

Soil and critical zone evolution in the coastal temperate rainforest of Alaska

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The USDA Forest Service Heen Latinee experimental forest (HLEF) in southeast Alaska seeks to define and describe the boundaries and functioning of the North Pacific Perhumid Coastal Temperate Rainforest (PCTR) critical zone. The HLEF provides a context where relatively young landscapes have developed during the Holocene within a hypermaritime climate. Relatively recent ice advances stripped away the upper critical zone and reset primary functions. The present post-LGM “young” critical zone developed under the hypermaritime climate of the Holocene. The intensity of climate driven rock weathering and soil development is very high due to the humid climate that promotes intense soil weathering and rapid accumulation of soil organic carbon. The soils and regolith range from recently emerging rock and sediment at the faces of glaciers to intensively weathered regolith along with meters of organic matter accumulation in peatlands. The contrasting temporal and spatial intensity of landscape change in the PCTR makes it particularly valuable for testing theories of critical zone function. We are investigating the relationship between rock weathering and soil development across elevation and aspect on three lithologic sequences at HLEF including intrusive igneous tonolite, and two adjacent accreted uplifted, marine terranes-the metamorphic Taku Terrane and Gravina Belt formations. Soil profile descriptions and samples were collected on ridgetop topographic positions as well as north- and south-facing aspects to quantify geochemical and mineralogical changes across lithologies at the CZO through X-ray diffraction and X-ray fluorescence. Along one ridgeline in the forest, weathering progresses from a few centimeters of altered weathering rind where bedrock is tonalite, to approximately 20 cm of weakly developed soil on schist bedrock, to Spodosol development in over 1 m of soil developed on sedimentary rock within the Gravina Belt. This presentation will outline the emergence, growth, and potential for a coastal rainforest critical zone observatory.