Applied Research on Boreal Peatland Restoration

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NAIT

Peatland

- Wetland with a minimum depth of 40 cm peat accumulated in place
- Bogs and Fens

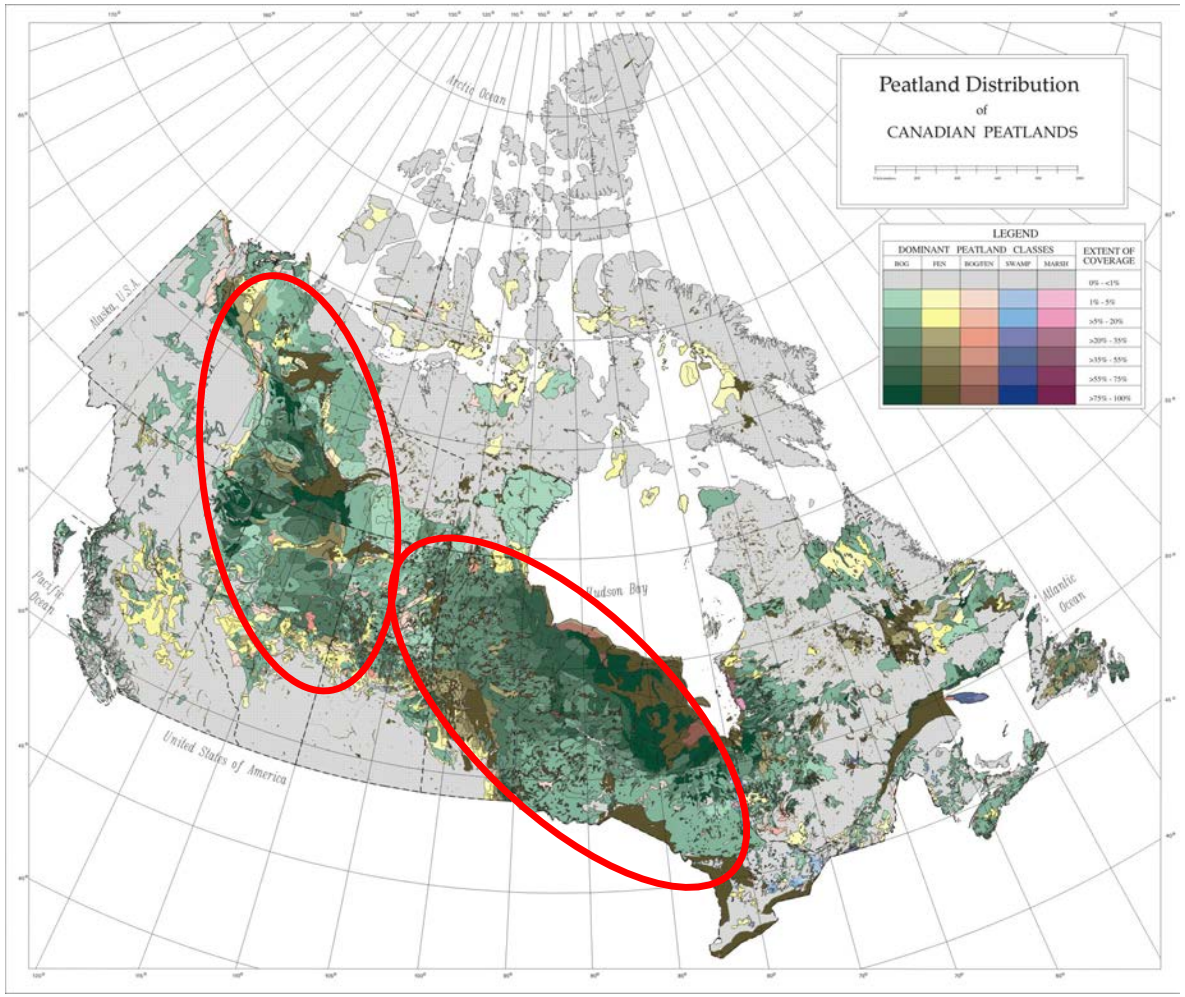
Sphagnum moss peat

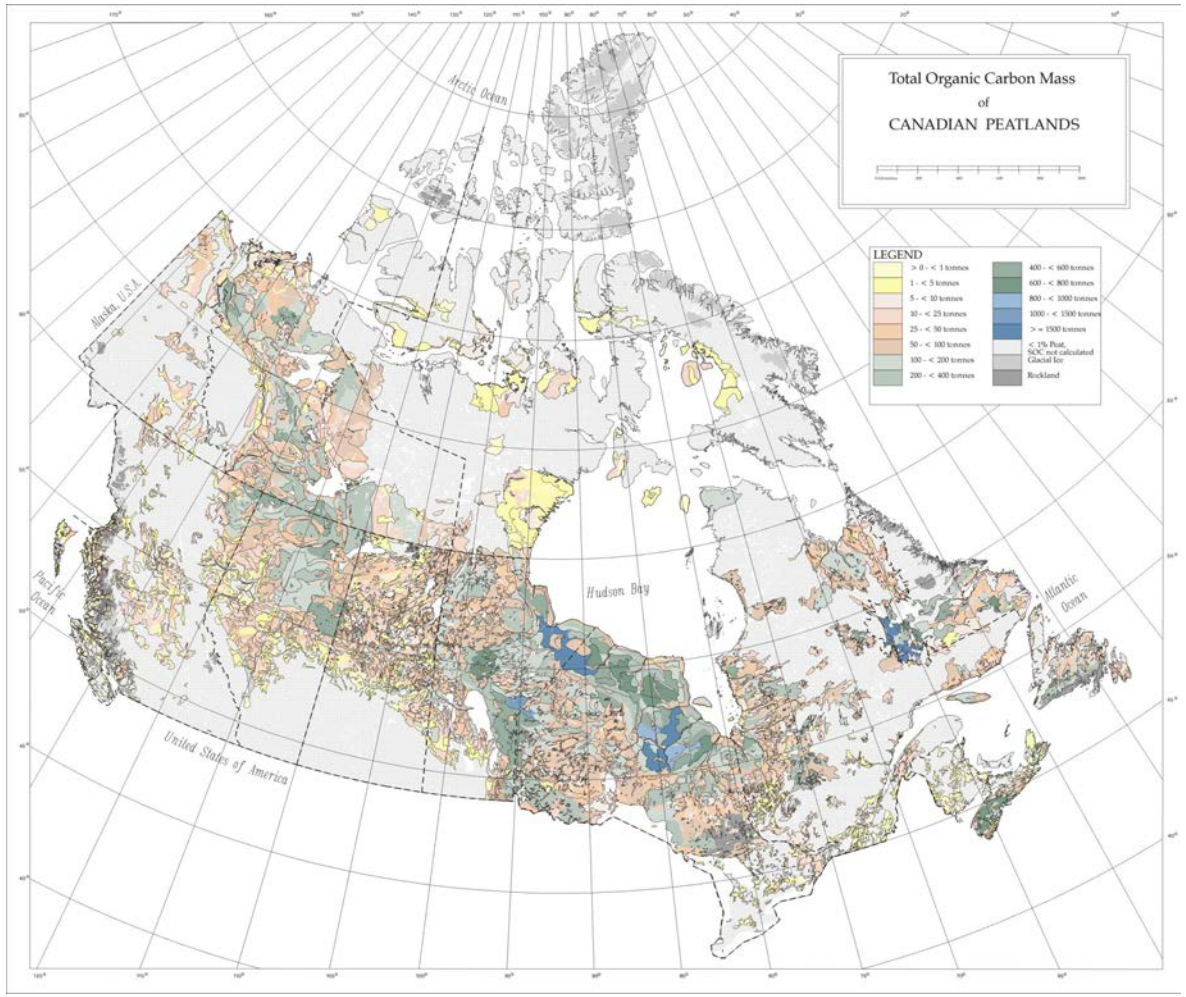
Provisioning	Regulating	Cultural
Nutrition (food, plants, animal, drinking water)	Climate regulation (C sequestration)	Recreation, hunting, fishing
Material (peat, paper, growing medium)	Water flow, filtration, bioremediation	Spiritual and/or emblematic
Energy (biomass fuel)	Soil formation, habitat	

Boreal Peatlands: Our Carbon Legacy

Canada Peatlands:

