Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.23185

Soil microorganisms, geochemistry, and hydrological processes have distinct, soil-specific responses and recoveries to wildfire in Northern California chaparral ecosystems

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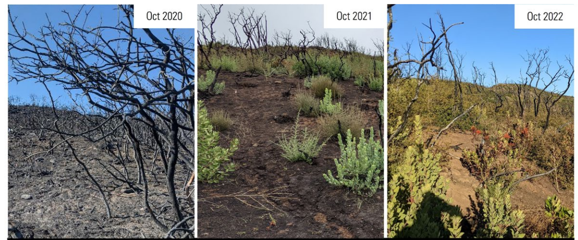
Wildfires are increasing in size and frequency in the Western US. In addition to the effects on aboveground vegetation, wildfires also affect belowground ecosystems, with impacts on soil biota, physical structure, geochemistry, organics, and hydrology. It is difficult to predict when and where these above and belowground responses will have a negative, positive, or neutral impact on human and ecosystem health. We hypothesized that in moderately to severely burned chaparral ecosystems, soil parent material is a master variable that can predict soil recovery. To address this hypothesis, we measured the seasonal response and recovery of vegetation, soil biota, geochemistry, carbon, and hydrology for several seasons at 21 sites across four bedrock lithologies within the 2020 LNU Lightning Complex and the 2021 Dixie Fire. We assessed aboveground vegetation recovery with pre- and post-fire burn indices calculated from satellite imagery, and belowground recovery relative to nearby unburned refugia. We found that soil microbial biomass and carbon cycling were related to seasonal changes in soil moisture and have similar recovery trajectories, although soils derived from variably metamorphosed volcanics, which have high amorphous content, show distinct responses from other soil types. In contrast, the geochemical soil properties impacted by wildfire, like electrical conductivity and extractable Cr, have yet to show recovery or recovery is independent of seasonal variations in soil moisture. We will discuss these results in the context of the lithologic-based changes in soil texture and mineralogy that vary across our sites. By determining whether biogeochemical and hydrologic processes are coupled following wildfire, and whether post-fire responses vary across soil types, we can better predict locations or situations (e.g., low post-fire precipitation) where belowground recovery may be slower than expected.



Response of infiltration, carbon cycling, geochemistry, and vegetation recovery to wildfire are highly temporally and spatially variable and difficult to predict. We will discuss whether soil type is related to recovery.