HIGH ELEVATION DISTURBANCE EFFECTS ON SOIL STRUCTURAL AND FUNCTIONAL COMPONENTS[1]

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Abstract. Mountainous regions comprise more than 30% of the world's terrestrial biomes and are valued for livestock forage, mineral and timber assets and recreation opportunities. Disturbance has resulted in major ecological changes in high elevation ecosystems, including vegetation loss, soil compaction, reduced soil organic matter (SOM), and altered habitat for soil biota. Restoring high elevation disturbed sites has proven challenging for many years, possibly because of our limited knowledge of disturbance effects on belowground biota, and the ecosystem functions they facilitate. To assess the effects of recreation disturbance on high elevation soils we compared physiochemical and biological properties on disturbed, undisturbed and restored sites in two national forests in Montana and 2 national parks in Washington. Soil physiochemical properties measured included soil moisture, bulk density, SOM, soil nitrogen (N) (total and plant available), phosphorous (P) and potassium (K). Biological processes measured include mycorrhizal infectivity potential (MIP), decomposition, enzyme activity, substrate induced respiration (SIR) and N mineralization. Soil moisture and SOM were significantly lower, while bulk density was higher, on disturbed sites. Total nitrogen (N) was lower on disturbed sites, while NO_3^- and NH_4^+ differed only between geographic locations. MIP was low overall and did not differ between disturbance types. Decomposition rates did not differ between disturbance after 3, 12 or 24 months. Enzyme activity differed between disturbance and location with significantly lower activity on disturbed sites for 1 substrate, while nearly significant lower activities for 4 out of the 8 substrates measured. SIR differed between disturbance and location with lower responses on disturbed sites for 6 of 26 substrates measured. Soil physiochemical and biological characteristics are affected by disturbance and location, however results vary between parameters measured. This suggests ecosystem components, including soil physiochemical and biological properties are decoupled, responding individualistically to disturbance and restoration.

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