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Are stable isotopes of carbon, nitrogen and sulphur a suitable tool to detect soil degradation in a mountain environment?

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Degradation of soils on upland sites can influence biogeochemistry of wetland soils in catchments by sedimentation of nutrients and minerals. In this study we test the suitability of stable isotopes of carbon, nitrogen and sulphur to detect soil degradation in a gradient between an erosion source on an upland site and an erosion sink in a wetland. One hypothesis was that stable isotope signals of carbon, nitrogen and sulphur of upland and wetland soils differ significantly in consequence of varying metabolisms. Different fractionation processes during assimilatory metabolisms predominantly occurring in upland soils and dissimilatory metabolism in wetlands result in a variation of stable isotope signals. Thus the influence of upland material in a wetland should be detectable.

Samples were collected at four sites in the Urseren Valley (Canton Uri, Switzerland). The different sites are very similar in e.g. exposition, altitude, landuse but differ in intensity of the visible soil degradation. Additionally a reference site at "Seebodenalp" (near Küssnacht a. Rigi, Canton Schwyz, Switzerland) was investigated.

This talk will mainly focus on nitrogen, where particularly interesting results were achieved. Stable nitrogen isotope signatures of upland and wetland sites differ significantly. The lighter signal of wetlands is principally caused by less decomposed organic matter. An influence of soil degradation from the upland site/erosion source in the wetland/sink area is detectable in the δ^{15}N signal of the wetland. Stable isotope signature of the top horizons in the wetland is shifted towards heavier values in comparison to an undisturbed site, representing a mixed signal of upland and wetland soil δ^{15}N. Sites which are treated with farmyard manure show heavier δ^{15}N values than

untreated reference sites. Analysed manure from the respective sites give evidence that application of manure may contribute to the relatively heavy nitrogen signals.