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Can satellite imagery be used to assess forest recovery on seismic lines?

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What are seismic lines?

- Linear clearings 5 -10 m wide
- Tree regeneration is slow and inconsistent even decades later
- Landscape fragmentation
- Affects predator-prey dynamics



How do we track seismic line recovery?

- Need to understand current condition of seismic lines
- Recovery depends on many factors
- How do we assess linear footprint recovery and track over time?



David Dodge <https://energi.media/alberta/seismic-lines-in-albertas-boreal-forest-boost-methane-emissions-u-of-c/>

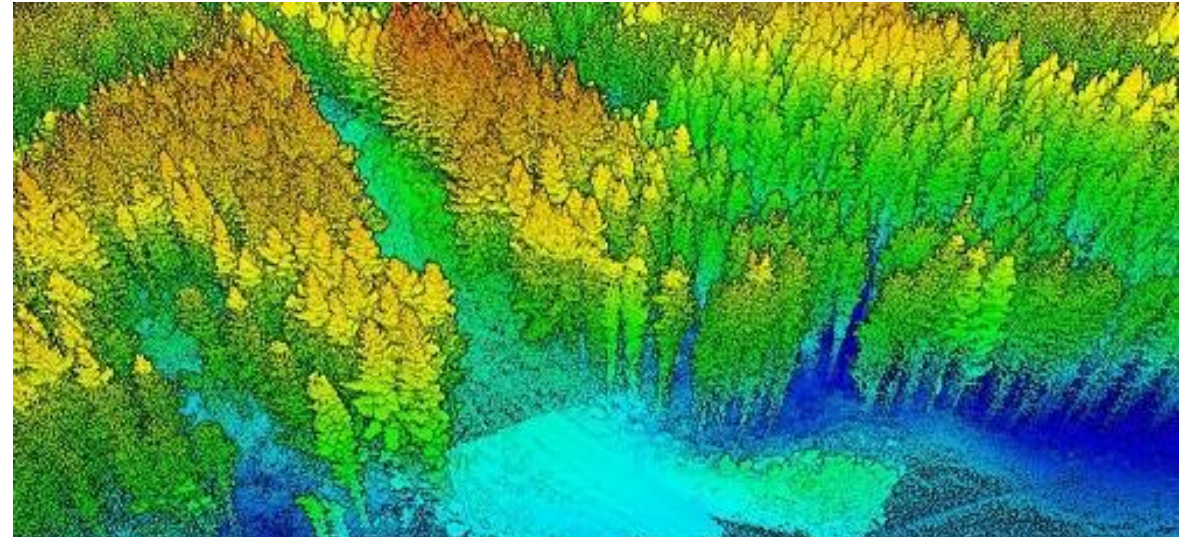


Remote Sensing

- LiDAR (Light detecting and ranging)
- High resolution photogrammetry
- Costly & complex data processing



Fuse consulting



<https://gogeomatics.ca/a-japanese-perspective-lidar-forest-data-for-resource-analysis-in-japan>



Could we use satellite imagery?

- Lower acquisition cost and simple interpretation
- Can it provide cursory-level recovery information?

