Erosion-induced changes in soil biogeochemical and microbiological properties in Swiss Alpine grasslands

ID 2349466
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Year 2014
Title Erosion-induced changes in soil biogeochemical and microbiological properties in Swiss Alpine grasslands
Journal Soil biology & biochemistry
Volume 69
Number
Pages / **Article-Number** 382-392
Keywords Alpine grassland, Bacterial abundance, Soil carbon sequestration, Dissolved organic carbon, Fluorescence EEMs, Soil enzymes, Soil erosion, Wetland soil

Soil erosion can alter the storage of carbon (C) and other biogeochemical properties in both eroding and depositional soils. Little is yet known about soil microbial responses to erosion-induced changes in the quantity and quality of organic matter in mountain grasslands. To examine biogeochemical and microbiological responses to soil erosion, we compared the concentrations and stable isotope ratios of C and N, and microbial properties in eroding upslope (oxic), and depositional downslope (oxic) and wetland soils among three grasslands in the Swiss Alps. Compared to the reference site (Moos), the eroding upslope soils (Laui and Bielen) tended to have lower N concentrations and δ^{15}N. The depositional wetland soils had higher δ^{13}C and lower δ^{15}N and C and N concentrations compared to the reference wetland, reflecting the influence of dry, oxic soils from eroding slopes. The depositional wetland soils had lower water-extractable organic C (WEOC) concentrations and optical intensities (UV absorbance and humic- and protein-like fluorescence) compared to the reference wetland. The activity of soil enzymes was positively related to most of the measured parameters indicative of organic matter quantity (e.g., %C and %N) and quality (e.g., WEOC and protein-like fluorescence), exhibiting significantly lower values in the sheet erosion-affected wetland (Bielen) than at the other sites. 16S rRNA gene copy numbers in the wetland were smaller than in the upland soil at all sites and greatest at Laui among three sites, indicating a potential alteration of the microbial community by the deposited oxic soils and attached microbial cells. The results suggest that soils deposited from the eroding slopes can slow down organic matter decomposition in the depositional wetland soils through decreases in the availability of labile organic matter and enzyme activity. Further research is required to elucidate erosion-induced changes in the activity and abundance of wetland microbial communities.

Publisher Pergamon Press
ISSN/ISBN 0038-0717
URL http://www.sciencedirect.com/science/article/pii/S0038071713004288
edoc-URL http://edoc.unibas.ch/dok/A6212408
Full Text on edoc No;
Digital Object Identifier DOI 10.1016/j.soilbio.2013.11.021
ISI-Number WOS:000332261600043
Document type (ISI) Article