2020 Project Summaries
Boreal Ecosystem Recovery & Assessment
An NSERC Collaborative Research & Development Program

Soils Team: Seismic Line Disturbances Change Rates of Peatland Carbon Cycling

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Project Summary
Peatlands are wetlands, where low oxygen content in the soil causes slow decay of dead plants and animals leading to carbon (C) being stored for thousands of years. Seismic lines as old as 50 years have shown very few signs of recovery and unfortunately, the impacts of these lines on peatlands are understudied, leading to uncertainty in their impact on peatland C storage function. The main objective of my study is to assess the effect of seismic lines on carbon cycling and greenhouse gas (GHG) exchange in Alberta peatlands. My specific goals are to: (i) quantify the effect of line characteristics (Age, Width, Orientation) on GHG exchange, (ii) identify the impact of lines on peat accumulation rates and (iii) study changes in microbial communities and functional diversity in response to these disturbances. We set up a field program in the Peace River oil sands region for monitoring peatland CO_2 and CH_4 fluxes along 8 seismic lines, with paired plots in the adjacent, undisturbed peatland. Weekly sampling occurred on 2D lines in a forested bog and fen and 3D lines in a forested bog. Available results highlight microbial community functional changes. Lines are significantly warmer and wetter, and these conditions resulted in higher CH_4 emissions at the bog sites.

Management Implications and Lessons Learned
This study provides a better understanding of the effects of seismic lines on soil and carbon dynamics, translating to higher efficiency in designing and monitoring restoration projects. Preliminary results constitute a database of both CO_2 and CH_4 flux measurements for the study area, indicating an increase in CH_4 emissions on lines which is directly correlated to the wetter and warmer conditions present.
Investigation of the microbial functional diversity indicates that microbial use of 10 (out of 15) carbon substrates were significantly impacted by study site or both site and seismic line disturbance. Once data is analyzed for the main drivers, the impact of seismic lines on peatland carbon exchange could be mapped across the landscape for generating GHG emissions data which could be submitted for inclusion in national GHG reporting, as a baseline to compare the effects of restoration.

Publication(s)
Anticipated Fall 2020