

Critical Remote Sensing Targets for Boreal Wetlands Research and Management

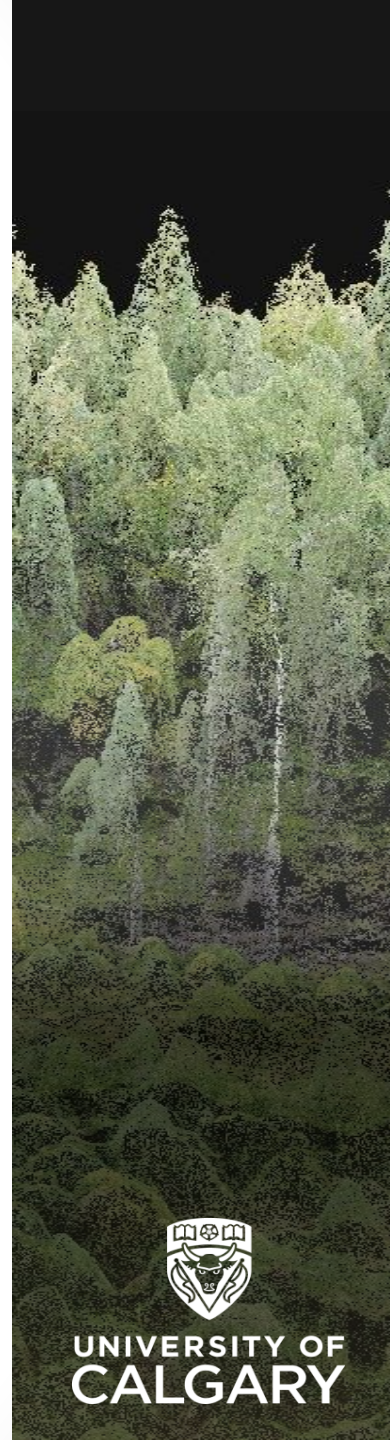
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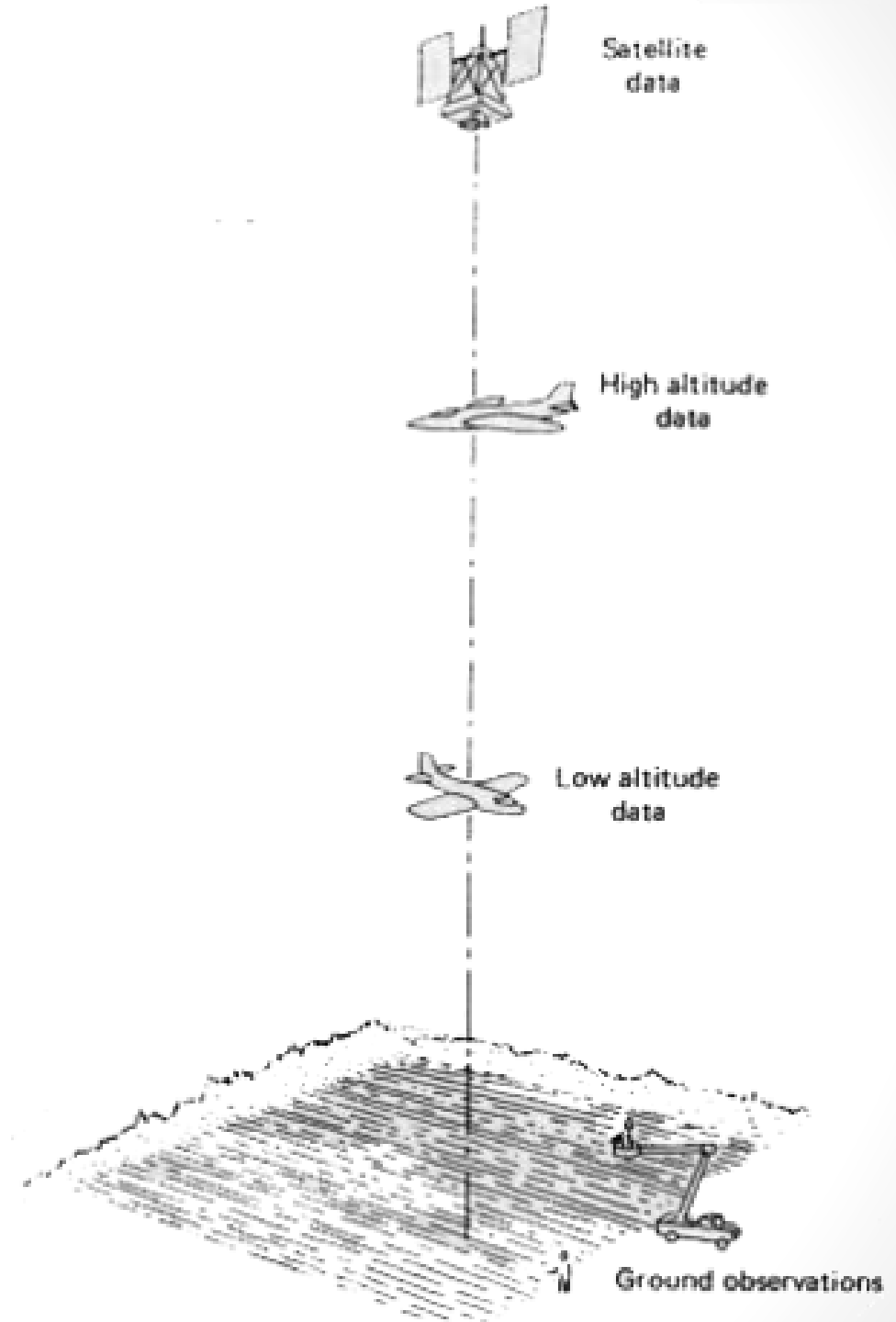
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Remote Sensing

- Obtaining information about the Earth using a device that is not in contact with the surface
- There are a wide variety of instruments (LiDARs, RADARs, sonars, optical cameras, etc) available on a large number of platforms
- Data sets are diverse, and processing workflows can be complicated



