



Impact of 90 years of drainage on the subsurface biogeochemistry of a northern bog

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Climate in the northern temperate and boreal zone will undergo significant changes in the 21st century and in some areas become drier and warmer. We investigated the impact of a century of drainage on hydrogeological and biogeochemical process patterns in the Mer Bleue Bog, Ontario, Canada. Depending on watershed area, either a bog system was maintained or trees invaded. Changed evapotranspiration and hydraulic characteristics, driven by increased decomposition of the soils, lead to distinct changes in hydrogeologic flow paths with recharging conditions in bog and discharging in treed areas, arguing that stability point exist for ecohydrological response. Altered vegetation and flow patterns corresponded to biogeochemical process patterns; under forest DOC concentration was increased, sulphate reduction dominated against methane production, syntrophic anaerobic microbial processes appeared to be partly disconnected according to thermodynamic analyses, and methane production was strongly reduced. A laboratory based analysis of these patterns demonstrated that humic substance enrichment may lead to suppression of methane production in such soils. The investigation of the electron accepting capacity of humic substances indicated clear redox gradients with depth and higher potential electron accepting capacities in the more intensely humified peat under forest. In summary, a century of dry conditions induced the development of two very different hydrological and biogeochemical systems that strongly differed in their redox and methane dynamics.