Carbon Balance Tradeoffs for Mountain Grasslands: Influence of Cutting Frequency and Growing Season Length on the Net Ecosystem CO_2 Exchange

G. Wohlfahrt, A. Hammerle, A. Haslwanter, M. Bahn, U. Tappeiner, A. Cernusca
Universität Innsbruck, Institut für Ökologie, Austria

Cutting, besides grazing, is the main agricultural management practise of mountain grasslands in the Alps and causes these ecosystems to temporarily become net sources of carbon dioxide (CO_2) to the atmosphere, requiring days to weeks before net uptake (measured on a daily basis) is resumed. Cutting frequency decreases with increasing elevation due to the shortening of the growing season, which led us to hypothesise that less frequently cut mountain grasslands at higher elevations would experience smaller management-induced CO_2 losses as compared to more frequently cut low-elevation meadows. This, we further hypothesised might offset to some degree smaller carbon gains due to the shorter growing season length at higher elevations. In order to test this hypothesis, net ecosystem CO_2 exchange (NEE) data measured at two meadows differing in elevation in the Stubai Valley (Austria) were analysed. Despite a 800 m altitudinal distance and associated differences in climate and management, the two investigated meadows exhibited hardly any difference both in the magnitude of and the controls on their NEE. The higher elevation site gained less CO_2 during the shorter vegetation period than the lower elevation site. At the same time, the higher elevation site lost only 55 % of the gained CO_2 following the cut, as opposed to 80 % lost by the more frequently cut lower elevation site. These net carbon gains were approximately balanced by winter/spring CO_2 losses of equal magnitude, rendering the annual NEE of both sites indistinguishable and confirming the hypothesised opposing influence of growing season length and cutting frequency.