The Information Needs-Definition Circle



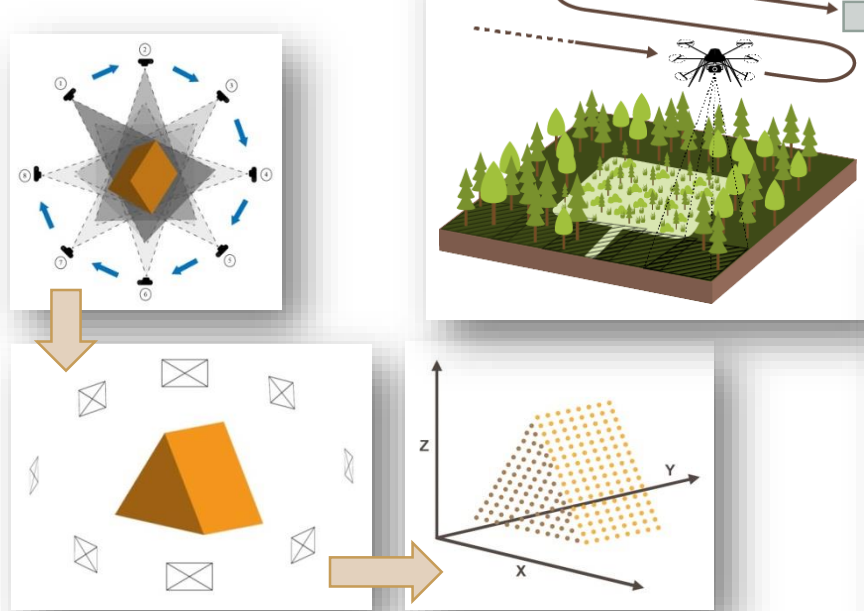
Critical Remote Sensing Targets

- Land Cover and Land Cover Change
- Vegetation Species and Species Composition
- Vegetation Structure and Biomass
- Land Surface and Vegetation Phenology
- Topography and Landforms
- Surface Temperature and Energy Balance
- And other things, if you're creative...

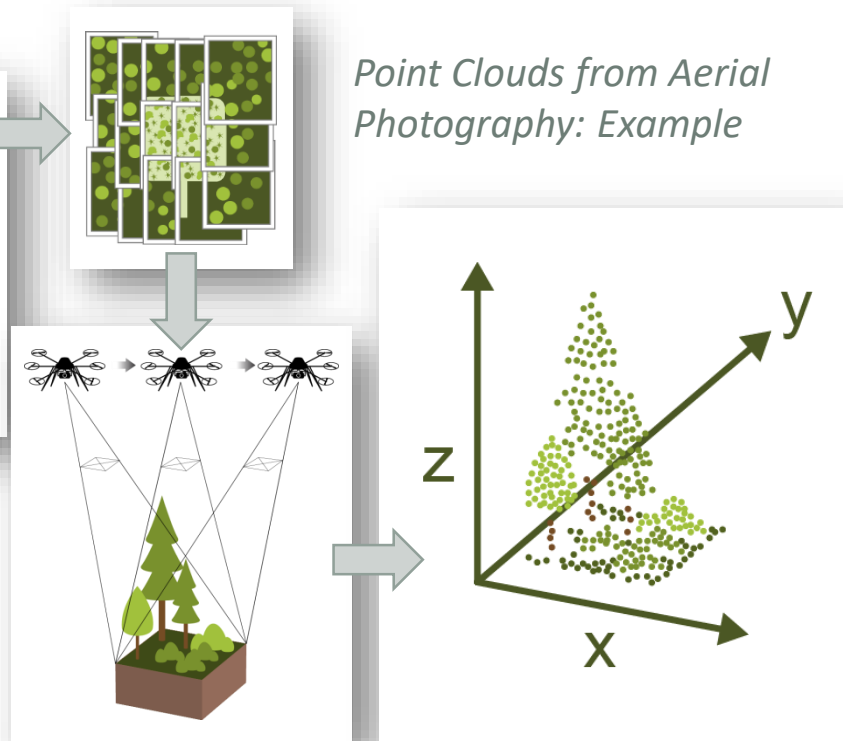
UAV Photogrammetry

- A key advantage of UAVs is their ability to capture dense sets of overlapping aerial photographs, from which LiDAR-like 3D point clouds can be generated

