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Variability of soil surface characteristics in a mountainous watershed in Valle del Cauca, Colombia

Christian Guzman (1,2), Mayesse Da Silva (3), Cesar Botero Vargas (3), Jan Boll (1), and Tammo Steenhuis (2)

(1) Washington State University, Civil and Environmental Engineering, Pullman, United States, (2) Cornell University, Biological and Environmental Engineering, Ithaca, United States, (3) CIAT, International Center for Tropical Agriculture, Cali, Colombia

Understanding stream discharge and sediment or solute transport frequently relies on understanding of soil physical properties and nutrient conditions. This study aims to improve prediction of hydropedological changes due to tropical weather patterns by understanding soil surface and soil nutrient changes. Soil nutrient concentrations and hydraulic properties were measured from the La Vega micro watershed in the southwestern region of the Colombian Andes at 16 distributed locations in four elevation ranges (∼1450 m a.s.l., 1500 m a.s.l., 1600 m a.s.l., 1700 m a.s.l.). The La Vega stream is a part of a recent initiative from a water fund established by Asobolo, Asocaña, and Cenicaña in collaboration with the Natural Capital Project to improve conservation efforts and monitor their effects. Three replicates of soil nutrient observations were analyzed for total nitrogen, Bray II- available phosphorus, exchangeable cations, pH, organic matter, and texture. Three replicates of soil hydraulic conductivities at two depths (0 to 5 cm and 5 to 10 cm) were determined within this small basin which was undergoing different types of conservation measures (exclosures and natural regrowth). On-site soil depth changes and groundwater depth measurements were also monitored to provide more information about changes within this mountainous watershed during one part of the yearly rainy season in 2015. Soils had varied compositions throughout but had consistent properties within elevation ranges. In the upper elevation range, regrowth of natural vegetation was found on deep soils (∼3 m) with moderate infiltration (26 cm/hr), the lowest bulk density (0.92 g/cm3), and the highest TN (0.4%). Soil in the lowest elevation range, in mixed land use of grazing and riparian forests with deep profiles, had the lowest infiltration (4 cm/hr), highest bulk density (1.02 g/cm3), and the lowest TN (0.26%). In the middle elevation ranges, conserved tropical forest vegetation were located on soils of shallow depths with high organic matter and high infiltration (86 cm/hr). When compared with regional precipitation (∼1000 mm/yr) the low infiltration rate is exceeded about 50% of the time, while the average and median infiltration rates are not exceeded, indicating that infiltration excess and saturation excess runoff mechanisms are both present. This information when coupled with the outlet sediment concentration and solute concentration patterns can help discern correlations between scales and will help to monitor effectiveness of conservation programs aimed at sustaining ecosystem services.