Critical Remote Sensing Targets for Boreal Wetlands Research and Management

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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

Remote Sensing Specialist: "Remote sensing can produce a vast array of data and many types of information. As a resource manager, what are your information needs?"

Resource Manager: "We have many, many resource information needs. Exactly what kinds of information can be obtained through the use of remote sensing?"
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.

• These point clouds can be used to model 3D structure with incredible detail.
Research Question

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

• 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
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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