Structure-from-Motion



Point Clouds from Aerial Photography: Example



- These point clouds can be used to model 3D structure with incredible detail

Sample Point Clouds

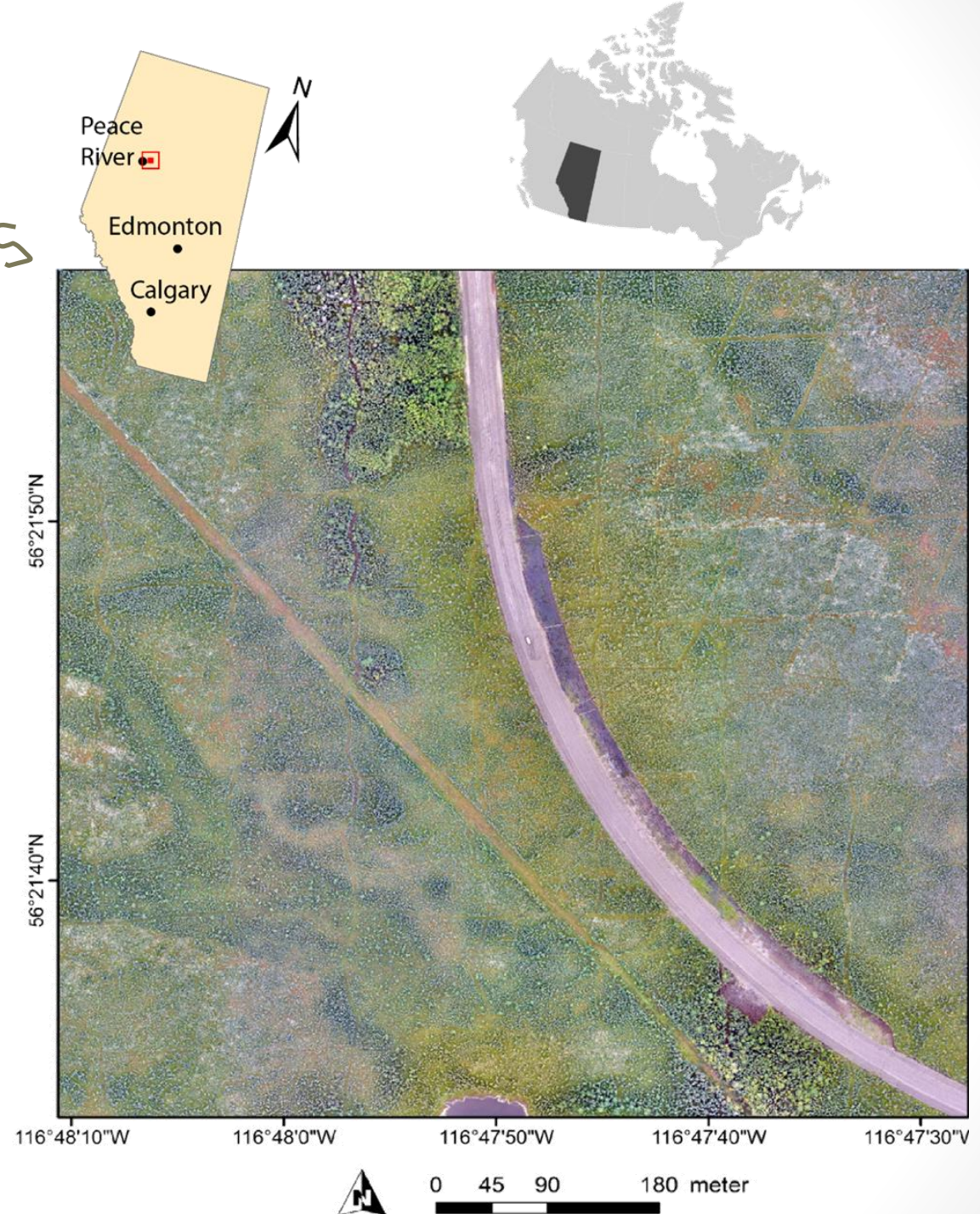


