EGU23-1207, updated on 24 Feb 2024
https://doi.org/10.5194/egusphere-egu23-1207
EGU General Assembly 2023

Heterogeneity of soil organic carbon dynamic regulated by microtopography in boreal peatlands

Ming Wang
Northeast Normal University, Institute for Peat and Mire Research, Key Laboratory of Geographical Processes and Ecological Security in Changbai Mountains, Ministry of Education, China (wangm100@nenu.edu.cn)

Hummock-hollow microtopography is common in the northern peatlands of the world, but its effects on soil organic carbon (SOC) components are still poorly understood. In this study, we investigated effects of microtopography on SOC stocks and soil labile organic carbon (LOC) fractions in a sedge peatland in Changbai Mountain in northeast China. We found that SOC and soil LOC fractions had much heterogeneity in microtopography. SOC concentration in hummocks was significantly higher than under hummocks and in hollows. On average, the total SOC stock to a depth of 0.3 m below the ground surface was 19.00 kg C/m^2. 56% of the total SOC stock was stored in soils in and under hummocks, despite the hummock only covering 30% of the total area. Light fraction organic carbon (LFOC), easily oxidizable organic carbon (EOC), microbial biomass carbon (MBC) and dissolved organic carbon (DOC) in hummocks were significantly higher than under hummocks and in hollows. In addition, the cumulative soil CO_2 emissions in hummocks were 2.0 and 4.5 times higher than those under hummocks and in hollows. The temperature sensitivity of soil CO_2 fluxes (Q_{10}) were 1.55, 1.67, and 1.52 in hummock, under hummock and in hollow, respectively. Redundancy analysis (RDA) identified that SOC explained most variations in soil LOC fractions (59.6%), followed by soil total phosphorus (7.4%) and soil water content (6.6%). Our findings indicate that the hummocks are important carbon pool in the sedge peatland, but they are vulnerable to global warming and human disturbance. Hummock-hollow microtopography creates heterogeneity in hydrological conditions and soil physicochemical properties, and thus influences SOC stocks and soil LOC fractions at a small scale. This study highlights the importance of microtopography in carbon storage and cycling and has direct implications for the assessment of the carbon sequestration function in northern peatlands.