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Linking soil C pools and N in radiotraced soils of Grey lake area (Torres del Paine, Chilean Patagonia)

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The Grey Glacier, located in the Torres del Paine region, belongs to the Patagonian ice sheet that suffered several glacial fluctuations during the Quaternary resulting in spectacular glacial landscapes. Similar as in other world mountains, glaciers in the Andean Patagonia are declining and the Grey Glacier has experienced during the last 80 years a clear retreat. Important ice mass collapses occurred in 1996 and recently in 2017 and 2019. In the proglacial environment of Grey Lake, the most characteristic glacial landforms are the Last Glacial Maximum moraine belts while landforms of the Little Ice Age reveal the advance of ice in modern times in the lake surroundings. At present the most active formations are composed of glacial deposits exposed after the recent retreat of Grey glacier. In this rapidly changing environment new soils are developing becoming a relevant framework to assess the trends in the pedogenesis dynamic and the variations of nutrient pools.

During a 15 days field campaign in the frame of the IAEA INT5153 project main proglacial landforms were identified and soil sampling was undertaken to assess if there were differences in the soil status and the nutrients pools in function of the geomorphic characteristics. Previous research in the area (Navas et al., 2019) revealed the usefulness of combining ^{137}Cs with soil organic carbon (SOC) for deriving information on soils generated on recently exposed glacial deposits linked to soil redistribution patterns. Our study aims to evaluate what is the status of the SOC pool in soils formed in the Grey Lake area in relation to ^{137}Cs proxies of soil stability. Analyses of ^{137}Cs (Bqkg^{-1}), and of contents of SOC and its fractions, and nitrogen (N) were done for characterizing the soils of the study landforms. We found that the most recent glacial deposits that are highly unstable in this paraglacial environment had the lowest contents of SOC and N along with negligible activities of ^{137}Cs. In parallel with the highest ^{137}Cs activity found in more developed soils on forest slopes, high SOC and N contents though less than in swamps indicated higher soil stability in forest slopes than in recently exposed glacial deposits. In the C pool, the stable fraction was most abundant in soils on forest slopes and on vegetated moraines in accordance with more abundant vegetation cover on relatively more developed soils. Though all landforms had much higher proportion of the active fraction, specially swamps, the contribution of the active fraction to SOC was also much higher in swamps, followed by forest and vegetated moraines. However, in

comparison with the rest of glacial deposits and forest slopes, swamps presented the lowest contribution of the stable fraction to SOC evidencing their fragility to degradation processes that would rapidly eliminate the more labile fraction disrupting the natural cycle of C towards more stable fractions. Our results show that combination of ^{137}Cs derived information with data from nutrients pools can be an important aid for interpreting changes in paraglacial landscapes where soils are forming on recently exposed glacial deposits.