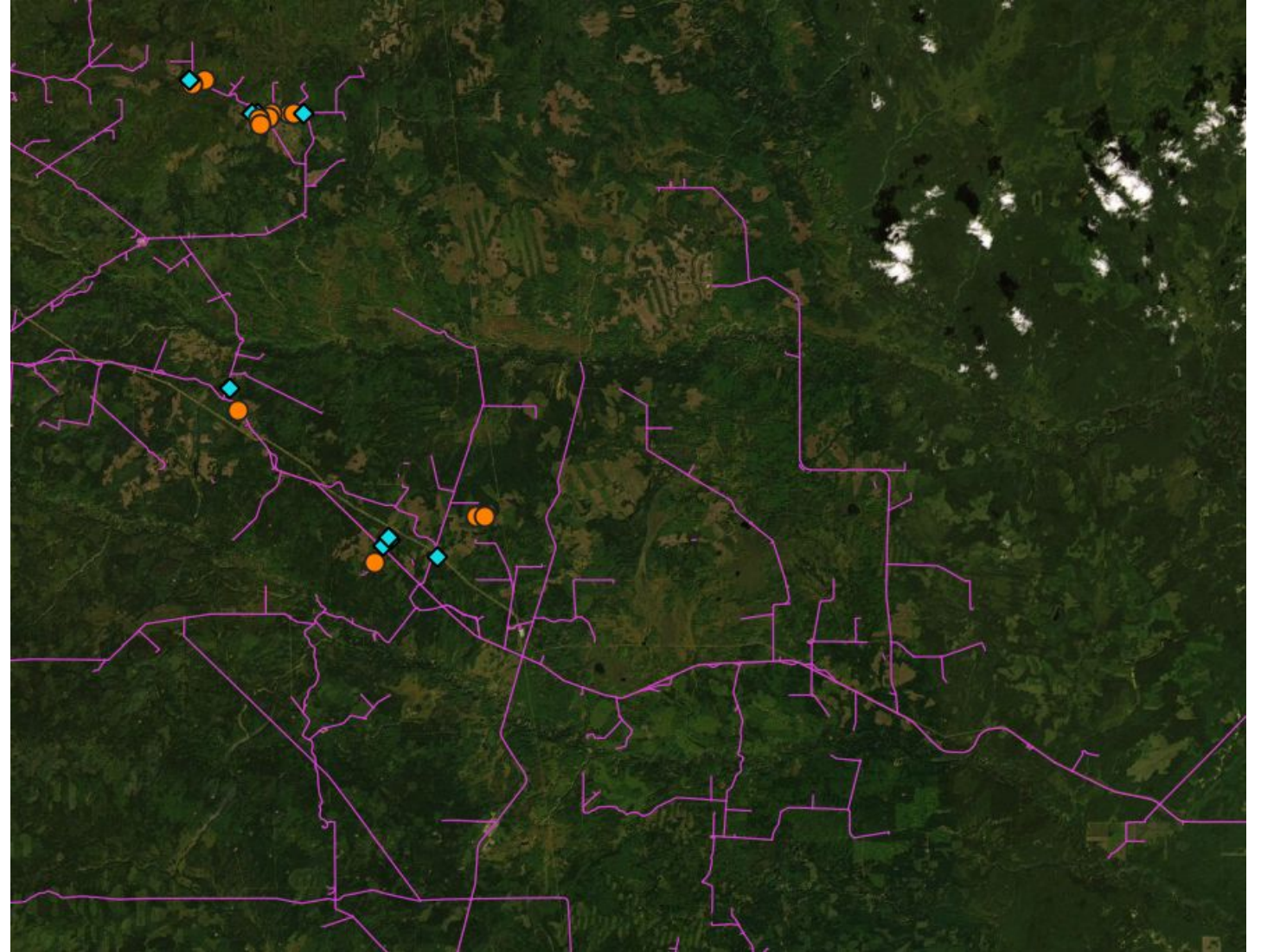


<https://spacenews.com/geoeye-2-price-tag-rises-ground-system-upgrades-0/>



Study Area

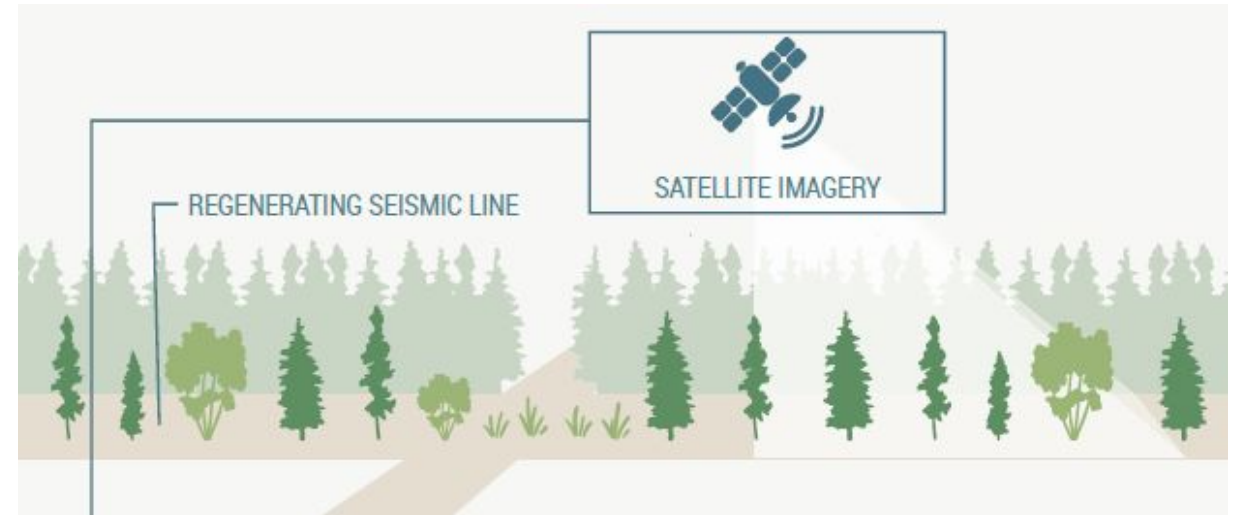
- NW of Manning, AB
- Seismic lines cleared in 1980s (5 m wide)
- Included seismic lines in natural forests and cutblocks
- Time since disturbance spanning 10-15 (cutblocks) and 40 years (natural forest)



Satellite Imagery Assessments

- Classifications categories assigned to seismic line segments based on recent SPOT 6/7 satellite imagery (1.5 m res.) from Altalis

- 3 classification categories:
 - Not Recovered (NR)
 - Fractionally Recovered (FR)
 - Recovered (R)



- Aerial photos from 2000 (1 m res.) were also used to evaluate relative change of the footprint over time



Classification Examples

Not Recovered (6 lines)