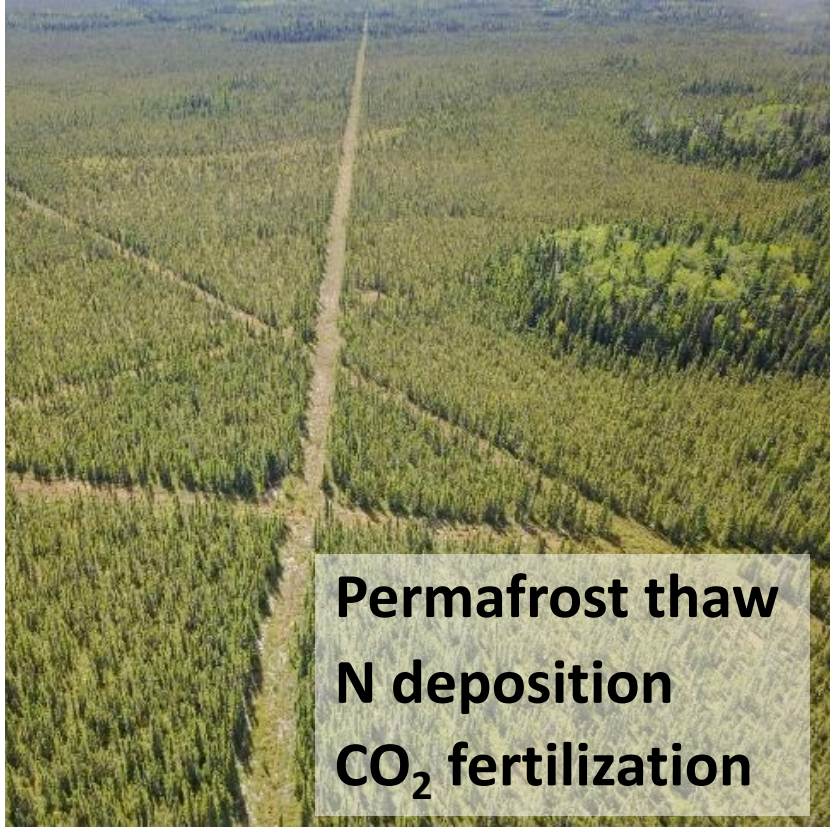
- **27% of global, 2nd largest**
- **1.14 m km² or 12% land area**
- **147 Pg of C, 56% of soil organic carbon**





Tarnocai, C., I. Kettles, and B. Lacelle. 2011. Peatlands of Canada; Geological Survey of Canada.


