Submitted Abstract

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Abstract

Despite that alpine and pre-alpine grassland soils are hotspots for the soil organic carbon (SOC) sequestration, the information about the changes in SOC stocks and the aggregate distribution is limited. In our study, we selected grassland soils along an elevation gradient in the Northern Limestone Alps of Bavaria (Germany): Esterberg (1,260 m a. s. l.), Graswang at (860 m a. s. l.), and Fendt (600 m a s.l.). In 2016, the study sites were initially sampled before plant-soil mesocosms were translocated downslope along the elevation gradient to simulate climate change (temperature increase of +1 K from high- to mid- elevation, +2 K from mid- to low elevation, and +3 K from high- to low-elevation). In addition, two management practices (extensive vs. intensive) were implemented. After 4 years, in 2020, we took soil samples from each translocated soil-plant mesocosm to study the changes of SOC stocks and the SOC distribution according to different aggregate size classes. We observed a significant decrease of SOC and N contents after four years, but no significant effect on stocks due to inconsistent changes in bulk density. The analysis of soil aggregation showed a decrease in the OC associated with macroaggregates in both extensive and intensive management, while OC in microaggregates and the silt/clay-sized fraction increased. Our results showed evidence that climate change will lead to significant losses of C in these SOC-rich soils, which not only contributes to climate change but also probably deteriorates the functionality of these grassland soils.