

UPDATES

BERA welcomes MSc Student [Yusif Abdullai](#) to the BERA Remote Sensing Team and PhD Student [Maryam Bayat](#) to the BERA Ecohydrology Team

Congrats go to BERA graduate Kimberley Kleinke (UWaterloo) for successfully defending her [MSc thesis!](#)

New Publications:

- [Effects of Fire Severity and Woody Debris on Tree Regeneration for Exploratory Well Pads in Jack Pine Forests](#)
- [Linear disturbances shift boreal peatland plant communities toward earlier peak greenness](#)

SUMMER 2021 FIELD WORK!

After a quiet, COVID-limited 2020 field season, BERA researchers were thrilled to get back into the field in 2021.

- [Colette Shellian](#) handled thousands of seedlings for growth analysis and remote sensing. She noted the largest mortality in jack pine seedlings and documented some interesting responses to treatment.
- Alistair Baron lead the installation of 10 new fen sites for forthcoming collaborative work with [Anna Dabros](#) of the Canadian Forest Service on plant functional traits.
- [Lelia Weiland](#) sampled soil, water table, and surface topography in Stoney Mtn and Kirby. Lelia noted that seismic lines in some upland sites were unexpectedly wetter than their surroundings, and tagged these locations for re-visit.
- [Jennifer Fliesser](#) compared four different mounding techniques for growth and survival of planted seedlings. She noted that the hummock transfer appeared to hold their shape best.
- [Tharindu Kalukapuge](#) set up autonomous recording units (ARUs) around seismic lines to understand how these features influence bird communities as a function of line width and recovery status.

RESEARCHER PROFILE

[Dr. Ellie Goud](#) is a postdoc in Dr. Maria Strack's lab at the University of Waterloo. Ellie is a broadly trained plant scientist with a focus on plant ecophysiology, stable isotopes, and ecosystem ecology. Her BERA research is examining how plant function and diversity are impacted by seismic lines and restoration treatments. Being from New Brunswick, Ellie is happiest in a bog surrounded by blueberries! We look forward to hearing about Ellie's latest research during the **BERA lunch-hour seminar on Oct 21, at noon.**





RESEARCH HIGHLIGHTS

PEATLAND TREE REGENERATION and the influence of wildfires

Seismic line restoration is vital to woodland carbon recovery and overall biodiversity. However, seismic lines are difficult and costly to restore, especially in peatlands. Wildfire can have both positive and negative effects on restoration: it can kill planted seedlings, but also release the seeds of fire-adapted species like black spruce, but how it affects tree regeneration on an seismic line is not well understood.

We compared tree growth on burned and unburned seismic lines at 143 boreal peatland sites and found that although fires can be damaging, they favour natural regeneration. Other factors including microtopography, water depth, and species could also affect recovery patterns.



Overall, the density of regenerating trees was greater on burnt sites compared to unburnt sites, both on seismic lines and in the forest. Tree regeneration (per ha) varied from:



Wildfire increased tree regeneration density in bogs and poor mesic sites

Seismic lines flatten and compress peatlands, resulting in a high-water table and loss of microtopography that doesn't allow trees to grow. In fens, increasing depression depth and wetness limits tree recruitment even after wildfire.

Understanding the impacts of wildfire on natural regeneration can help restore and protect boreal and subarctic forests. Seismic lines in one area are likely to benefit from wildfire, which could make them a greater priority for active restoration.

Fires Help Erase Seismic Lines in Peatlands

Seismic lines alter a host of ecosystem processes in the boreal forest, and many of those lines are in a state of arrested succession. Restoration managers have to choose: active restoration (mounding, planting, other treatments) or passive (leave for natural)? Researchers in BERA's Vegetation Team are helping to understand the role of fire in this equation. Read about some of their work [here](#).

Forest Line Mapper

a free open-source software tool for mapping linear features

Forest research and restoration planning requires accurate information on the location and condition of linear disturbance features. However, most existing linear feature databases were generated by human interpretation of aerial photos and lack the data needed to assess key restoration conditions (e.g., line width, vegetation height).

We developed the Forest Line Mapper (FLM), a semi-automated software tool for mapping linear features using LiDAR-derived canopy height models.

The FLM toolset offers broad application to researchers and land managers working in forests.

The source code is freely available online at: <https://github.com/appliedgrg/flm>

We assessed the accuracy of the tool for linear features in the boreal forest of Alberta and found that the FLM:

- Reliably predicts both the center line and footprint of a variety of linear-features types (including roads, pipelines, seismic lines, and power lines).
- Outputs are consistently more accurate than publicly available datasets produced by human-photo interpreters.
- Can also determine line geometry and vegetation attributes, which may be useful for characterizing disturbances and assessing recovery.

Open Access Software Tools for Researchers and Land Managers

Most linear-feature databases work fine for cartographic purposes but are not up to the demands of detailed research and restoration planning. Researchers in BERA's Remote Sensing Team tackled this problem by developing the Forest Line Mapper: a free, open-access software kit you learn more about [here](#).