Fire

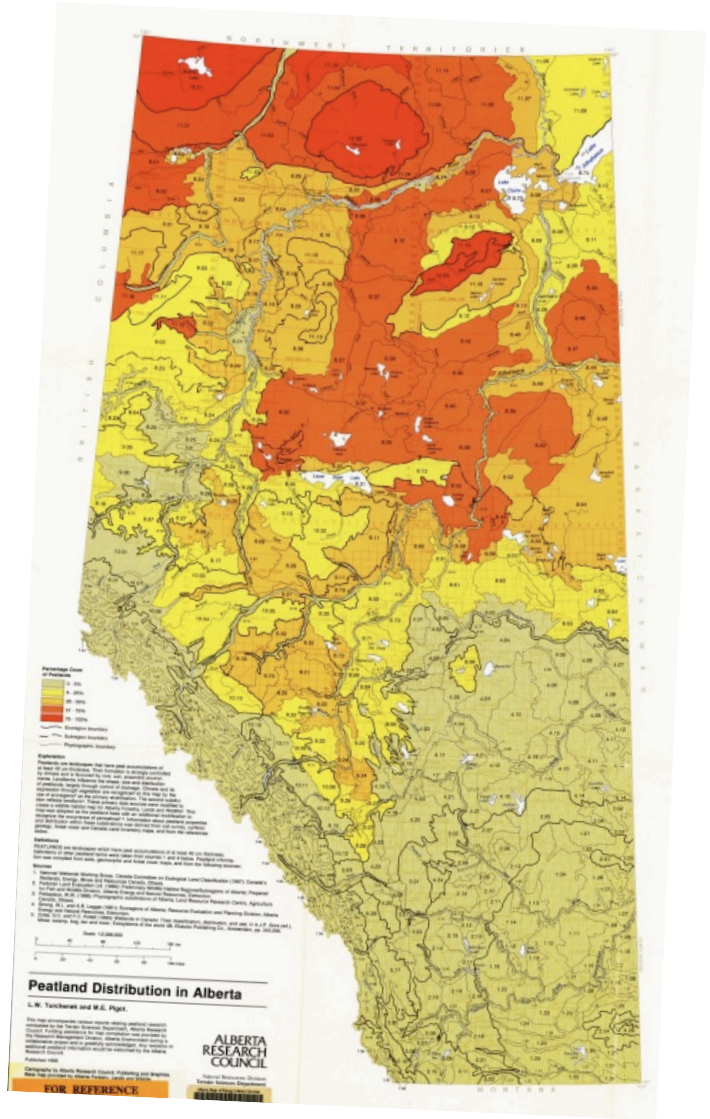

Permafrost thaw
N deposition
CO_2 fertilization


Mining
Reservoir creation
Linear disturbance

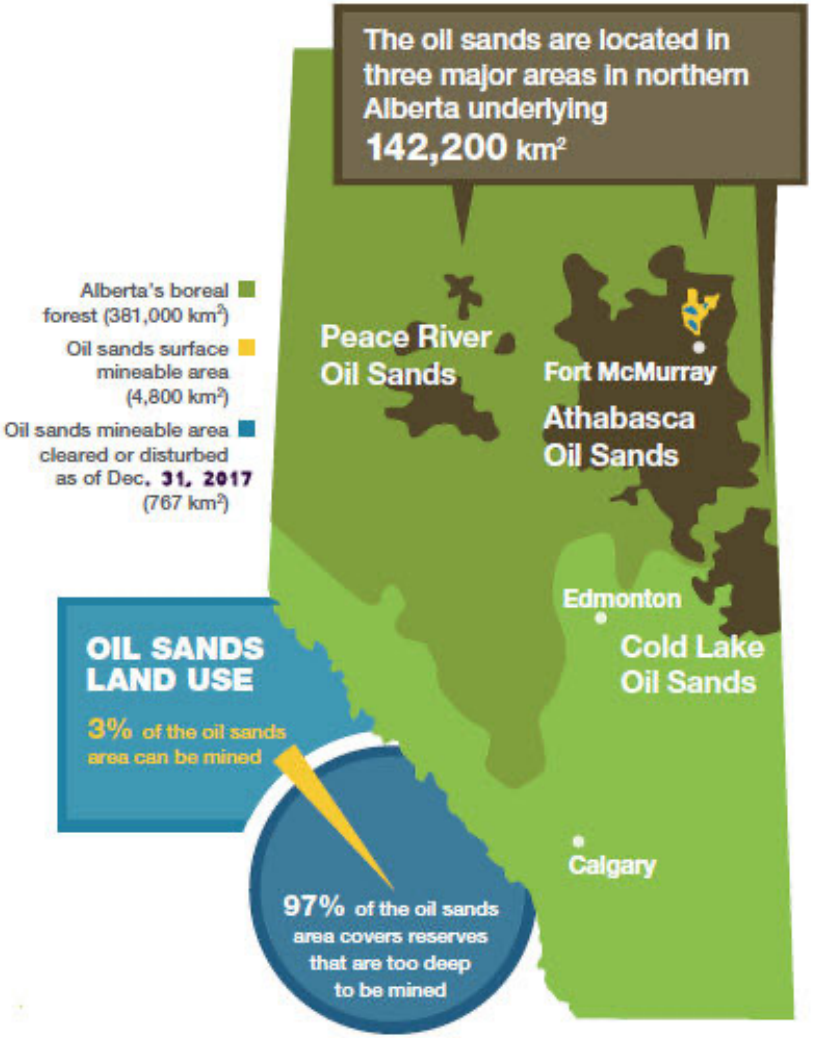
In Canada


Peat harvest
Forestry
Agriculture
Beaver

PEATLAND DISTRIBUTION

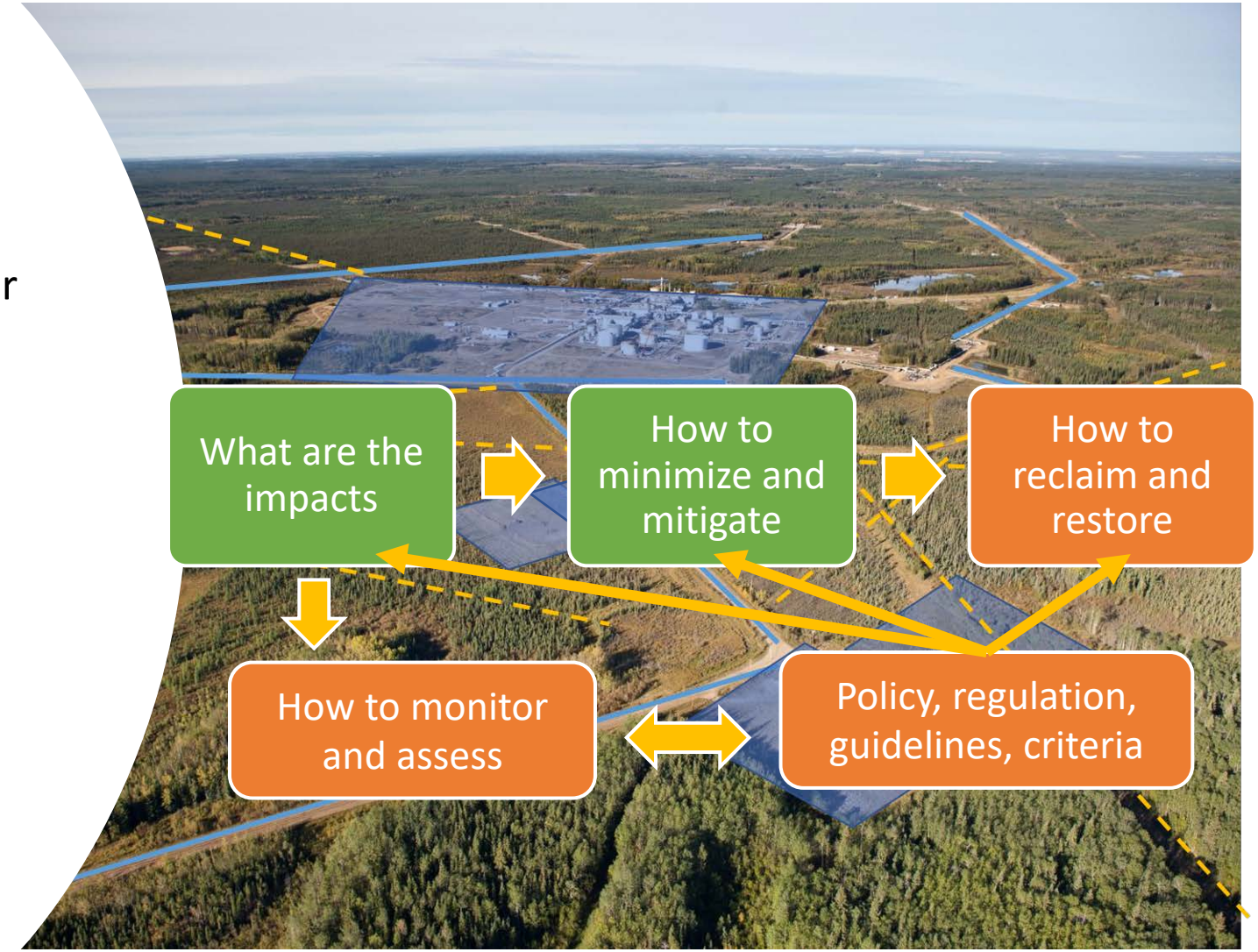


OIL SANDS DISTRIBUTION



In-Situ Footprint

- Shift/loss of vegetation and/or productivity
- Altered hydrology/water flow
- Change in soil physical and chemical properties
- Change in carbon dynamics
- Habitat fragmentation
- Loss of function and value



Complete Removal/Burial + MLTT - IPAD

Goal: Remove clay and restore 40cm peat surface (PI)
Transfer donor peatland moss/diaspores (MLTT)

Pad Removal


BURIED CLAY INVERSION
MIXED CLAY INVERSION
PEAT INVERSION

Moss Donor Collection

Donor site 1

Dominant moss:

Sphagnum spp.