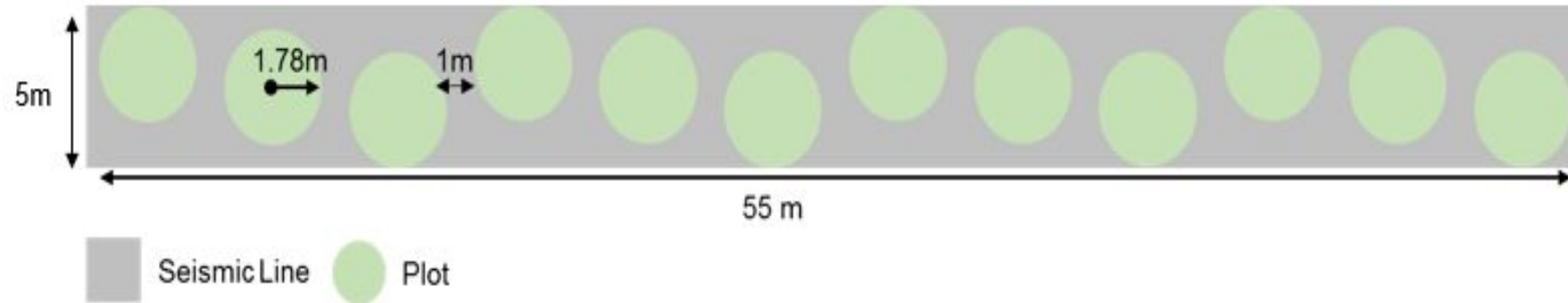
Fractionally Recovered (10 lines)



Recovered (6 lines)



Ground-truthing



PRACTICAL ARTICLE

Field sampling methods on seismic lines: a comparison between circular plots and belt transects

Caren Jones¹ , Angeline Van Dongen¹, Jill Harvey¹, Dani Degenhardt^{1,2}

Seismic lines are linear clearings created for oil and gas exploration. Regeneration on seismic lines in Alberta's boreal forest is limited by slow natural recovery, making them persistent features on the landscape and prompting interest in line restoration through vegetation reestablishment. The goal of this study was to establish an effective woody vegetation sampling method for monitoring seismic line regeneration in boreal mixedwood forests. Data collected in belt transects and circular plots were sim-

