Submitted Abstract

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Abstract

Mountain areas provide important habitats for many plant and animal species, but they also contribute with important ecosystem functions and services such as carbon storage or areas for livestock grazing. At the same time, mountain ecosystems are particularly vulnerable to climate change.

Climate warming, nitrogen deposition and grazing are important global change drivers with impacts on carbon cycling. Warmer temperatures might both increase soil decomposition and plant productivity. The impact on carbon storage will then depend on which of those is the strongest. Nitrogen deposition might mostly impact plant productivity, eventually increasing carbon storage, but with a negative impact on biodiversity. Grazing reduces biomass, but also increases the nutrient input in ecosystems which also increases plant productivity. The intensity of grazing is however important for how grazing affects carbon storage, a too strong grazing pressure affecting negatively plant productivity.

Climate change, nitrogen deposition and grazing pressure operate simultanously in nature. In order to understand their impacts on carbon fluxes, we need to investigate their relative effects and interactions together.

We designed a field experiment in south west Norway to investigate those complex interactions. In a full-factorial design, alpine plant communities were exposed to (i) a warmer climate by transplanting turfs to a lower elevation (~400m, corresponding to a 3°C temperature increase), different (ii) grazing pressures (grazing exclusion, one clipping per year, two clippings per year, and natural grazing), and (iii) nitrogen deposition concentrations (0, 0.5, 1, 5, 10, 50, 100, 150 kg N/ha/yr). Carbon fluxes were measured four times during the growing season using a closed loop chamber system. Both gross ecosystem production and ecosystem respiration were measured, and, in some of the plots, soil respiration was also measured.
Data on decomposition rate, vegetation analysis and biomass are also being collected.

We hypothesized that medium grazing level could mitigate the loss of carbon storage by stimulating plant productivity without damaging the ecosystem, while also mitigating the effects of nitrogen deposition on biodiversity.

Our preliminary results show that gross ecosystem production was not affected by warming, while ecosystem respiration increased. At the current point of the study, no strong effect on carbon fluxes from grazing and nitrogen deposition were detected, suggesting that warming is the main driver. However, taking into account soil respiration and decomposition rate data might provide more insights on that matter.