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Carbon dynamics on a mire with nutrition gradients

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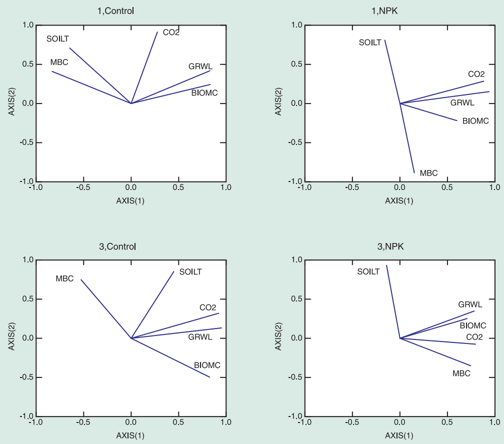

Fig.1. Factorial plots (Principal component analysis) with the relevant variables. The results are presented from the first (1) and third (3) year for the control and NPK treatments. The variables are: BIOMC = aboveground tree stand biomass carbon CO2 = CO_2 respiration from the peat; GRWL = ground water level; MBC = microbial biomass carbon; SOILT = soil temperature.

Introduction

Boreal peatlands drained for forestry are considered C sinks. On some site types the peat nutrients limit tree growth and these sites may become C sources. In the future there may be an increased demand for nutrient application in order to maintain stand growth on peatland sites with low P and K.

Material and methods

The experiment is located on the mire Liesineva in Parkano, western Finland. Originally the mire was a wet, open mire with a low K content in the peat while the N and P followed a trophic gradient. On the 20 sample plots the treatments are control (n = 10) and repeated fertilization with NPK (n = 10). CO_2 respiration from the peat, together with air and soil temperature and ground water level, were measured during three vegetation periods. Based on these observations, plot soil respiration was modelled. Before the third investigated vegetation period the fertilized plots were fertilized once more. The tree stand biomass and soil microbial carbon biomass were measured twice during the experiment.

Results and discussion

During the third growing season the CO_2 respiration from the peat on the fertilized plots was significantly greater than on the untreated plots. The mean soil temperature was significantly higher on the controls. There was no difference in the ground water levels of the different treatments. The tree stand biomass was significantly greater on the fertilized plots. The microbial biomass carbon in the surface peat was greater on the untreated plots. The microbial biomass carbon is an indication of the biomass of the heterotrophic and autotrophic (including mycorrhiza) microbial populations in the soil. Thus, the results suggest that roots and symbiotic microbes of trees and ground vegetation on the controls have to invest more in their belowground biomass because of scarce nutrient resources. The changes in the allocation and fluxes of soil and stand carbon after repeated nutrient application ought to be noted in carbon balance sheets. The shifts of the different variables according to treatment are illustrated in Figure 1.

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