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Soil erosion controlled by biota along a climate gradient in Chile

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Soil erosion is one of the main problems in soil degradation nowadays and is widely distributed in many landscapes worldwide. Particularly water erosion is widespread and determined by rain erosivity, soil erodibility, topographic factors and the management carried out to mitigate this phenomenon. Although this process is mostly known as a consequence of human management such as agriculture or forestry, it is a process that also occurs naturally, being one of the factors that regulate the shape of the landscape.

One of the main agents that stabilize the soil surface is biota and its activity, either in the form of plants, microorganisms or as an assemblage in the form of a biological soil crust (biocrusts). However, there are limited studies about how and what extent biota drives soil-stabilizing processes. With particular view on the impact of biocrusts on soil erosion, most studies have been carried out in arid and semi-arid regions, so its influence under other climates is largely unknown.

This study focuses on the influence of biota on soil erosion in a temperature and rainfall gradient, covering four climate zones (arid, semi-arid, mediterranean and humid) with very limited human intervention. Other variables such as the origin of the geological formation, geographical longitude and glacial influence were kept constant for all study sites. The effect of vegetation (biocrusts) and its abundance, microbiology and terrain parameters are investigated using rainfall simulation experiments under controlled conditions and by a physico-chemical evaluation of the soil, surface runoff, percolation and sediment discharge, in order to determine the different environmental filtering effects that the soil develops under different climatic conditions.

It is expected that as vegetation vigor and cover increase, soil erodibility will decrease. The biocrust is the protagonist of this stabilization in conditions of low pedological development and will become secondary as edaphoclimatic conditions favor the colonization of plants.

The results of this study will help to achieve a better understanding of the role of biota in soil erosion control and will clarify its influence on soil losses under different climate and slope conditions. Analyses are currently ongoing and first results of our work will be presented at the EGU 2020.