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Vulnerability of soils to degradation by wildfires in Torres del Paine National Park (Patagonia, Chile)

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Wildfires are a common phenomenon across the world, but some ecosystems are more adapted to this perturbation than others. In this work we show some results of a study conducted in the Torres del Paine National Park (Chile) that suffered a big forest fire in 2011 affecting 17,666 ha. Based on vegetation coverage, five areas of the park were sampled in 2019 following the transects where a vegetation recovery study has been monitored in order to know the status of the ecosystem and how fire and post-fire conditions affected.

The study area is in a temperate cold rainy climate zone without dry season. The park is located in the transitional forest-steppe zone whose annual rainfall varies between 1500 mm and 300 mm. Plant communities goes from Patagonian steppe, pre-Andean scrub to Magallanic forest. The soils of the region vary from Cryorthents and Udorthents to Haplocryolls (Soil Survey Staff, 2014), most of them with scarce development.

A total of 69 composite soil samples were taken, and the following parameters were analysed: texture, soil water repellency (WR), organic matter (OM), and aggregation, including total content of macroaggregates (TCA; % of sample that are forming macroaggregates) and their stability (AS; % of macroaggregates that resist the energy of a rainfall simulation of known energy).

The results showed high values of OM, with an average of 10.5%. Three of the five areas showed statistically lower values of OM in burned samples. WR (from slight to severe) was present in the 75% of the samples, and without differences between burned and unburned samples. The correlations analyses indicated that WR is more related with the OM quality than with quantity, since better correlations were obtained when only samples from same area -thus similar vegetation- were included in the analyses, and no correlation when all samples from different sites are pooled together. The results of aggregation indicated that these soils have a poor structural development. The TCA varies from 16 to 50%, and the AS is not very high (average of 66 %), being

the higher in the area with lower TCA, and more affected by the fire and erosion processes. This suggests that the higher values of AS are consequence of the destruction and loss of the less resistant fraction after the fire.

WR is a natural property in these soils. The combination of the high sand content (low specific surface area) and high OM make them very susceptible to develop WR. Since these soils have a scarce development with a poor structure, the combination of these factors make them very vulnerable to erosion processes after the fire. This could be verified in three of the five study areas and specially the one with plant community in transition between steppe to scrub, which was the one more affected by the perturbation caused by the fire and post-fire erosion processes. Measures to protect the soils or accelerate the recovery are recommended in these areas when new human caused wildfires will occur.