Fire Management in Boreal Peatlands: Consequences for Carbon Cycling

PROJECT SUMMARY

The goal of Boreal Water Futures 2 is to work with collaborators to develop a model that couples wetland cold region hydrological process, wildfire behaviour, and carbon exchange. We will assess trade-offs between management decisions and wildfire risk and enhance global peatland restoration and conservation.

RESEARCH TEAM
Project Lead: Marissa Davies m3davies@uwaterloo.ca
Project PIs: Maria Strack mstrack@uwaterloo.ca; Mike Waddington jmw@mcmaster.ca
Collaborators: Kelly Bona (ECCC); Dan Thompson (ECCC); Sophie Wilkinson (UToronto)

Boreal Water Futures: Modelling Hydrological Processes for Wildfire and Carbon Management

Objectives

More boreal peatlands are expected to be vulnerable to carbon loss through peat smouldering with anthropogenic climate change. Therefore, active management may be needed to to prevent carbon loss. This research project aims to:

- Model the impact of different fire management techniques on peatland carbon cycling before and after fire
- Determine what site types benefit the most from fire management treatments from a carbon storage perspective


PELICAN MTN

Approach

The impacts of different fire management treatments and how they alter fire behaviour is being tested using the Canadian Model for Peatlands (CaMP; Bona *et al.*, 2020 Ecol Mod).

- Four fire management techniques are being modelled (clearfell, thin, mulch, compress)
- Three site types are being modelled (default, shallow soils, marginal)
- Parameters such as temperature and water table depth will be altered to reflect site and treatment types

Progress to Date

Creation of disturbance matrices for each fire management treatment and altered fire disturbance matrices as the result of treatments is ongoing.

- Fire management technique disturbance matrices based on experimental set up in Pelican Mountain, AB (Wilkinson *et al.*, 2018 Ca J For Res)
- Altered fire disturbance matrices as the result of fire management techniques are based on the water holding capacity of *Sphagnum* vs. feathermosses and their ground cover in relation to canopy openness (e.g., Deane *et al.*, 2022 Can J For Res).


HAND THINNED


MULCHED

Outcomes and Application

This research aims to provide information on best practices for fire management in boreal peatlands by investigating carbon trade-offs between reducing peat burn depth and removing forest cover. Sensitivity analyses of different parameters will also inform future field campaigns that can collect data to improve model estimates. The project will also improve the representation of ecohydrological changes in response to fire management within CaMP, with the goal of being able to apply this to national-scale greenhouse gas emission budgets.