Charcoal Stimulates Ectomycorrhizal Fungal Association with Pine

M. Mausolf, M.D. MacKenzie, and M. Flannigan

UNIVERSITY OF ALBERTA
EDMONTON·ALBERTA·CANADA

Project Layout

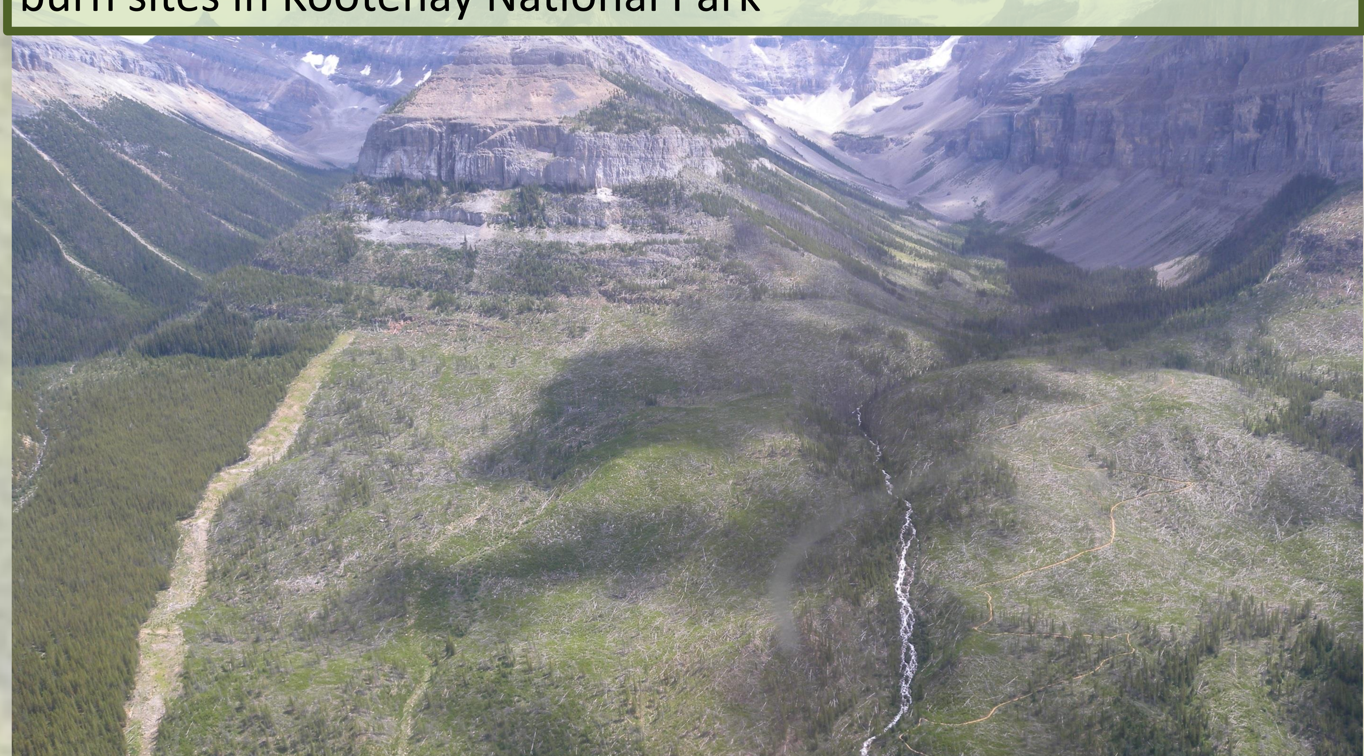
Background

Prescribed fire is being used as a tool to restore fire to Canadian landscapes, but its effects on soil and soil microbiota need continued investigation.

- In northern forests, most tree species form ectomycorrhizal symbioses with an array of soil fungi that transfer soil nutrients from mineral and organic sources to their plant hosts in exchange for C, (Smith and Read, 2008).
- Black Carbon is a range of thermally altered organic material from charcoal to soot to graphite, (Preston and Schmidt, 2006).
- The impact of Black Carbon on ectomycorrhizal communities that mediate C and nutrient cycling in boreal forest soils are largely unknown, (Robertson, 2012).