Recovery Criteria

- Average height of 3 m
- Average density of 2000 stems per hectare

2010 Reclamation Criteria for Wellsites and
Associated Facilities for Forested Lands

(Updated July 2013)

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journal homepage: www.elsevier.com/locate/biocon



Natural regeneration of forest vegetation on legacy seismic lines
in boreal habitats in Alberta's oil sands region



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ABSTRACT

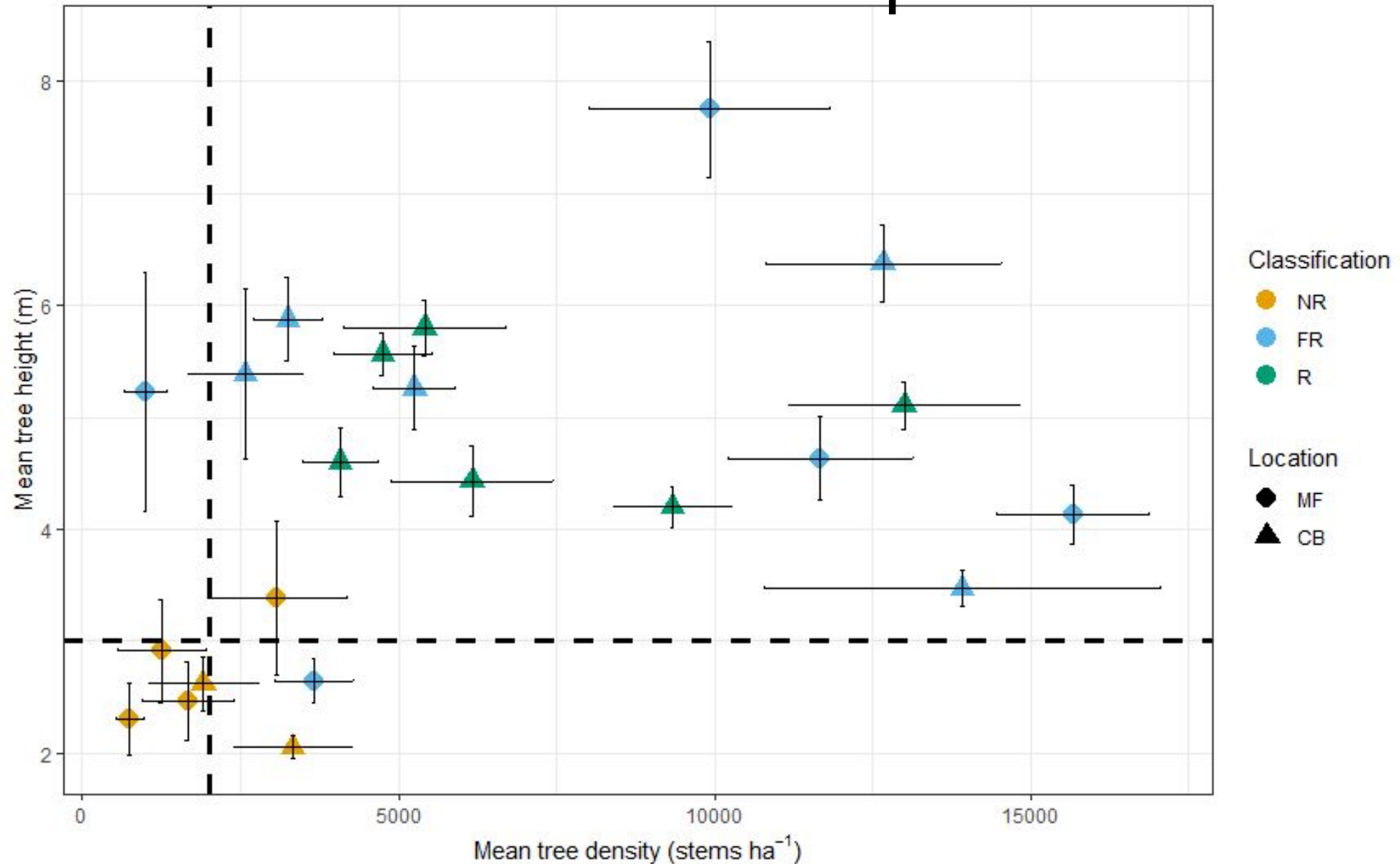
Mapping of oil reserves involves the use of seismic lines (linear disturbances) to determine both their location and extent. Conventional clearing techniques for seismic assessment have left a legacy of linear disturbances that cause habitat fragmentation. Little is known, however, about how local and landscape factors affect natural regeneration patterns of trees and shrubs on seismic lines that facilitate mapping and future projections of regeneration patterns. To understand factors affecting early forest regeneration