Dominant forb:

Donor site 2

Dominant moss:

Tomenthypnum nitens

Dominant forb:

Donor site 3

Dominant moss:

Polytrichum strictum
Sphagnum spp

D

D

W

Moss Layer Transfer

Comments:

Ratio surface collected: surface restored = 1:10

Well Pad Restoration - IPAD

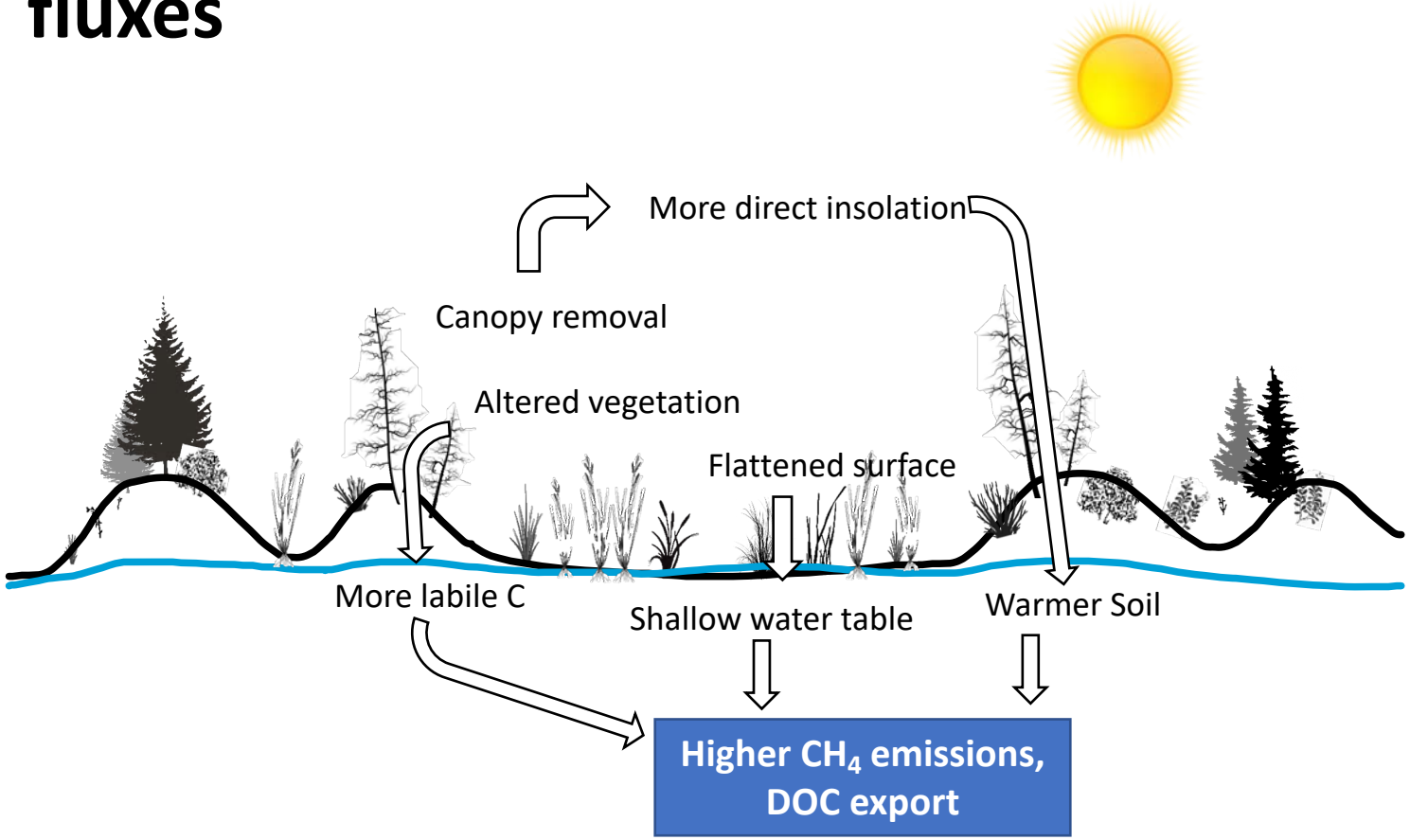
First Certifiable Reclaimed Peatland Well Site in Alberta

