Geophysical Research Abstracts
Vol. 16, EGU2014-11916, 2014
EGU General Assembly 2014

Regulation of Boreal soil respiration: evidence from a Swedish forest fire chronosequence.

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Globally, boreal forests occupy 14% of total land surface and are important regions for biogeochemical cycling of carbon (C) and nitrogen (N)[1]. They are recognised as stores of terrestrial C and reservoirs of uniquely adapted biodiversity. Like many forest biomes, boreal forests are under pressure from climate change and growing populations. C and N cycling in the boreal region is strongly influenced by the occurrence of forest fires, which return large amounts of stored N back into an otherwise N limited system[2]. The frequency and intensity of boreal forest fires is expected to increase in the next century as the global atmosphere warms and N deposition continues to increase due to human activities[3,4]. Despite the importance of these ecosystems, there is limited knowledge of the effects of interactions between climate and N limitation on soil respiration and feedbacks of carbon dioxide (CO_2) and other greenhouse gases (GHGs) to the atmosphere.

In this research we aimed to improve understanding of how changes in the frequency and intensity of fires might alter N and C dynamics in the boreal region. Specifically, we examined the degree of N limitation and the temperature sensitivity of GHG (CO_2, N_2O and CH_4) fluxes from soils underlying carpets of *Pleurozium schreberi*, a feather moss known to form important symbiotic relationships with N-fixing cyanobacteria[1], from a fire chronosequence of Swedish boreal forest stands. We hypothesised that: (1) soil respiration in late succession ecosystems is most N limited due to high soil C:N ratios and high microbial biomass; and (2) early succession forest soil respiration is most temperature sensitive due to higher N availability and higher bacterial biomass.

To test these hypotheses, we took soil cores from a chronosequence of six sites in the northern boreal region of Sweden, including two early, two mid, and two late succession stands. These sites are dominated by mixed *Pinus sylvestris* and *Picea abies*, with an understory dominated by ericaceous dwarf shrubs and feather mosses. Soil properties including microbial community composition, C:N, pH, and extractable $NH_4$and NO_3 were measured and two microcosm experiments were conducted on cores incubated under controlled conditions. In the first experiment, ammonium nitrate (NH_4NO_3) fertilizer was applied and the dose-response of GHG emissions was measured over several weeks. Differences in fluxes between sites were observed in response to N additions, with greatest differences in N_2O emissions compared to CH_4 and CO_2. In a second experiment, respiration was analysed from cores incubated at different temperatures over two weeks and Q_{10} values were calculated for the different sites. Q_{10} values obtained were approximately 2.5-3.5, indicating higher sensitivity to rising temperatures in these soils than predicted in most climate models[5]. We will present how these differences in N limitation and temperature sensitivity are driven by differences in soil properties along the chronosequence.

References

[1] DeLuca *et al*. 2002. *Nature.* 419.

[2] Zackrisson *et al.* 2004. *Ecology.* 85.

[3] Friedlingstein *et al*. 2006. *JClimate*. 19.

[4] Dentener *et al.* 2006. *Global Biogeochem Cy*. 20.

[5] Kilpeläinen *et al.* 2010. *Climatic Change*. 103.