Research Question

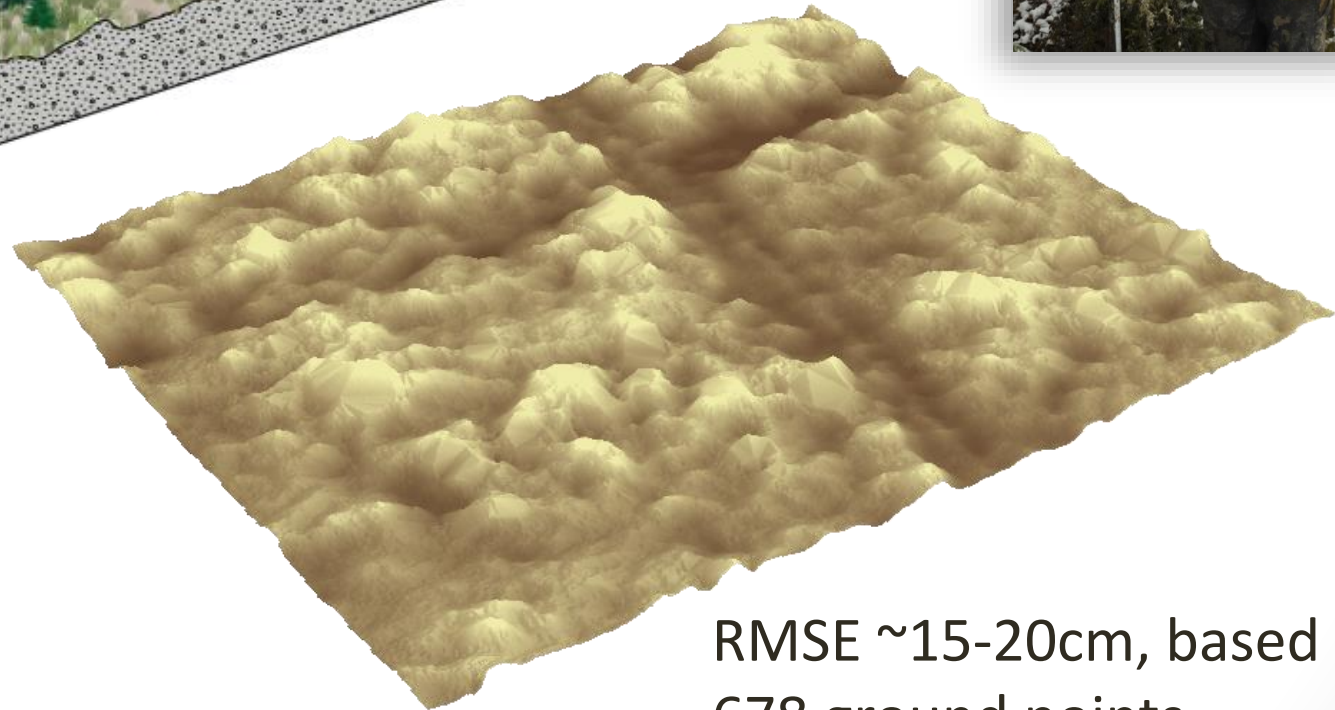
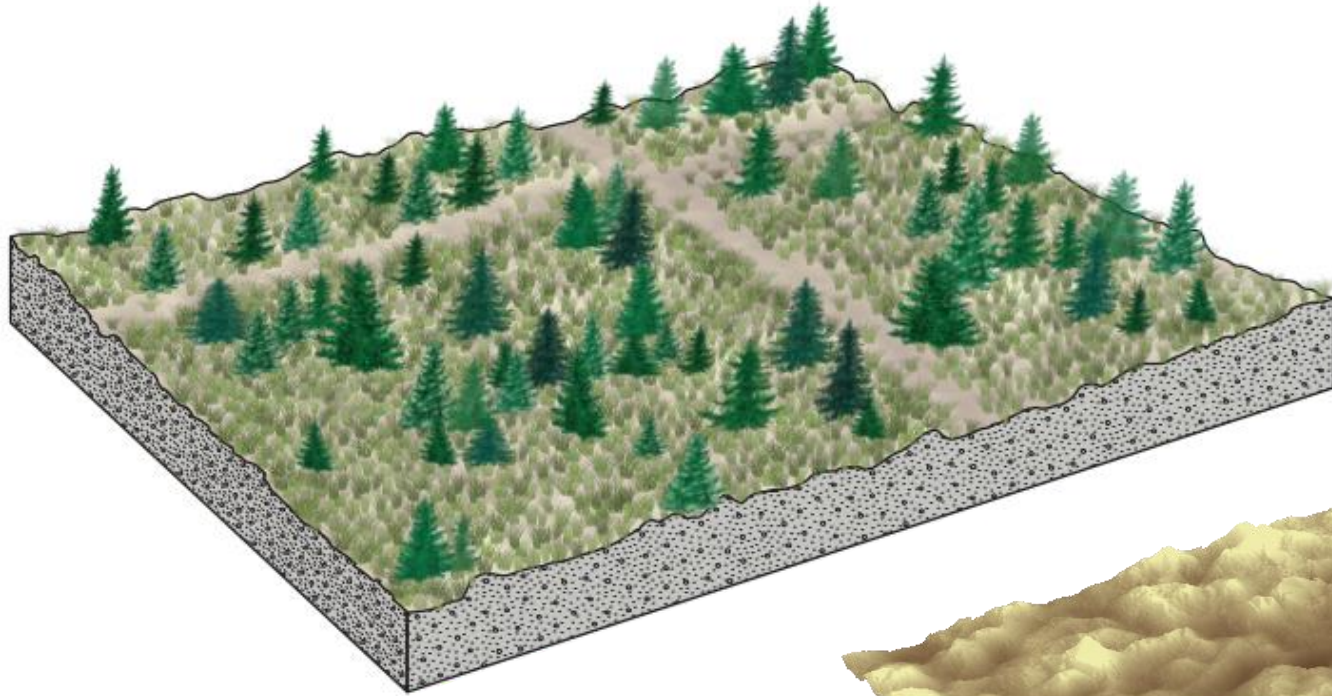
- What is the impact of mineral-filled access roads on peatland GHG emissions?

