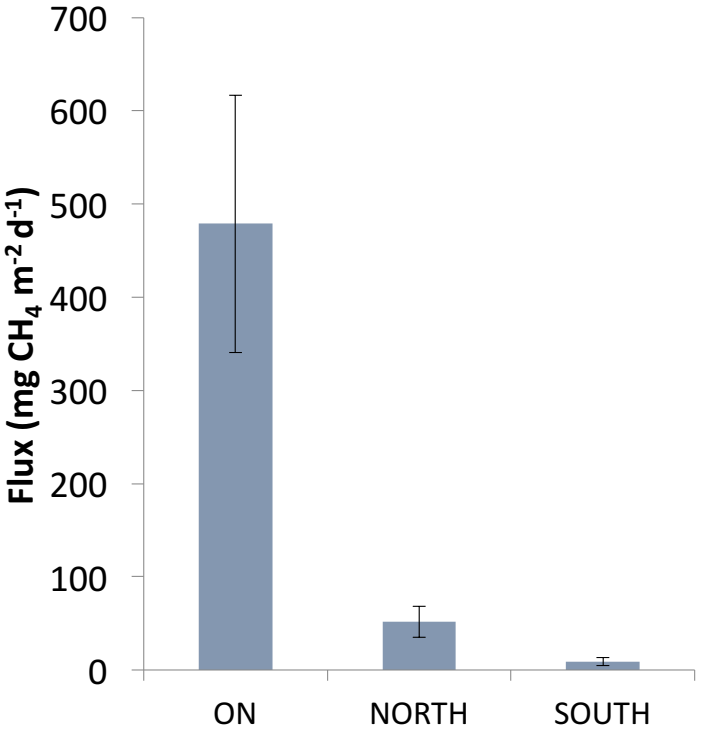


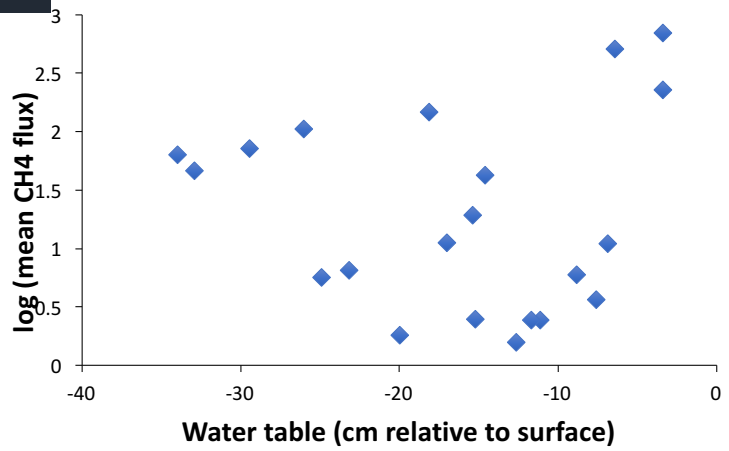


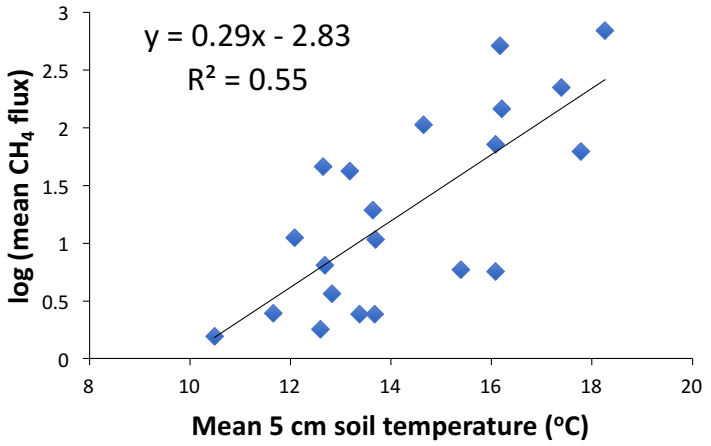
Cutlines: ecohydrological conditions

	ON ROAD	NORTH (upstream)	SOUTH (downstream)
Soil temperature (5 cm; °C)	17.3 (0.6) a	14.5 (0.7) ab	13.1 (0.5) b
Date of thaw (top 30 cm)	Prior to May 12	May 12 to Jun 10	May 12 to Jun 25
WT (cm)	-4.4 (1) a	-22.6 (2.9) b	-14.1 (1.9) c
Total understory vascular plant cover (%)	55 (5) a	35 (2) b	44 (2) c
Understory moss cover (%)	20 (5) a	60 (4) b	50 (4) b
Understory graminoid cover (%)	53 (3) a	2 (1) b	3 (1) b
Tree biomass (kg/m^2)	0 a	2.3 (0.3) b	0.9 (0.2) b

Cutlines: CH_4 emissions







Strack et al., 2017, Global Change Biology

Summary and Future Research Needs

- Impacts specific to wetlands have not been well-quantified
  - Linear disturbance are distributed across the boreal forest in Canada indicating that impact on peatland function is extensive

- Hydrological changes related to flow blockage and compression alter GHG exchange, with CH_4 flux generally increased by linear disturbance

- More research needed on a range of peatland types, disturbance types (width, aspect, extent of compression) to better estimate regional and cumulative impacts