Title: **Modelling Microbes to Predict Post-fire Carbon Cycling in the Boreal Forest across Burn Severities**

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BER Program: ESS

Project: University Project (Whitman Lab)

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Project Abstract: Boreal forests hold between 370-1720 Pg carbon (C) above- and belowground, making them a major stock of C globally. In North American boreal ecosystems, wildfire is the primary stand-replacing disturbance, and fires are projected to increase in frequency and severity in the future, which could affect soil C cycling and microbial community composition. However, data quantifying these effects are sparse, and our understanding of the mechanisms driving them remains limited. Recent advances in biogeochemical model representations of soil C cycling, such as the Carbon, Organisms, Rhizosphere and Protection in the Soil Environment (CORPSE) model, have included an emphasis on explicitly representing the system in an increasingly mechanistically accurate way. In our project, we aim to determine whether linking belowground microbial community composition, size, and activity to aboveground properties of burn severity and plant community composition (upland jack pine and upland spruce) allows us to better model post-fire soil CO_2 fluxes using the CORPSE model.

Our first project objective is to quantify changes in C fluxes, microbial biomass, and microbial community composition, after simulated fires in intact soil cores across a burn severity gradient. Here, we present our initial findings related to this objective. Using a cone calorimeter, we simulated wildfires in intact soil cores, manipulating soil moisture to achieve lower and higher burn severities. We incubated burned and unburned control soils for up to six months, tracing CO_2 emissions using KOH traps and characterizing soil microbial community composition using high-throughput sequencing. Higher severity burns generally resulted in greater C losses but lower C:N ratios, greater increases in soil pH, and smaller fast-cycling C pools in a simple two-pool exponential decay model than lower severity burns. Higher severity burns were also accompanied by greater shifts in bacterial community composition, including a shift toward taxa with higher predicted weighted mean 16S rRNA gene copy numbers – a parameter associated with the potential for fast growth.

Future objectives will include developing and evaluating adaptations to the CORPSE model to better represent post-fire SOC dynamics along a burn severity gradient across a hierarchy of model complexity and testing the capacity of the adapted CORPSE model to predict CO_2 flux rates in burned cores from new sites.