seismic lines

- Key targets:
 - Groundwater
 - Microtopography
 - Above-ground biomass
- UAVs can map these factors with unprecedented detail, providing a valuable complement to traditional field work in peatlands

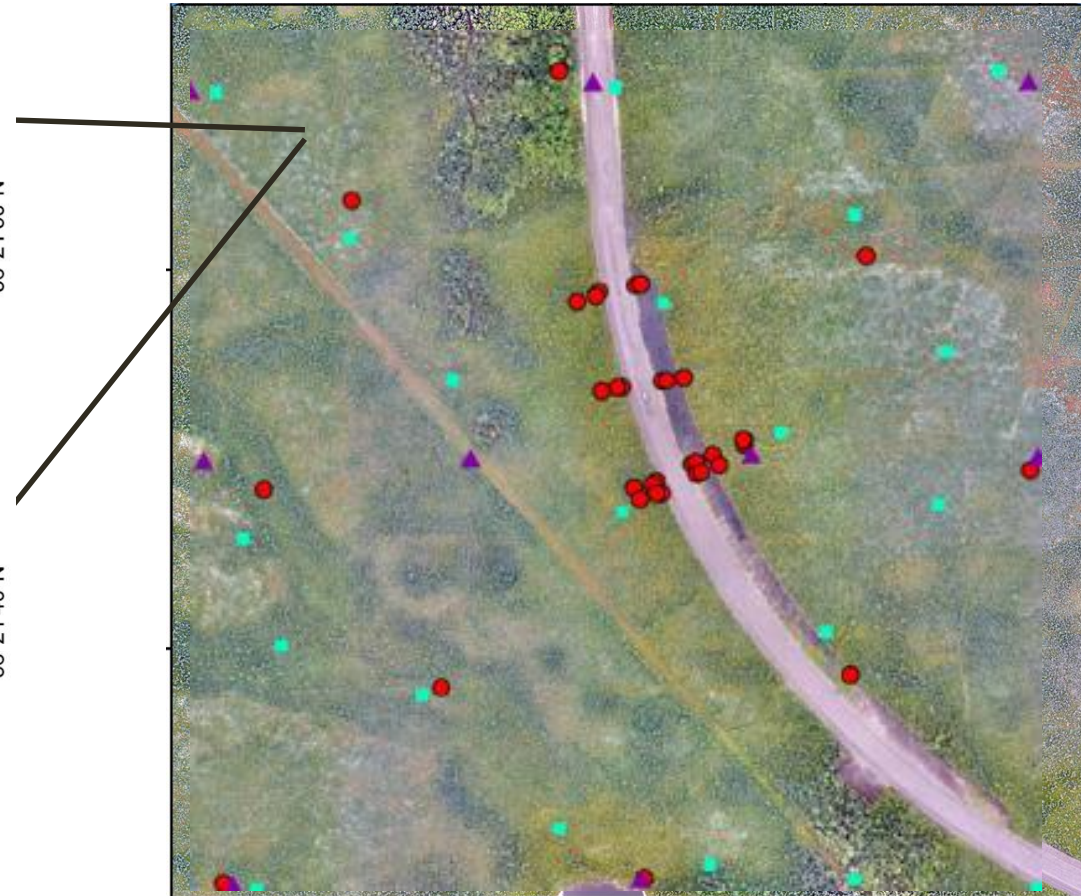
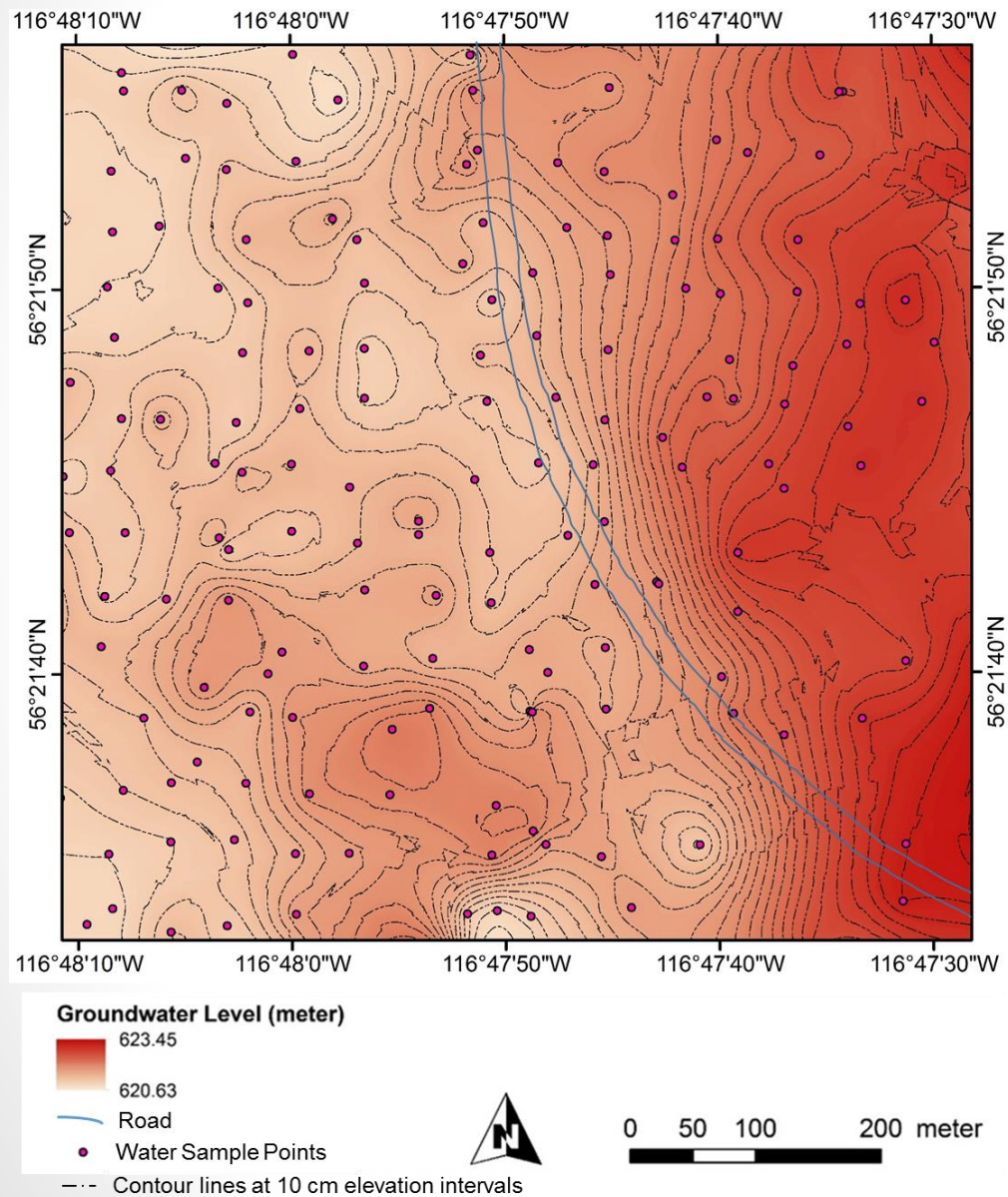


