Title: Physical and Chemical Properties of Fire-Affected Soils from the Sagebrush Ecosystem of the Western U.S.: A Laboratory Study

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This study aims to understand the effects of wildfires in the sagebrush ecosystem on soil properties through examining connections between Soil Water Repellency (SWR), reflectance spectra, and chemistry. Ash and burned soil samples were collected after performing laboratory burns of three common sagebrush plants: sagebrush, rabbitbrush, and bitterbrush. The collected samples were analyzed for their physical properties, including SWR with Water Drop Penetration Time (WDPT) and Apparent Contact Angle (ACA) measurements, and solar spectral reflectance in the wavelength range of 350-2500 nm. Chemical functional groups of the samples were analyzed using Fourier Transform Infrared (FTIR) spectroscopy over the wavenumber range of 4000–400 $cm^{-1}$.

WDPT and ACA values were in the range of 1–600 s and ~10° to 88°, respectively, for all three tested fuels. Unburned soil was more reflective than burned soil samples, also apparent by its brighter color. The FTIR analysis showed a decrease (~2-4 times) in the ratio of $COO^-$/C=C signals for the burned soil samples compared to the unburned soil. Correlations between ACA and temperature for the burned and 2 cm deep burned soil samples showed that an increase in temperature led to the increase in ACA and decrease in visible reflectance (visible range: 350–850 nm) of the same samples. The high linear correlation ($R^2$=0.9) between $COO^-$/C=C and ACA showed that non-polar compounds with C=C functional groups were formed in the burned soil samples, which led to higher values of ACA and hence SWR of the burned soil samples compared to the unburned soil.