Xu et al. 2021 Restoration Ecology

Linear features in Peatland

- Leading cause for woodland caribou habitat fragmentation and population decline (Latham & Boutin. 2015)
  - Lichen rich bogs are foraging grounds
  - Preferred travel by predators
  - Switch to shrub and herb vegetation attract preys

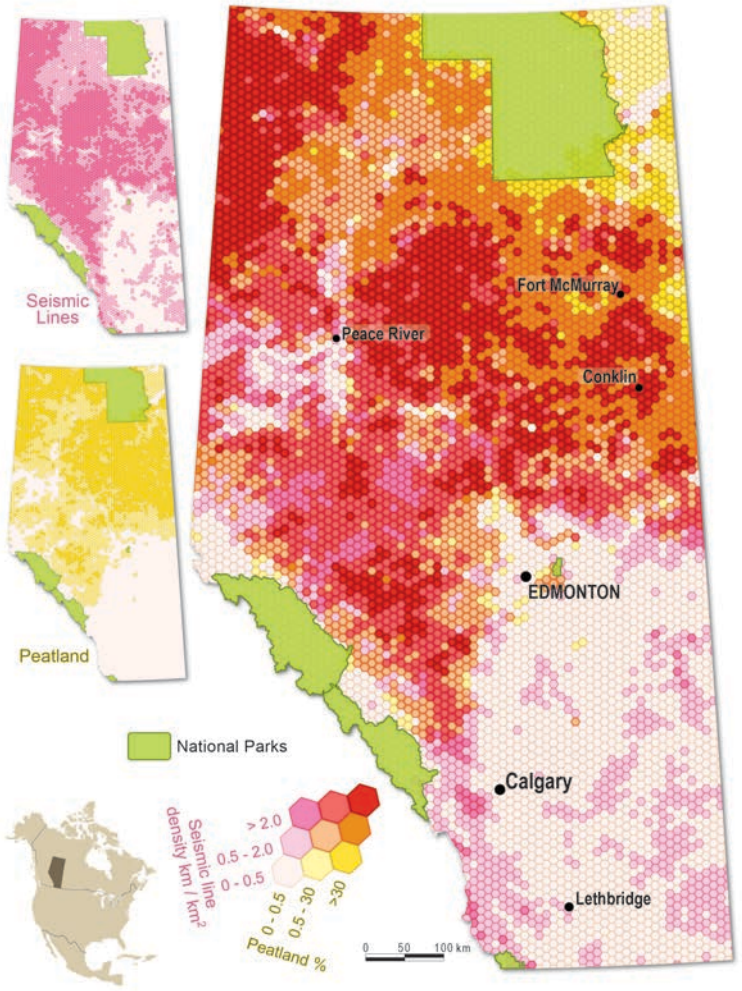
Ecosystem Functions – Greenhouse gas fluxes



Winter road 10 times more GHG than natural peatland.

Strack, M., D. Softa, M. Bird, and B. Xu. 2017. Global Change Biology.

Seismic lines are methane hotspots



- Over **345,000 km** of seismic lines through peatlands in Alberta alone
- Total area disturbed = **1,900 km²**
- Methane emissions increase of **4.5-5.1 kT** per year
- Increase land-use CH_4 emissions by **7-8%**

Equivalent to the CO_2 emitted by 27,000 passenger vehicles driven for one year

Strack, M., S. Hayne, J. Lovitt, G. J. McDermid, M. M. Rahman, S. Saraswati, and B. Xu. 2019. Nature Communications 10:1–8.

Airstrip Summer 2014- Wetland Initiation

- Dry compacted clay surface
- Hydrologically disconnected from adjacent wetland (berm)
- Loss of entire peatland/wetland vegetation community

<u>Goal</u>: to create a saturated mineral surface, introduce donor seedbank with wetland diaspores, and plant with fen/marsh herbaceous and woody species


KOMATSU
D7R

Airstrip - Summary

- Partial Removal + Planting + Natural Regeneration
- High wetland vegetation cover
- Fen mosses in pockets where WT is near surface (not flooded)
- No bare areas and low undesirables
- Marsh → Fen as water table stabilizes and moss expansion;