Geophysical Research Abstracts
Vol. 20, EGU2018-4288, 2018
EGU General Assembly 2018

Biochar management in a boreal forest

Michael Gundale, Marie-Charlotte Nilsson, and David Wardle
Swedish University of Agricultural Science, Forest Ecology and Management, Umea, Sweden (michael.gundale@slu.se)

Biochar management has been proposed as a possible tool to mitigate anthropogenic CO_2 emissions, and thus far its impacts in forested environments remain poorly understood. We conducted a large scale, replicated field experiment using 0.05 ha plots in the boreal region in Northern Sweden to evaluate how soil and vegetation properties and processes responded to biochar application and the disturbance associated with burying biochar in the soil. We employed a randomized block design, where biochar and soil mixing treatments were established in factorial combination (i.e. control, soil mixing-only, biochar-only, and biochar and soil mixing; n=6 plots of each). After two growing seasons, we found that biochar application enhanced net soil N mineralization rates and soil NH4+ concentrations regardless of the soil mixing treatment, but had no impact on the availability of NO_3-, the majority of soil microbial community parameters, or soil respiration. Meanwhile, soil mixing enhanced soil NO_3-concentrations, but had negative impacts on net N mineralization rates and several soil microbial community variables. Many of the effects of soil mixing on soil nutrient and microbial community properties were less extreme when biochar was also added. Biochar addition had almost no effects on vegetation properties (except for a small reduction in species richness of the ground layer vegetation), while soil mixing caused significant reductions in graminoid and total ground layer vegetation cover, and enhanced seedling survival rates of P. sylvestris, and seed germination rates for four tree species. Our results suggest that biochar application can serve as an effective tool to store soil C in boreal forests while enhancing NH4+ availability. They also suggest that biochar may serve as a useful complement to site preparation techniques that are frequently used in the boreal region, by enhancing soil fertility and reducing nutrient losses when soils are scarified during site preparation.