Kootenay National Park Fire Sites

Soil samples were collected from 2 wildfire and 2 prescribed burn sites in Kootenay National Park



Research Questions

1. Are there measureable differences in soil characteristics and microbial communities after wildfire vs prescribed fire?
2. How does fire affect symbiotic relationships between soil fungi and pine species?

Soil Analysis Methods

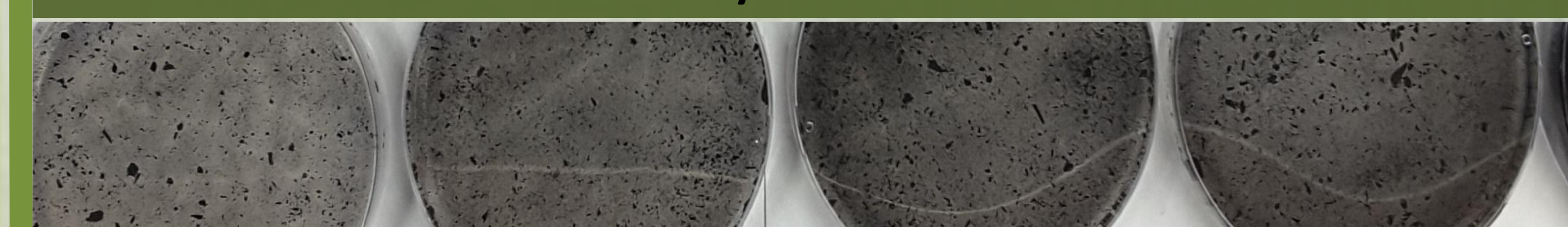
Are there differences in black carbon by fire type?

- Benzene Poly Carboxylic Acids (BPCAs) were quantified as a marker for Black Carbon. The BPCAs quantified from the soil samples were compared to BPCAs recovered from pure charcoal samples, Figure 1.

Do soil communities recover differently by fire type?

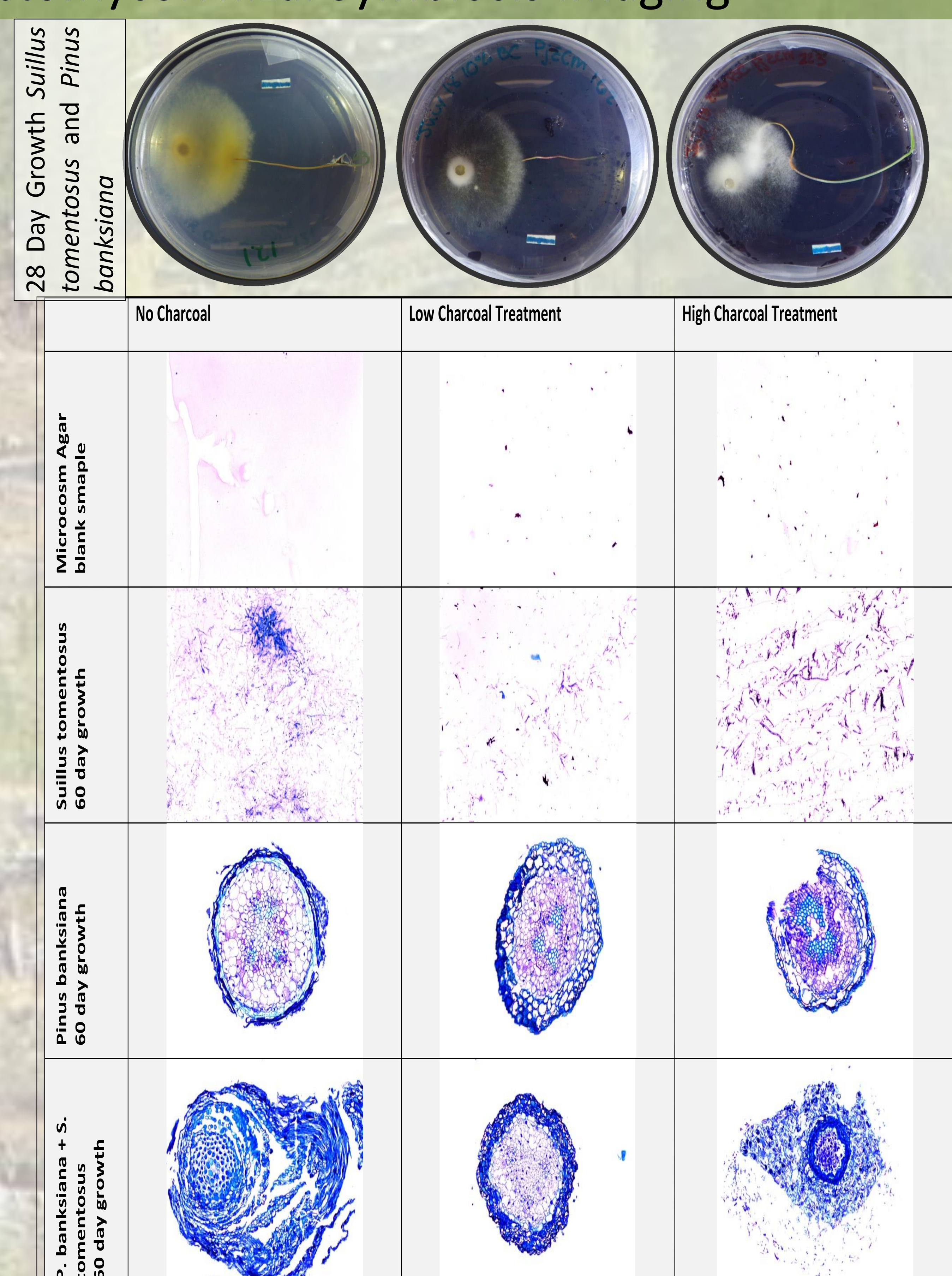
- A microbial community level physiological profile was established using the A horizon fire site soil samples, Figure 2.
  - Rate of carbon dioxide respiration was measured upon A horizon soils incubated with 16 substrate types, including; carbohydrates, amino acids, carboxylic acids, amines and phenolic compounds.

