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Patterns of soil organic Carbon, Nitrogen and 137Cs in the high wetlands at the foot of the Huayna-Potosí Glacier (La Paz, Bolivia)

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Rapid changes of glacierized areas of the Andes in Bolivia are affecting high altitude wetlands threatening their sustainability with further socioeconomic consequences for the population in the area. At the food of Huayna-Potosí (16 ° S, 68 ° W, 6088 m a.s.l.) in the Cordillera Real there are eight permanent wetlands (bofedales) that are affected by the rapid retreat of the Huayna-Potosí Glacier. Their characteristic perennial vegetation fulfills the function of forage provision to the camelid cattle typical of the region. Groundwater, rain, melting glaciers and snow are sources of water for these bofedales that play an important role in the storage and provision of water to the Tuni reservoir that supplies water to La Paz.

During a two weeks expedition in the frame of IAEA INT5153 project in May 2017, a field survey of the Huayna-Potosí Glacier area was undertaken following the glacier retreat where rocks highly reactive are recently exposed. Potential modifications on water quality and supply of sediments may alter the chemical equilibrium and produce changes in the wetlands. With the aim of gain knowledge to promote the preservation of bofedales, representative soils were sampled across the moraine complex in the direction of glacier retreat for characterizing the nutrients, soil organic carbon and nitrogen (SOC and SON), along with 137Cs as indicative of soil status in the area. Soils were acidic and nutrient contents was highly variable; the SOC ranged between 0.07 to 25.25 % and SON between 0.04 to 1.22 % and EC values were low. The fallout 137Cs activities varied between bdl and 5.4 Bq kg-1.

Four sites at an altitude between 4884 and 4746 m a.s.l. were classified as high Andean wetlands. The water regime is hydromorphic due to the continuous presence of water and soil characteristics are also clearly distinctive. The peat soils with silty loam textures had significantly different mean values of the study properties compared to the other soils. The pH values were higher ranging between 5.72 and 6.25 and salinity was up to 10 times that found in colluvium soil. The highest values of SOC and SON in peat soils also accompanied the highest 137Cs activities of the study soils reflecting the large capacity of peat soils to fix the radionuclide along with improved stability conditions due to higher soil aggregation by organic matter. The distribution of soil nutrients along with that of 137Cs helps interpreting the key role of wetlands and its buffer effect on highly reactive recently exposed areas due to shrinking glaciers. Further research on the dynamics of nutrients in relation to new inputs of sediments and changes in soil redistribution following glacier retreat is needed for preserving high altitude wetlands that are vital for maintaining ecosystem services. Such information will be of value for assessing the evolution of the vegetation cover in parallel with glacier retreat in these fragile environments.