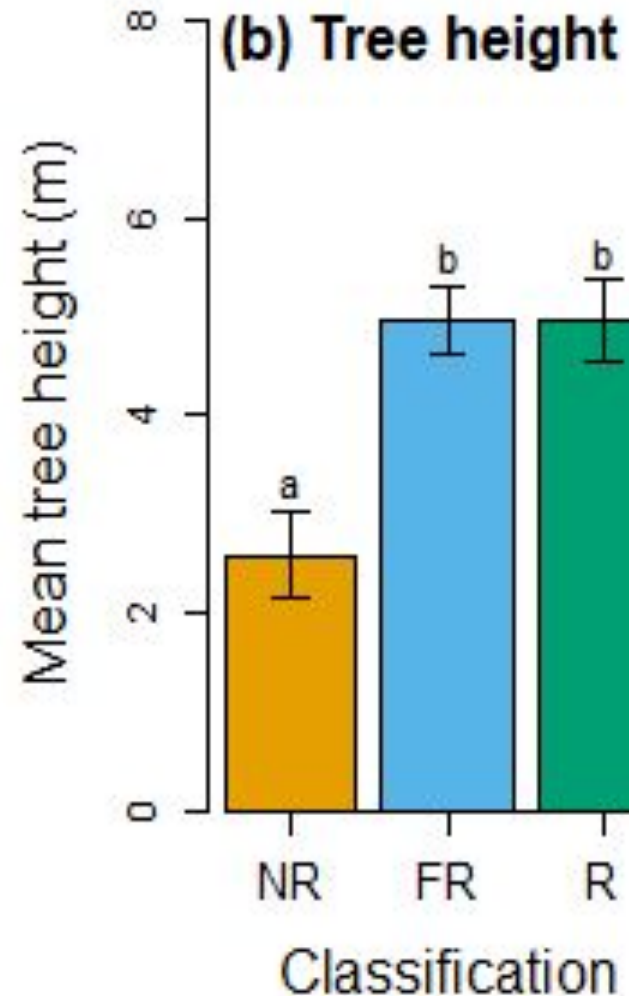
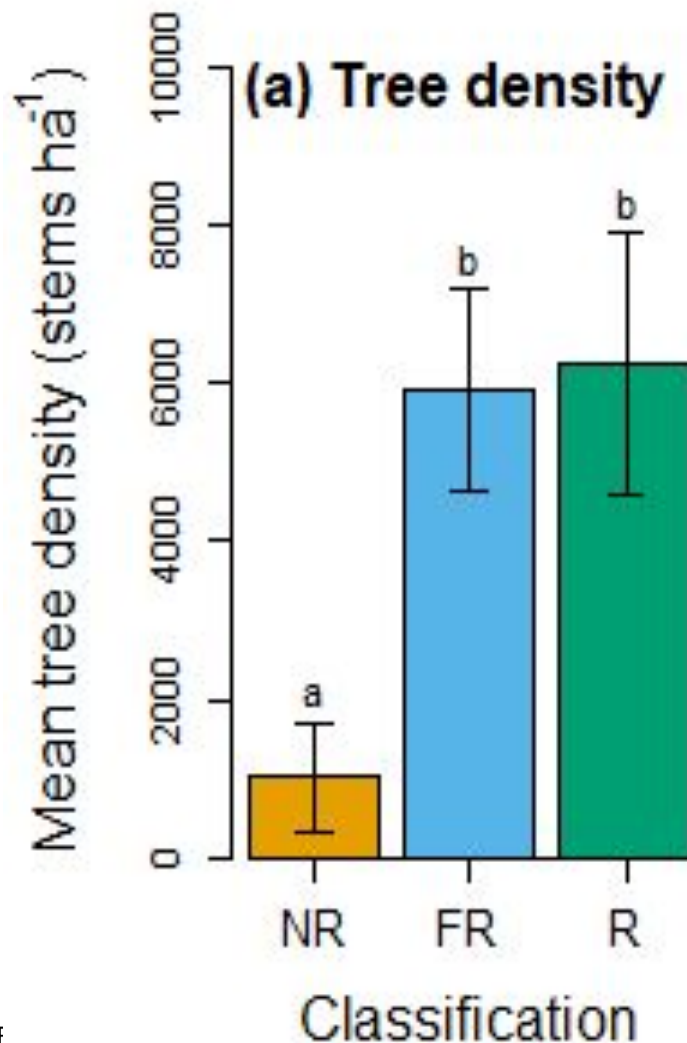
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How do classifications compare to criteria?