Mapping Microtopography



RMSE ~15-20cm, based on
678 ground points

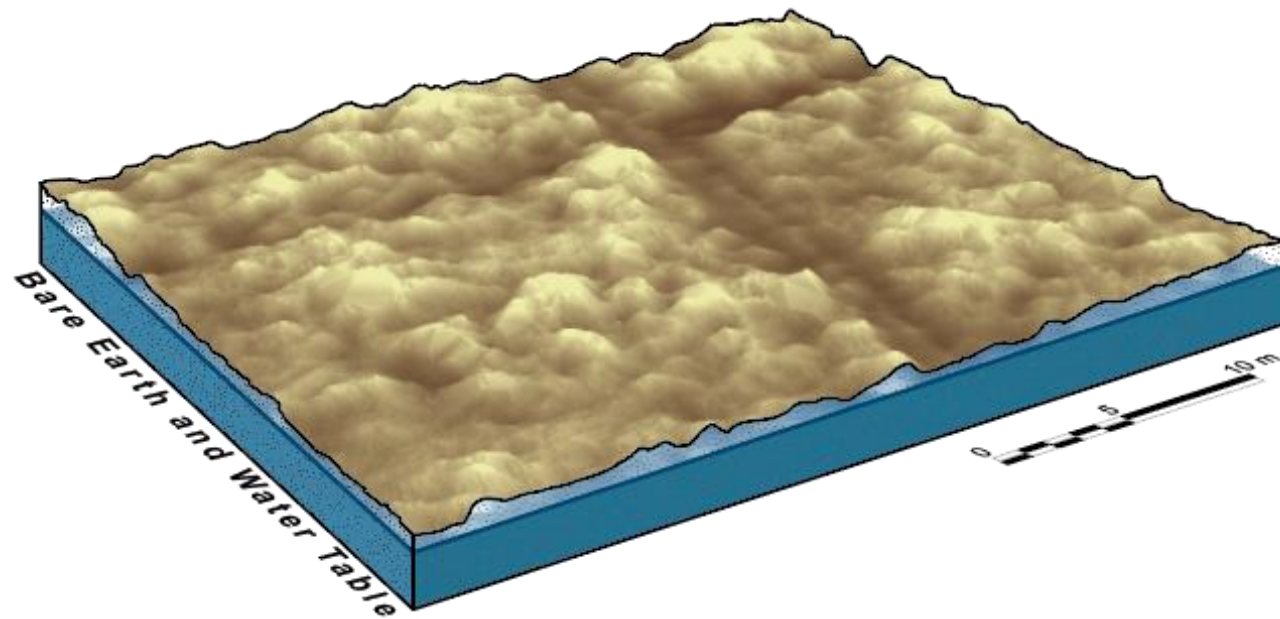
Mapping Groundwater



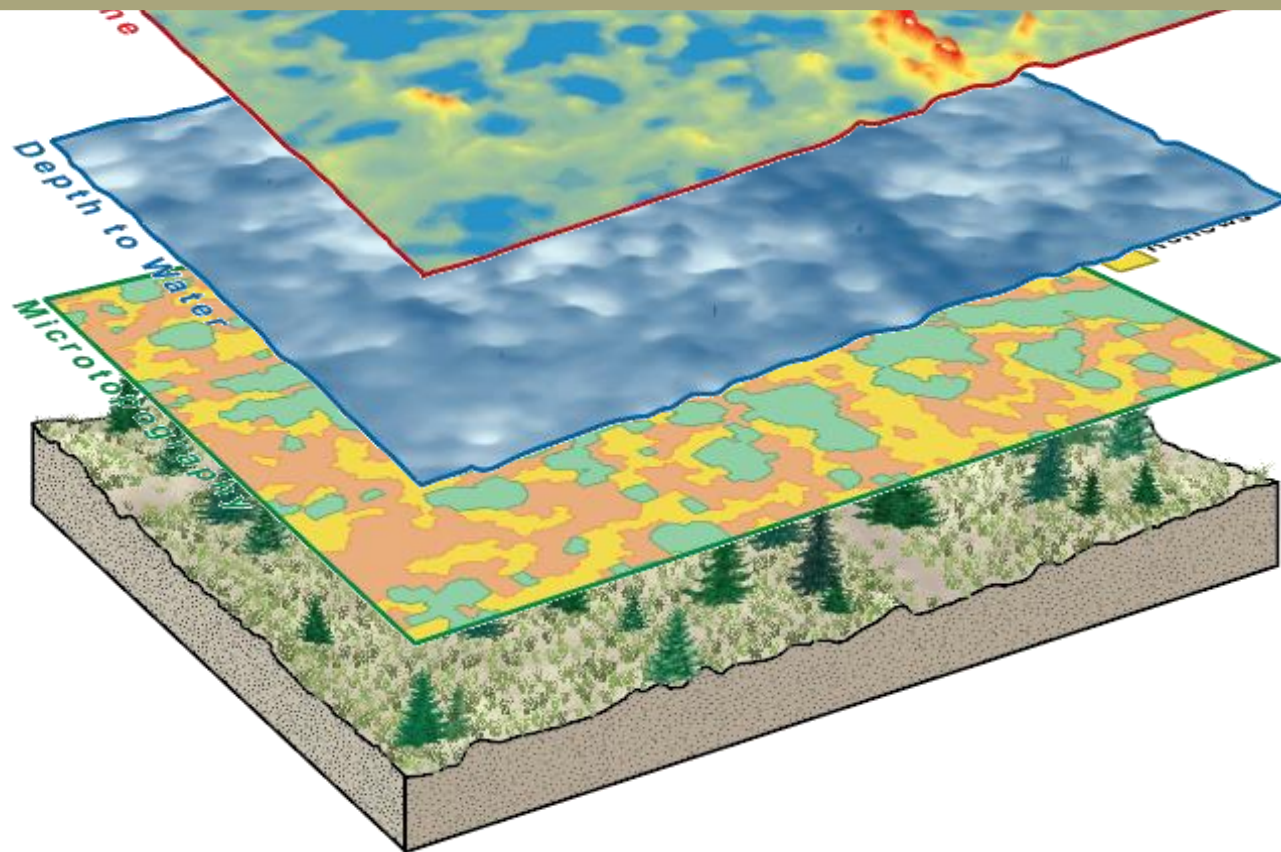
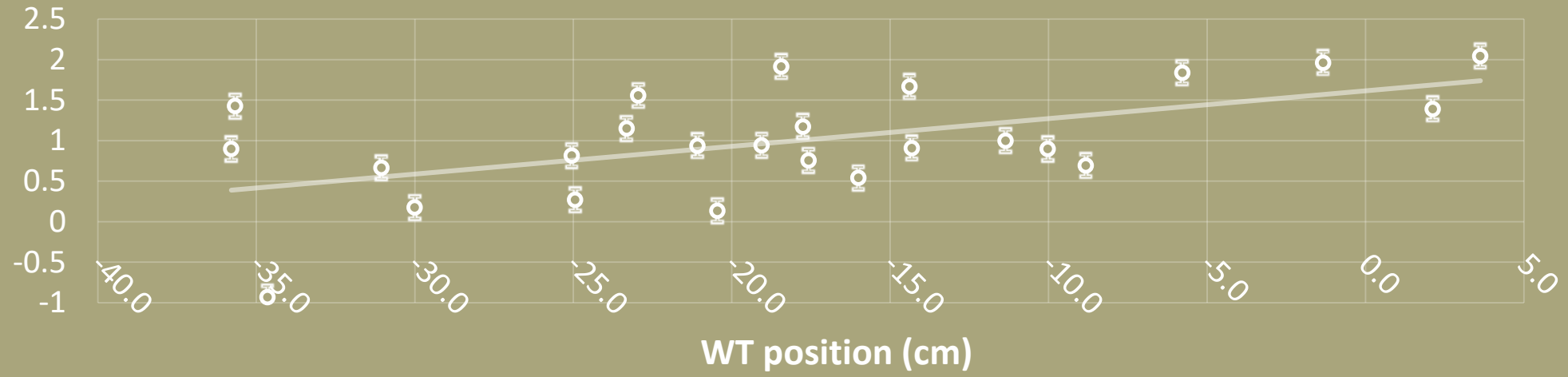
Most errors in the 0-20cm range,
based on 31 water wells

Revealing the Effect of Low-impact Seismic Lines

- LIS caused an overall flattening of microtopography
 - 25% decrease in microtopographic variability
 - Reduction in tall hummocks
 - Increased prevalence of hollows
- Mean depth to water decreased by 15.4cm



