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# Rewetting effects on soil $CO_2$ flux and nutrients leaching in alpine Kobresia pasture on the Tibetan Plateau

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Kobresia pygmaea pastures of the Tibetan Plateau are one of the most important ecosystems around the world due to its large grazing area and very high soil organic carbon storage. Since the last decades grasslands of the TP are highly affected by grassland degradation because of various sedimentary programs and strongly increase grazing pressure. Climate changes (e.g. increased precipitation and temperature) may accelerate this degradation processes by enhancing soil organic matter mineralization and nutrients leaching. We exposed repeated rewetting cycles to test the effects of increased precipitation frequency on $CO_2$ fluxes and leaching on varying K. pygmaea root mats (including: intact root mats (KL); recently died root mats (KD); crust covered root mats (LI)). Two phases were conducted (a) to identify the response of nighttime $CO_2$ flux to changing soil moisture and (b) to investigate the impacts of rewetting cycles on day-, night-, and full day $CO_2$ fluxes together with leaching of carbon (C) and nitrogen (N).
Nighttime $CO_2$ fluxes correlated positively with soil moisture, indicating that increasing precipitation will accelerate SOC losses due to increasing mineralization rates. KD showed highest C losses as $CO_2$ efflux and also the highest leaching compared to KL and LI. It indicates that dying of Kobresia root mats (as induced by overgrazing and continuously removal of photosynthetically active shoot biomass) will rapidly decrease SOC storage. The lowest C losses (from soil respiration and DOC leaching) were obtained in the crust covered root mats (LI), because most C losses have already occurred during the early period.
Highest N losses (especially $NO_3$-) were obtained in the highly degraded pasture (LI). Due to long-term SOM decomposition of crust covered root mats (LI) in situ, inorganic nitrogen ($NO_3$-) was accumulated in and was leached out during the first rewetting cycles. In contrast, no losses of NH4+ and $NO_3$- occurred for intact Kobresia root mats (KL), because the plants took up mineral nitrogen. These results were consistent to very low C/N ratios of leachates in crust-covered root mats. The low C/N ratio in LI was mainly connected by nitrogen accumulation before leaching, whereas the slightly lower C/N ratio in KD was mainly affected by carbon losses (DOC) due to increased SOM decomposition.
This study indicates that in combination overgrazing and precipitation change might strongly reduce SOC storage. Furthermore, the high nutrient losses after initial degradation of these N and P limited grasslands might have dramatic consequences for this ecosystem. Therefore, saving and restoration of natural vegetation cover by decreasing grazing intensities is the only strategy to maintain soil fertility and protect Kobresia ecosystems against degradation.