REMOTE SENSING TOOLS FOR CONIFER STOCKING ASSESSMENT – PART 2: **AUTOMATED OBJECT-BASED ANALYSIS**

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Introduction

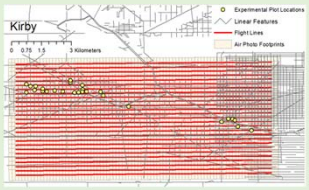
- Seismic lines in the boreal region are constructed to facilitate resource extraction activity.
- They are abundant in the province of Alberta (estimated density approaching 10 km/km^2).
- They leave behind adverse and long-lasting impacts on the environmental and the ecosystem.
- This demands for substantial reclamation and recovery measures.
- The provincial government of Alberta recently unveiled a framework for the restoration of these seismic lines. The framework:
  - Is a practical guide to restoring seismic lines
  - Includes a list of indicators to monitor the progress
  - Scopes out both ground survey and aerial survey as acceptable monitoring approaches
  - Establishes 'stocking' as a metric to evaluate the success of restoration efforts.
- Stocking of conifer seedlings refers to a combination of
  - Density
  - Survival
  - Height
  - Distribution

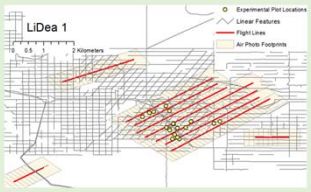
Objective

- The objective of this study is to reveal the influence of various data type and environmental conditions on automated remote-sensing based seedling detection and stocking assessment.

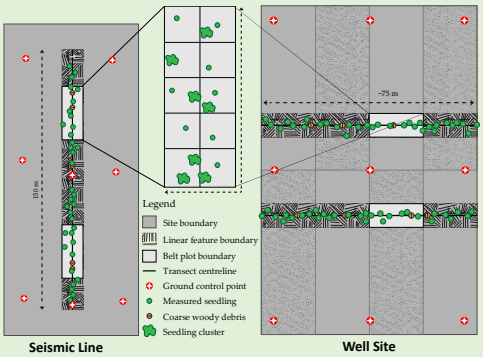
Study Area

- Our study took place in the Boreal Forest natural region of northeastern Alberta, Canada.
- Specific areas of interest: Kirby, LiDEA I, and LiDEA II.





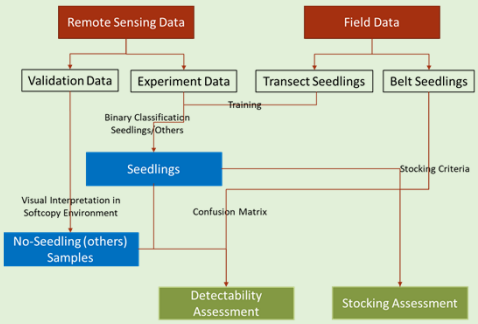
Field Data Collection



- We established 63 field sites based on the stocking criteria in the Provincial Restoration Framework
  - 7 well sites
  - 56 seismic line sites

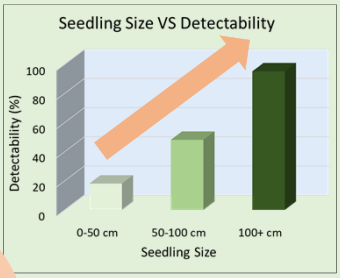
Experimental Design

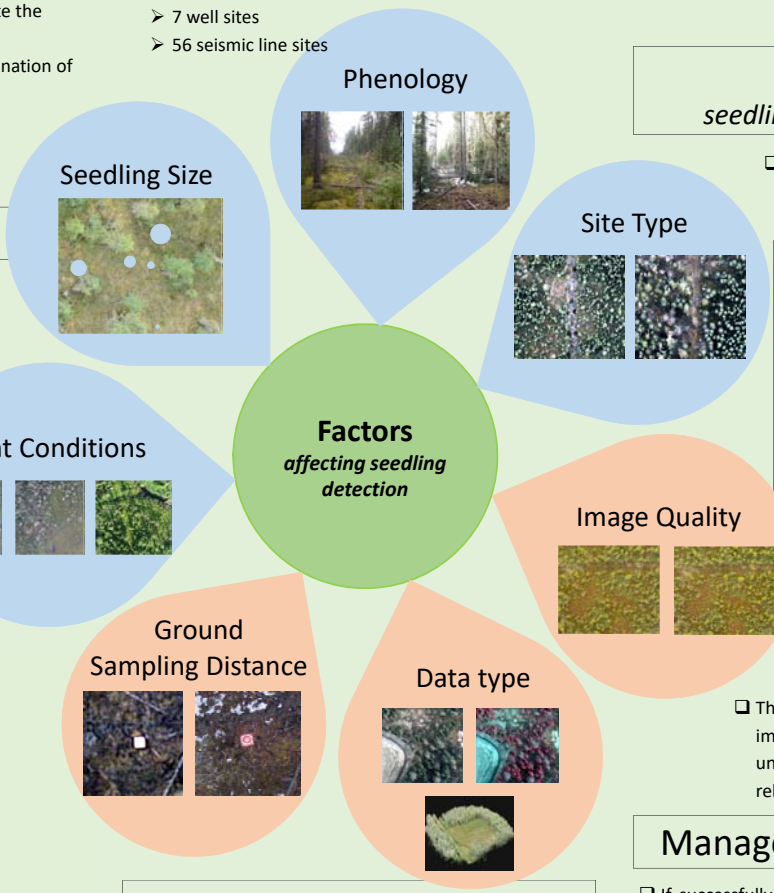
- How does automated object-based analysis do compare to field surveys?
- How is performance affected by data type and environmental conditions?



Results: *seedling size vs detectability*

- Our early results show that seedling detectability increases as the seedling size increases





Next Steps

- Evaluate how different environmental conditions and data types impact seedling detection.
- The ultimate goal is to identify appropriate imaging conditions and data requirements under which remote sensing can deliver reliable estimates of conifer stocking.

Remote Sensing Survey

Type	Resolution/ Pont Density/	Sites Covered	Leaf On	Leaf Off
Airborne Orthophoto (RGBNIR*)	5 cm	63	Yes	Yes
Airborne PPC**	300-400 pts/sq.m	63	Yes	Yes
UAV orthophoto (RGB)	3 cm	17	Yes	No
UAV PPC	350 – 500 pts/sq.m	17	Yes	No
UAV orthophoto (RGB)	1-10 mm	~10	Yes	No
UAV PPC	Varied density	~10	Yes	No
Airborne single band LiDAR	50-100 pts/sq.m	63	P***	P***
Airborne multispectral LiDAR		Kirby Only	Yes	No

**** Red, Green, Blue, Near Infrared***
*****Photogrammetric Point Cloud***
******P - Partial coverage: The spring data covers the entire LiDEA-1, portions of LiDEA-2, no Kirby data, The summer data covers the entire Kirby and LiDEA-1 Sites and a portion of LIDEA-2***

Management Implications

- If successfully developed, our research is expected to provide the resource managers with 'an automated remote sensing based workflow for stocking assessment and seismic line restoration monitoring'. This solution should be-
  - Cost effective, fast and repetitive, and
  - Scaled over large study areas.

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