Construction of Ectomycorrhizal Microcosms



- 250 Jack pine seeds were germinated in microcosms with ectomycorrhizal partner, *Suillus tomentosus*.
- Charcoal was included by % weight of growth media in each plate.
- Microcosms were photographed every 7 days .
- Cross sections of root tips were embedded in wax, mounted and stained

Ectomycorrhizal Symbiosis Imaging



Preliminary Results

Black Carbon Quantification by Fire Type

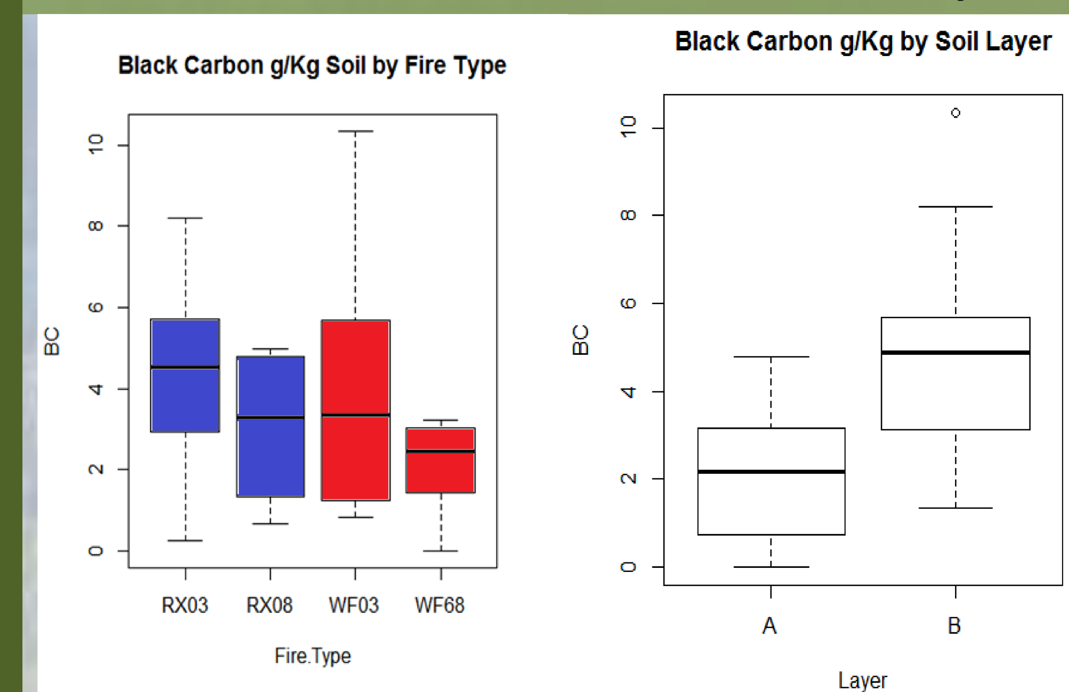
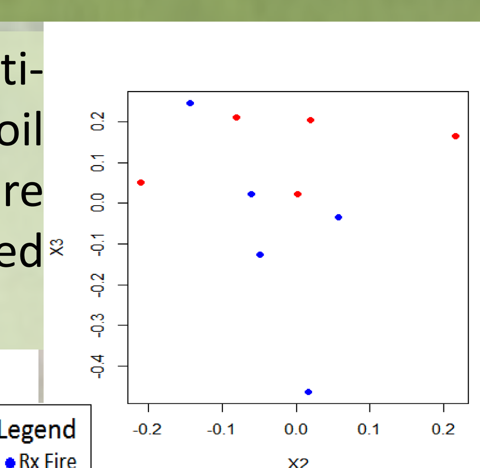
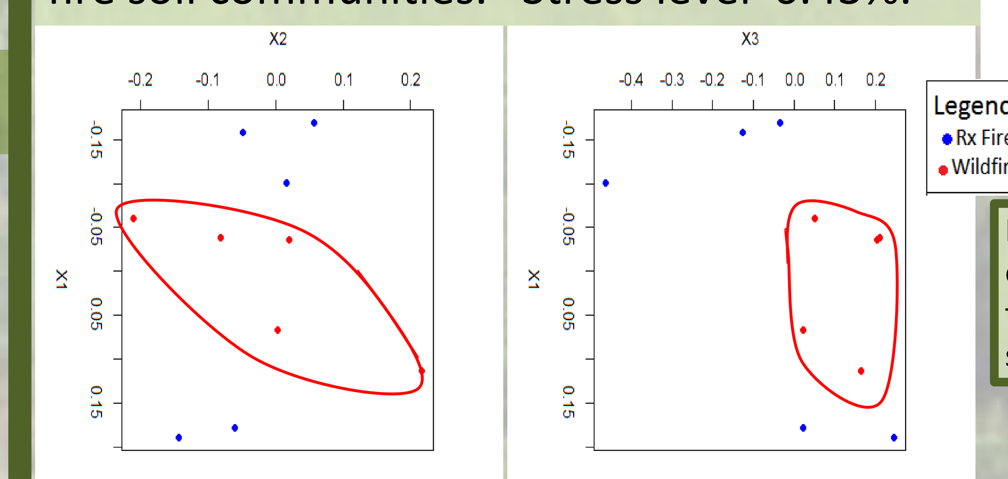


Figure 1. Black Carbon quantification by HPLC suggests that there is more black carbon in the mineral soil B layer compared to the A layer and similar levels of black carbon in soils after wildfire and prescribed fire.

Microbial Community Level Physiological Profiling

Figure 2. Early analysis by non metric multi-dimensional scaling suggests that the soil microbial communities at wildfire sites are more similar to each other than to prescribed fire soil communities. Stress level 6.43%.





In this distance based data exploration technique points that appear closer together share more similarities.

Summary

This fire ecology project investigates how soil communities recover from fire, and compares Black Carbon deposition in soil after wildfire to prescribed fire.

An understanding of below-ground strategies for seedling success is an important tool for reclamation of disturbed sites to resilient ecosystems.

References

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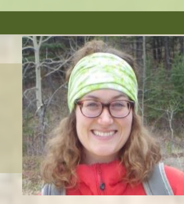
Michelle Mausolf
mausolf@ualberta.ca
@MichelleMausolf
michellemausolf.wordpress.com



Grateful acknowledgement and thanks to Jennifer McGuiness, John Ralph Enterina, Justine Karst, Arlene Oatway, Sebastian Dietrich, Jonathon Cale, @WesternPartners and the PERELab at the University of Alberta

WESTERN PARTNERSHIP FOR WILDLAND FIRE SCIENCE

NSERC CRSNG

Parks Canada Parcs Canada