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Effect of water table restoration on microbial communities and enzyme activities in drained peatland

Yuting Wang[1], Klaus-Holger Knorr[2], Guangyuan Xu[1], Dejing Sun[1], Zhiwei Xu[1], and Shengzhong Wang[1]

[1]Key Laboratory of Geographical Processes and Ecological Security of Changbai Mountains, Ministry of Education; School of Geographical Sciences, Northeast Normal University, Changchun 130024, China

[2]ILÖK, Ecohydrology and Biogeochemistry Group, University of Münster, Münster, 48149, Germany

Hydrological conditions are the most important environmental controlling factors in the restoration of drained peatlands. And soil microorganisms are sensitive to environmental changes. In this study, soil samples were collected from 0 - 50 cm in the natural area, drained area, and rewetted area in the Baijianghe peatland of the Changbai Mountains to determine soil physicochemical properties, phospholipid fatty acids (PLFAs), two oxidative enzymes (peroxidase and polyphenol oxidase) and three hydrolytic enzymes (β-1,4-glucosidase, β-1,4-N-acetyl-glucosaminidase and acidic phosphatase). This study aimed to reveal the characteristics of changes in soil microbial communities and enzyme activities during water table restoration and their influencing factors, and to provide data to support the restoration of drained peatlands. The results showed that the microbial communities and enzyme activities differed considerably among the three areas and that the degree of change varied by depth in the profile. Soil oxidase activities of the oxic zone were significantly lower in the rewetted area than in the drained and natural areas. However, for the transitional and anoxic zones, they were higher than the drained area but lower than the natural area. Soil hydrolytic enzymes in the oxic zone were significantly higher in the rewetted area than in the drained. For the transitional zone, soil hydrolytic enzyme activities were significantly lower in the rewetted area than in the drained area. Water table depth (WTD) restoration had significant effects and soil microbial biomass and community structure. Soil total PLFAs, fungal, actinomycetes, and G- bacterial PLFAs of the oxic zone were significantly higher in the rewetted area than in the drained and natural areas. For the transitional zone, soil total PLFAs, bacterial, and G+ PLFAs were significantly higher in the rewetted area than in the drained. We found that these variations in the microbial communities and enzyme activities were associated with differences in the litter quality, soil organic carbon (SOC), soil water content (SWC), phenolics (PHEN), and pH among three areas. Changes in the WTD the SWC and affect other physicochemical properties of the soil by changing the redox conditions and the availability of O_2, which in turn affects the decomposition of SOC. PHEN and SWC explain the highest degree of SOC accumulation, but mainly regulate it by controlling the C limitation of soil microbial activities. Rewetting is conducive to improving the C sink capacity of drained peatlands.