



The effect of nitrogen fertilization on soil surface CO₂ fluxes in Siberian forest soils

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Human activities, production of nitrogen fertilizers have altered the global nitrogen cycle greater than the carbon cycle. The purpose of our study was to investigate the effect of nitrogen application on the CO₂ flux under two tree species - Siberian larch and Scots pine.

To estimate nitrogen effect on heterotrophic and autotrophic components of soil respiration the three-year experiment with deep and shallow collars was carried out. Collars were installed in May of 2010. Nitrogen was applied in June of 2010 in the form of ammonium nitrate (dry) at the rate of 50 kg N/ha on the four replicated plots under both tree species. The emission of CO₂ was measured every 2 weeks from May to October over three years with LI-8100A CO₂ analyzer.

Nitrogen application positively affected soil surface CO₂ flux under both tree species. The effect of N was even significant for annual CO₂ production. Under Scots pine, the N fertilization increased annual CO₂ production during the first and second year of measurements, under larch only for the first year. For the third year the effect of N has disappeared under both tree species. The total losses of soil carbon due to N application were 600-650 kg C/ha under Siberian larch and three times higher (1800-2000 kg C/ha) under Scots pine. Different collar types revealed that the effect was mostly due to increased activity of heterotrophs and subsequent laboratory incubations proved that this activity was accelerated by N mostly in the litter layers.

Overall, our results suggest that in N unpolluted Siberia, the application of N leads to soil C losses, mainly due to accelerated decomposition of forest floor. The losses of soil C might exceed N-driven C sequestration in tree biomass, negating thus positive effect of N addition on net C sequestration.