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

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Project Abstract: Boreal forests hold large amounts of carbon (C) above- and belowground, making them a major reservoir 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, which could affect microbial community composition and soil C cycling. However, data quantifying the effect of wildfire on soil community and C storage are sparse, and our understanding of the mechanisms driving these effects 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 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 allows us to better model post-fire soil carbon dioxide (CO_2) fluxes using the CORPSE model. In burn simulations on soil cores, we found that higher temperature burns led to larger shifts in bacterial community composition, which were accompanied by shifts toward taxa with higher predicted weighted mean 16S rRNA gene copy numbers and proportionally smaller fast-cycling C pools. Using laboratory incubations, we empirically identified fire surviving and fast growing bacterial taxa, as well as taxa with an affinity for the post-fire soil environment and then analyzed the importance of these fire adaptive strategies in field data one and fire years after natural wildfires of varying severities. The relative importance of these three strategies varied with time, burn severity, and soil depth. In the next step of this project, we will use burn simulations in intact soil cores, post-burn incubations, and corresponding measurements of CO_2 emissions, C use efficiency, and microbial biomass paired with microbial community composition to build and test models of post-fire soil CO_2 fluxes. We will compare the abilities of a low-complexity model based on fast and slow C pools, a mid-complexity model that considers C protection mechanisms and microbial biomass, and a high-complexity model, which incorporates microbial fire-adapted strategies, to predict post-fire soil CO_2 fluxes.