Catchment-scale analysis of interactions between soils and water at Hubbard Brook, NH

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Soils, groundwater, and surface waters are not separate entities; they are inter-connected at many scales of observation. Hydropedology aims to examine the inter-relationships between soils and water. Soils are formed at the landscape scale as well as the pedon scale, since soluble materials can be transported from one pedon to another according to hydrologic flowpaths. In Watershed Three (WS3) of Hubbard Brook Experimental Forest, New Hampshire, spodic materials are redistributed throughout the catchment, resulting in lateral as well as vertical podzolization. Several soil types, based on morphology, topography, and hydrology, have been identified in the catchment and called hydropedologic units (HPUs). At least 90 pedons (including some from each HPU) will be described and sampled by horizon throughout WS3. Soil samples will be extracted with citrate-dithionite and acid ammonium oxalate in order to quantify pedogenically significant fractions of Al, Fe, Mn, and C. The ratio of Fe_o to Fe_d indicates the degree of crystallinity of Fe oxides, and is expected to vary with redox conditions. The ratio of Mn_d to Fe_d can also be used as an indicator of lateral flowpaths in soils, due to the higher sensitivity of Mn oxides to reductive dissolution. All variables will be compared by HPU using analysis of variance, in order to determine differences in solute source potential for each soil type. Vertical and lateral variations in soil chemistry will be compared to hydrologic conditions. Preliminary results indicate redistribution of Al, Fe, and C generally downslope, with these elements accumulating most in the riparian zone. Soils in and around seep zones show the highest concentrations of Fe and Mn; this is likely due to deep groundwater inputs. This research is part of a larger project examining spatial and temporal variations in groundwater and stream water chemistry at Hubbard Brook.