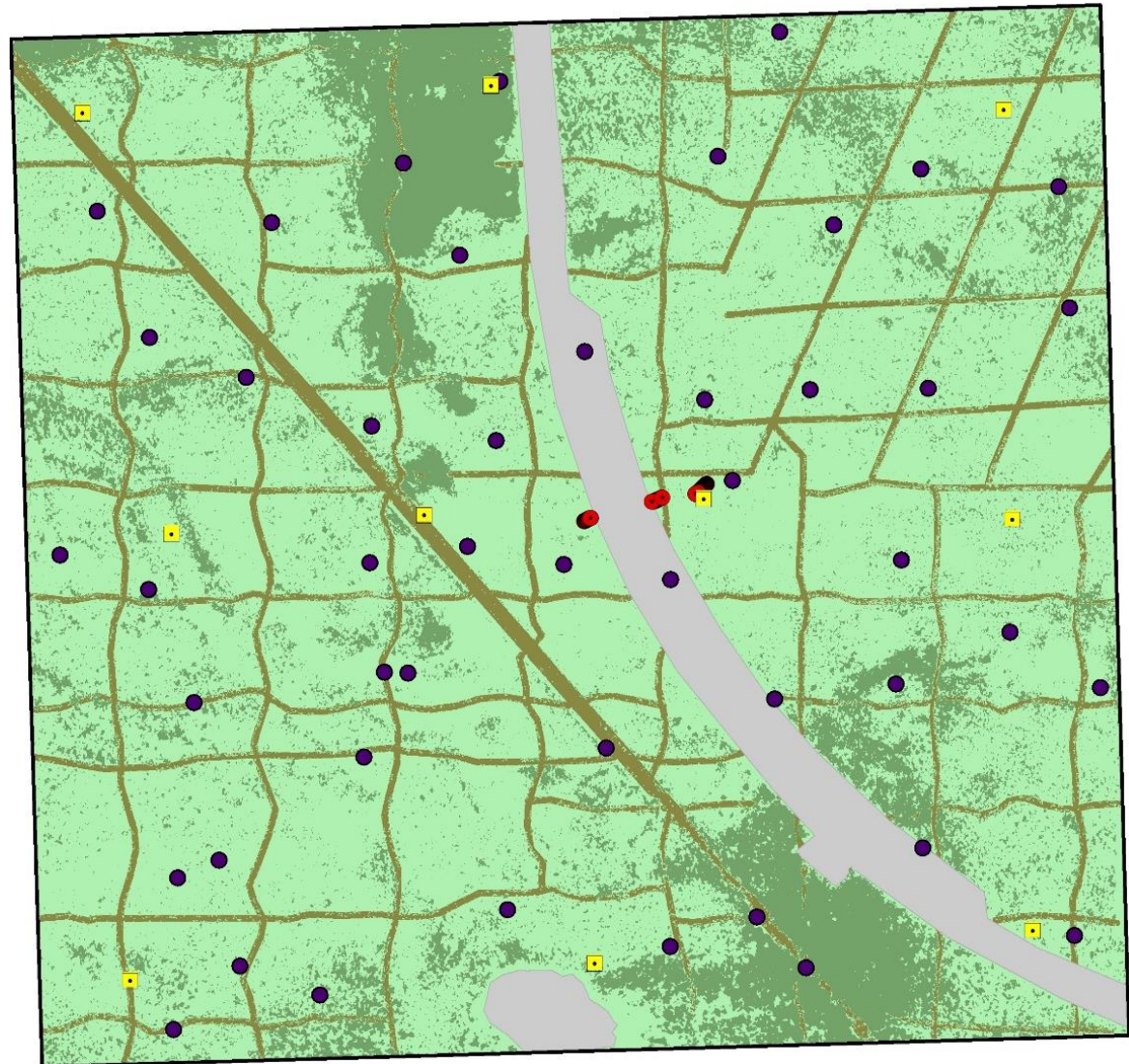
CH₄ flux (mg m⁻² d⁻¹)



What Impact to Our Study Area?