HOW SEISMIC LINES ALTER SOIL PROPERTIES

Seismic lines form vast networks over Canada's boreal peatlands. These disturbances flatten and compress soil, disrupt water flow, and alter biogeochemical processes, which can prevent the recovery of natural vegetation.

Restoration techniques like mounding seek to recreate natural microtopography and encourage ecosystem recovery. However, little is known about how seismic line disturbance and subsequent mounding treatments affect soil properties.

The study compared soil properties of seismic lines and adjacent natural areas and examined how soils changed following mounding. 34 seismic lines (and adjacent natural areas) in poor mesic and treed fen ecotopes were sampled near Fort McMurray, Alberta.

Seismic line disturbances impact soil properties.

In both poor mesic and treed fen ecotopes, soils on seismic lines were wetter and more compacted.

Following mounding, we found evidence of increased decomposition on mounds within the treed fen.

Within poor mesic sites, we found evidence of increased decomposition and organic matter loss from soils on seismic lines compared to natural areas.

Seismic line disturbance and restoration could have major implications for carbon cycling. Future research should investigate alternative mounding techniques to encourage tree recovery while minimizing carbon losses from the system.

DAVIDSON ET AL. 2020
DOI: 10.3389/FEART.2020.00031

Seismic Line Treatments Alter Peatland Soil Properties

Mounding – the process of using machinery to create artificial hummocks in peatlands – helps tree regeneration on seismic lines, but what other effects might they have? BERA researchers on the Soils and Hydrology Team have uncovered alterations that might have major implications for carbon cycling. Read the manuscript [here](#).



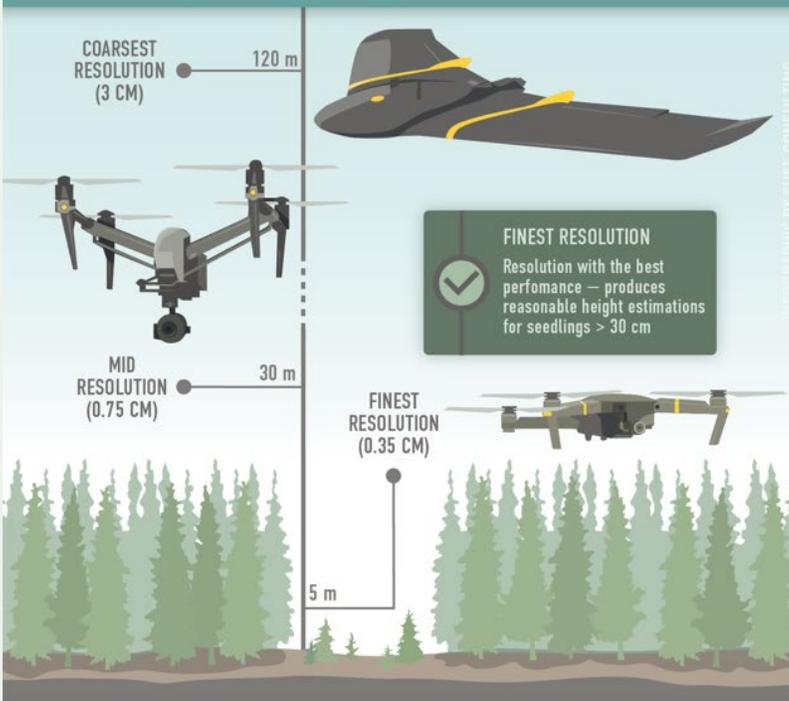
Using Drones

To Measure Seedling Height

Monitoring restored seismic lines is costly. It usually requires a crew to count seedlings from specific tree species taller than a certain height while treading through sensitive terrain. Seedlings can be easily detected in drone imagery, but height estimates are needed to decide if the seedling should be counted.

We compared seedling height estimates from Drone-Based Image Point Clouds (DIPCs) to ground measurements.

We used three different drones flown at different altitudes to survey nearly 200 conifer seedlings between 0.15 m and 2 m tall



Height Estimates

- Led to small counting errors (<5%) when the height cut-off for seedlings was 60 cm
- Became more reliable with taller seedlings ERROR = 10% FOR SEEDLINGS > 2 M
- Were not as reliable for seedlings < 30 cm due to errors associated with overlying vegetation

Drones could replace ground-based seedling surveys, reducing costs, increasing survey area, and avoiding trampling over restored terrain.



CASTILLA ET AL. 2020
DOI: 10.3390/F11090924

RESEARCH HIGHLIGHTS

Towards Drone-Based Establishment Surveys

BERA researchers at the Canadian Forest Service and University of Calgary are teaming up to show how drones could potentially replace ground-based seedling establishment surveys, reducing costs, increasing survey area, and avoiding trampling over restored terrain. One important step towards that process involves using drones to measure seedling height. Read the manuscript [here](#).

BERA is currently in its second phase. We also invite you to learn about the key outcomes from [BERA Phase 1](#)