Are the classification categories different from each other?



Effect of surrounding tree height

- Only seismic lines in cutblocks classified as Recovered
- Likely attributed to height differences casting shadows
- Until trees on the line reach similar heights to the surrounding forest, the lines will remain distinguishable on the imagery



Recovered



Fractionally Recovered



Imagery does capture lack of recovery

- Lines with poor regeneration were distinguishable from the satellite imagery



Fractionally Recovered

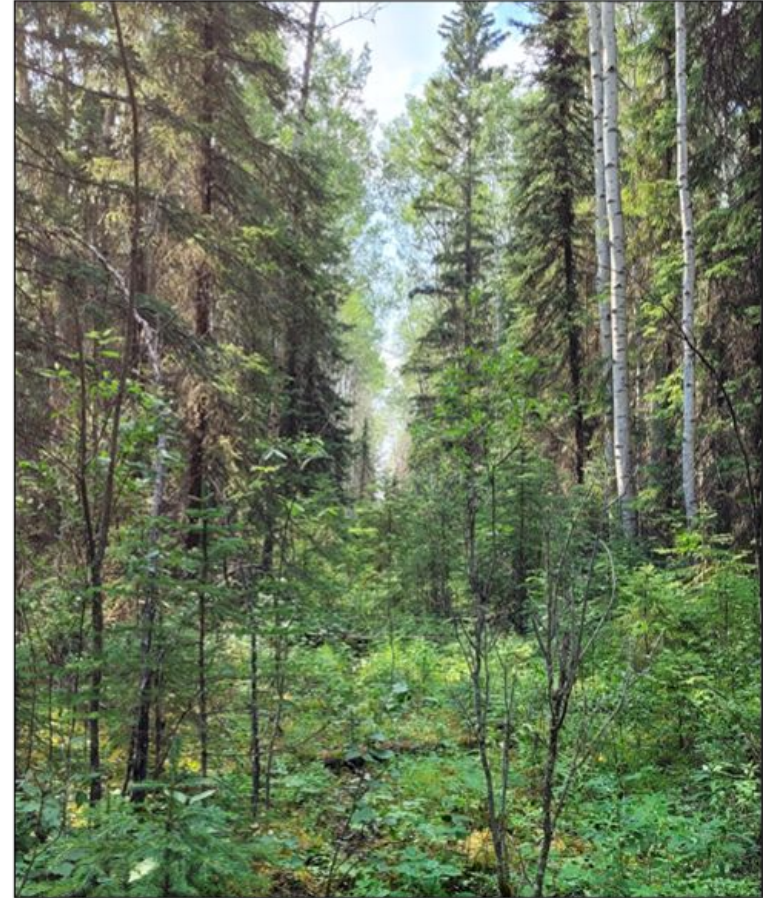


Not Recovered



Conclusions

- Visual assessments of satellite imagery are capable of distinguishing recovery from lack of recovery.
- We recommend a simpler two-tiered recovery classification system.
- Preliminary way for decision makers to understand recovery status and track over time



