GC11J-0064 Rapid Changes In Soil Development Of Previously Glaciated Soils Driven By Roots (Invited)

Monday, 9 December 2024
08:30 - 12:20
Hall B-C (Poster Hall) (Convention Center)

Abstract

Parent material and biota impart a strong influence on chemical and physical characteristics of the soil, and thus how rapidly soil profiles develop. In addition, human modifications to the landscape, such as changing land use from forest to pasture or vice versa, can also alter the trajectory of soil formation by altering root architecture within the soil. These processes – geologic and biological – operate across a diversity of timescales and can be particularly evident in early stages of soil development when rates of soil change can be rapid. To probe the extent of soil development in newly forming soil profiles and some of the possible mechanisms driving it, we studied soil profiles forming on a diversity of lithologies since Holocene glacial retreat in high-elevation alpine tundra of Gran Paradiso National Park, Italy. We sampled six soil profiles forming from diverse parent materials across multiple landscape positions and measured soil chemical, physical, and biological properties. Soil pH, bulk density, and calcium and magnesium concentrations varied as might be predicted with parent material. All soil profiles exhibited strikingly advanced pedogenic development despite their recently deglaciated status. In all soils, we observed coarse (> 2 mm in diameter) roots declining linearly with depth rather than the more commonly observed steeper exponential decline with depth such that below 50 cm, ~20% of the soil in all profiles contained coarse roots. In contrast, below 50 cm, fine roots were present in more than 75% of the soil. These data suggest that roots and the biotic activities they foster promote a meaningful degree of soil development even in recently deglaciated environments with short, cool growing seasons. Our work also indicates that human alteration of aboveground biota and thus of root architectures, either by modifying land use or indirectly through changing climate, has the potential to alter soil developmental trajectories in young soils, with attendant shifts in nutrient release from weathering and soil carbon storage.

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