

EGU2020-6284

<https://doi.org/10.5194/egusphere-egu2020-6284>

EGU General Assembly 2020

© Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.



## Impact of vegetation species on soil pore system and soil hydraulic properties in the high Andes

**Sebastián Páez-Bimos**<sup>1,2</sup>, Veerle Vanacker<sup>1</sup>, Marcos Villacís<sup>2</sup>, Oscar Morales<sup>3</sup>, Marlon Calispa<sup>3,4</sup>, Silvia Salgado<sup>5</sup>, Pierre Delmelle<sup>4</sup>, and Armando Molina<sup>3,6</sup>

<sup>1</sup>Earth and Life Institute, Georges Lemaître Centre for Earth and Climate Research, Université catholique de Louvain, Louvain-la-Neuve, Belgium ([carlos.paezbimos@uclouvain.be](mailto:carlos.paezbimos@uclouvain.be))

<sup>2</sup>Departamento de Ingeniería Civil y Ambiental, Facultad de Ingeniería Civil y Ambiental, Escuela Politécnica Nacional, Quito, Ecuador

<sup>3</sup>Programa para el Manejo de Agua y Suelo (PROMAS), Facultad de Ingeniería Civil, Universidad de Cuenca, Cuenca, Ecuador

<sup>4</sup>Université catholique de Louvain, Earth and Life Institute, ELIe, Louvain-la-Neuve, Belgium

<sup>5</sup>FONAG Fondo para la Protección del Agua, Quito, Ecuador

<sup>6</sup>Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium

Soils play a key role in the provision of vital ecosystem services. Soil functions, that deliver these services, are governed by soil properties. Soil structure is a fundamental property of soils since it controls water, geochemical and biological processes. The soil pore system, one of the main components of soil structure, can be affected by different biological feedbacks. Vegetation can have an impact on soil pore system through changes in pore size distribution and porosity, causing differences in soil hydraulic properties as well as soil-water processes.

In high elevation tropical Andean ecosystems (páramos) little is still known about vegetation feedbacks on soil properties. At high elevation páramos (above 4100m), it is possible to find high diversity and co-dominance of plant species over short distances. In these landscapes, cushion plants and tussock grasses dominate alongside shrubs. These vegetation types, adapted to extreme local climatic conditions, are placed on young volcanic soils. We take advantage of this diverse setting, located within Antisana's water conservation area in the north of Ecuador, by studying soil hydraulic properties and soil pore system in eight soil profiles. We hypothesize that the effect caused by *Calamagrostis intermedia* (tussock) and *Azorella pedunculata* (cushion) species on soil pore system and soil hydraulic properties at different horizons will be statistically different. In addition, we explore these effects in relation to other soil's physical properties and root traits.

Soil hydraulic properties were determined on the basis of field observed saturated hydraulic conductivity as well as based on water retention contents at saturation (porosity), field capacity and permanent wilting point measured in the laboratory by the multi-step outflow method and the porous membrane pressure cell. Furthermore, water retention curves were fitted to measured data by the bimodal van Genuchten model. Based on these fittings the pore size distribution was determined. Equivalent pore diameters were derived from the soil water tension head via the

capillary rise equation. Statistical analysis to determine differences was carried out by means of the Mann-Whitney U test.

The results show that measurable differences in soil hydraulic properties and soil pore system between vegetation species are present at the upper soil horizons, while they become negligible at greater depth. These differences are mainly related to bulk density and root traits. Based on this baseline study, further research could elucidate the effects of vegetation species on soil-water processes at high elevation páramo landscapes and will contribute to enhancing water resources management.