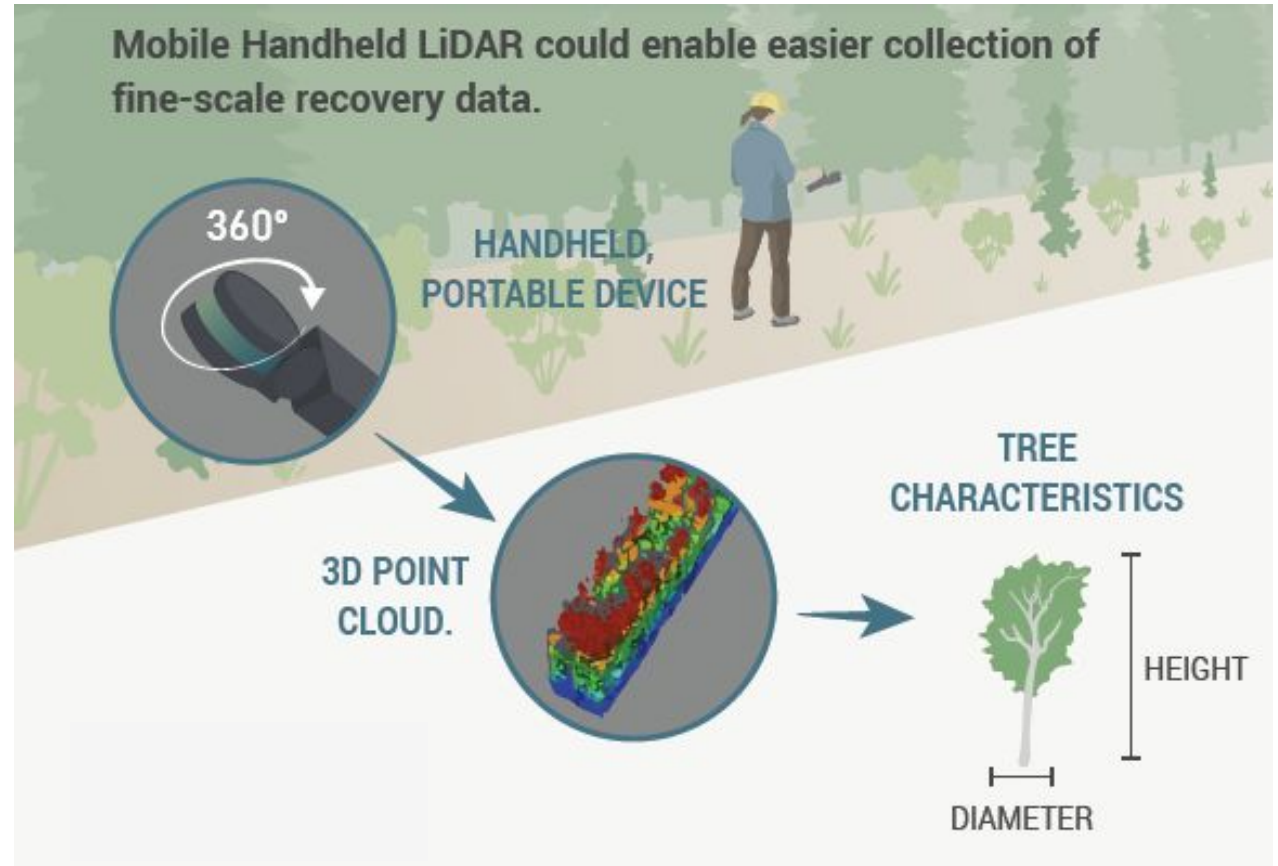
Other Work – Cutblock study

- Are cutblocks ‘erasing’ the seismic line’s footprint?



Other Work – Handheld LiDAR

- Partnered with Wild & Pine to ground-truth commercially available handheld LiDAR technology for assessing seismic line recovery



Other Work – Drone LiDAR

- Evaluating the use of drone-mounted LiDAR for monitoring recovery on oil sands and coal mine reclamation sites as an alternative to survey plots



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Thank you!



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