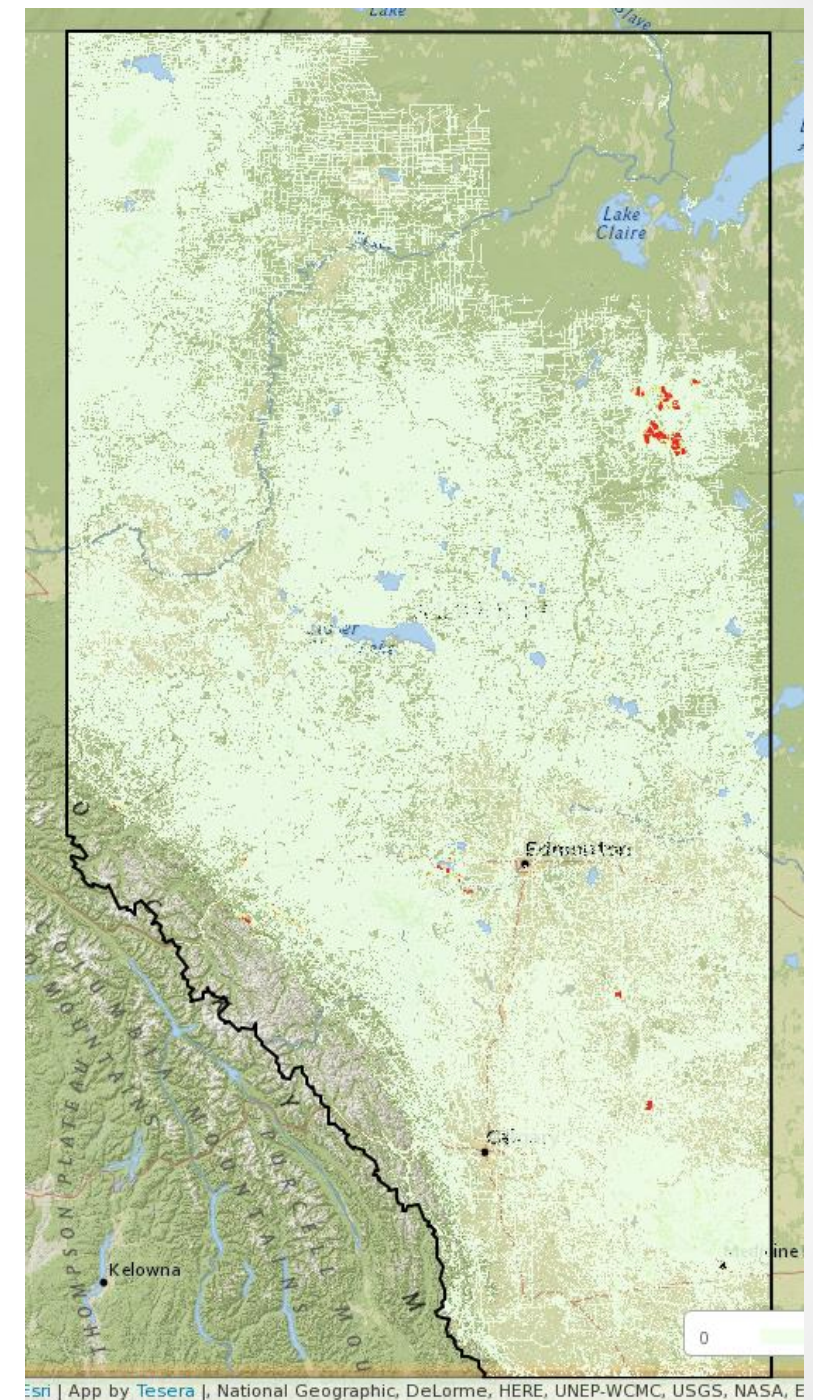
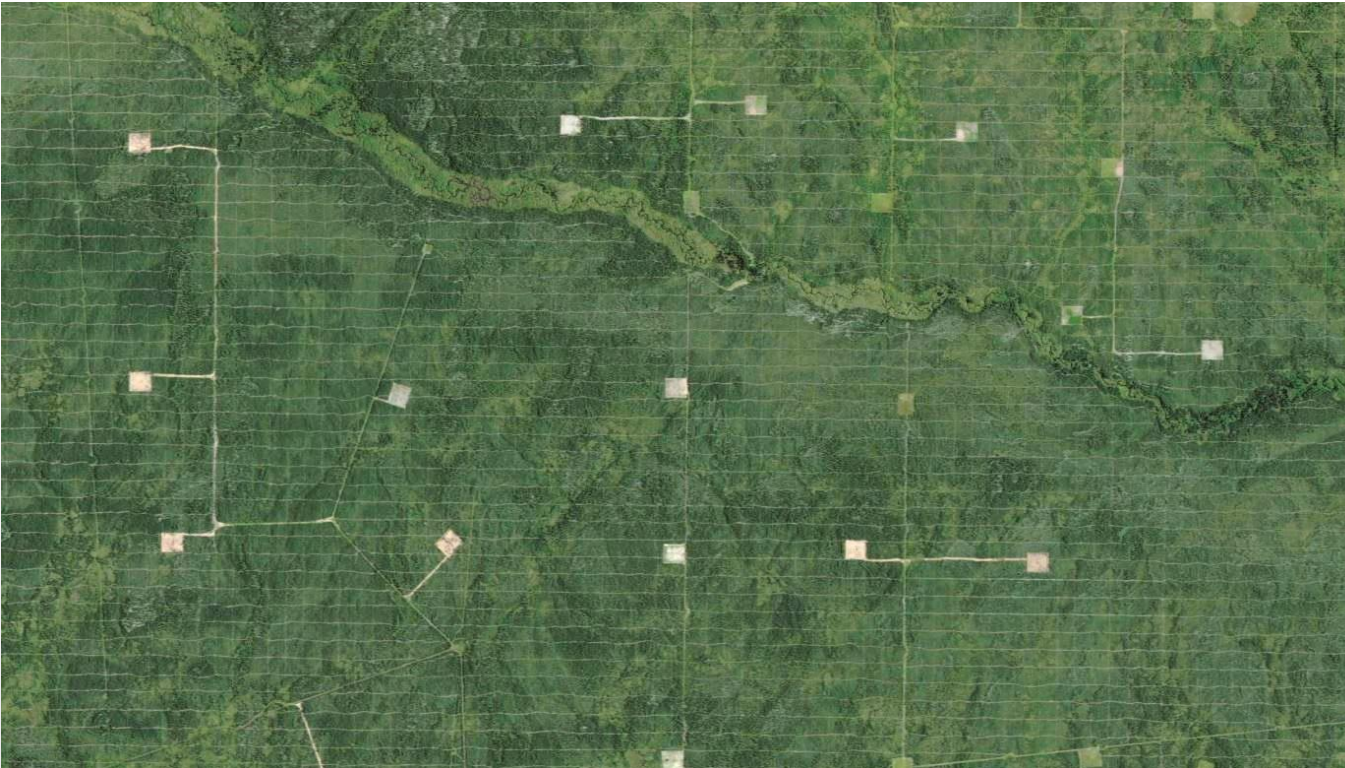
- The ~16 km of LIS present in our study area were predicted to boost CH_4 emissions by 20 to 70 kg between May and September, 2016

Lovitt et al., UAV remote sensing can reveal the effect of low-impact seismic lines on methane release in a forested Boreal bog. *Journal of Geophysical Research: Biogeosciences*, in review.



What About the Alberta Boreal?

- Methane has 28x the global warming potential of CO₂
- We estimate that there are ~300,000km of seismic lines in Alberta peatlands



Our Session This Morning

- **Rebecca Warren**, Wetland Mapping: A tool for better understanding the impacts of wetland disturbance
- **Evan DeLancey**, Modelling the pre-anthropogenic distribution of wetlands in the Lower Athabasca Region
- **Julie Lovitt**, Mapping the microtopography of a complex forested bog in Alberta using Unmanned Aerial Vehicles (UAVs)
- **Mustafizur Rahman**, Mapping groundwater table in peatlands: An Unmanned Aerial Vehicle (UAVs) based technique
- **Annie He**, The application of Unmanned Aerial Vehicle (UAVs) with estimating aboveground biomass in Alberta's peatlands
- **Caitlin Willier**, Evaluating changes in forest canopy structure in road-fragmented peatlands using airborne LiDAR

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