KIPF Pascal (2022): Ecosystem functioning along elevation gradients : a focus on organic matter decomposition

Abstract

Terrestrial gross primary production (GPP) and soil respiration are the two largest carbon fluxes in the global carbon cycle. Soils being the largest terrestrial carbon stock, understanding the pedological processes and their connection to other ecosystem functions is of major importance in the context of ongoing climate change. Especially possible implications for the relationship between carbon sources and sinks are highly relevant, as therein lies the potential of self-enhancing feedback loops. To better understand the functioning of ecosystems and their processes involved in the carbon cycle, we conducted a field experiment along North- and South-exposed elevation gradients in two regions of the Swiss Alps. The aim of our work was to investigate ***(1)*** the effect of climate on organic matter (OM) decomposition rate, and ***(2)*** how soil microbes and soil fauna activities are related to different climatic conditions and how they influence OM decomposition. We described the vegetation, soil type and properties and the humus form on a total of 24 plots, and we assessed different aspects of ecosystem functioning, including soil fauna activity, microbial activity, total soil respiration rate, and decomposition of organic material. We found decreasing microbial activity, soil fauna activity, and decomposition rates, but increasing total soil respiration along increasing elevation. Our results point towards increasing importance of roots from subalpine to alpine elevation for total CO2 flux from soil to atmosphere. Further, we identified litter quality as the major driver of organic matter decomposition rate, with likely interactions between litter quality and environmental factors. Our study provides a foundation for further work and more detailed analyses on ecosystem functioning in the Swiss Alps with regard to the carbon cycle in the context of climate change.

Keywords: ecosystem functioning, climate change, organic matter, decomposition, carbon cycle