Rising From the Ashes: Succession and Metabolism of Post-Fire Fungi

Monika S. Fischer*[1] (monikaf@berkeley.edu), Neem J. Patel[1], Sydney I. Glassman[1,2], Thomas D. Bruns[1], **Matthew F. Traxler**[1]
[1]University of California, Berkeley, [2]University of California, Riverside

Project Goals:

- To define the pattern of post-fire fungal succession across a gradient of fire severities in the Sierra Nevada mountains.
- To elucidate the nutrient niche of post-fire fungi.
- To identify how post-fire fungal communities affect the fate of pyrolyzed carbon stocks and soil organic matter.

Wildfires increasingly pose a threat to ecosystems and communities across the western United States. Given the current trajectory of climate change, wildfires are predicted to dramatically increase in size and severity. We are already witnessing this effect. Each year, wildfires have set new records for the amount of land burned and destruction caused. One critically important aspect of mitigating the long-term impacts of wildfires is understanding and promoting ecosystem recovery after wildfires. Fire transforms soil organic carbon into pyrolyzed carbon, which alters the accessibility of carbon for soil dwelling organisms that depend on soil carbon stocks for survival. Soil bacteria and fungi consume soil carbon and are also are vitally important for the growth and survival of plants. While decades of research has defined the dynamics of post-fire plant succession, we have only recently acquired the tools necessary (i.e. environmental high-throughput sequencing) to begin to define post-fire fungal succession and how this process supports the reestablishment of plants. Serendipitously, in 2013 the Rim Fire burned two long-term sampling plots near Yosemite National Park (YNP). Fungal community sequencing of soil samples in addition to observing the development of fungal fruiting bodies for one year after the fire demonstrated a clear pattern of succession. In an ongoing study at the Blodgett Forest Research Station (~70miles north of YNP), we are working to confirm whether or not the fungal succession pattern observed after the Rim Fire is predictable and reproducible, similar to how post-fire plant succession is generally predictable. Within two months after the Rim Fire, the quick-growing Ascomycete *Pyronema omphalodes* dominated. The Ascomycete *Morchella spp*. dominated roughly four months post-fire, and then the Basidiomycete *Pholiota molesta* dominated roughly ten months post-fire. Representatives of these three species are easily cultured in the lab, and we are using these cultures to directly investigate the metabolism of these fungi. Our preliminary data indicates that the nutrient niche of these fungi is broad, and that these fungi respond uniquely to various chemical aspects of pyrolyzed soil. Ongoing work will determine how the chemistry of post-fire soils changes over time, connecting specific fungi with the transformation of specific compounds in these soils. Together, these data will determine the fate of pyrolyzed carbon, and demonstrate how fire-adapted fungi survive, thrive, and promote the re-establishment of forest ecosystems after wild fires.