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Effect of land cover and hydro-meteorological controls on soil water DOC concentrations in a high-elevation tropical environment

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Abstract

Páramo soils store high amounts of organic carbon. However, the effects of climate change and changes in land cover and use (LC/LU) in this high-elevation tropical ecosystem may cause a decrease in their carbon storage capacity. Therefore, better understanding of the factors influencing the Páramo soils' carbon storage and export is urgently needed. To fill this knowledge gap, we investigated the differences in dissolved organic carbon (DOC) content in the soil water of four LC/LU types (tussock grass, natural forest, pine plantations, and pasture) and the factors controlling its variability in the Quinuas Ecohydrological Observatory in south Ecuador. Weekly measurements of soil water DOC concentrations, meteorological variables, soil water content, and temperature from various depths and slope positions were monitored within the soils' organic and mineral horizons between October 2014 and January 2017. These data were used to generate regression trees and random forest statistical models to identify the factors controlling soil water DOC concentrations. From high to low concentrations, natural forest depict the highest DOC concentrations followed by pasture, tussock grass, and pine forest. For all LC/LU types, DOC concentrations increase with decreasing soil moisture. Our results also show that LC/LU is the most important predictor of soil water DOC concentrations, followed by sampling depth and soil moisture. Interestingly, atmospheric variables and antecedent evapotranspiration and precipitation conditions show only little influence on DOC concentrations during the monitoring period. Our findings provide unique information that can help improve the management of soil and water resources in the Páramo and other peat dominated ecosystems elsewhere.

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