Geophysical Research Abstracts
Vol. 19, EGU2017-19594, 2017
EGU General Assembly 2017

Initial shifts in nitrogen impact on ecosystem carbon fluxes in an alpine meadow: Patterns and causes

Bing Song

It is proposed that rising nitrogen (N) deposition could increase ecosystem net carbon (C) sequestration. However, as a direct measure of ecosystem net C sequestration, how net ecosystem CO_2 exchange (NEE) and its different components respond to rising N deposition is still far from clear. Using an N addition gradient experiment (six levels: 0, 2, 4, 8, 16, 32 gN m-2 year-1) in an alpine meadow in the Tibetan Plateau, we explored the responses of different ecosystem C cycle processes to increasing N loading gradient and revealed mechanisms underlying response dynamics. Results showed that NEE, ecosystem respiration (ER), and gross ecosystem production (GEP) all increased linearly with N addition rates in the first year of treatment, but shifted to N saturation responses in the second year with the highest NEE (-7.77 $\pm$ 0.48 μmol m-2 s-1) occurring under N addition rate of 8 gN m-2 year-1. The saturation responses of NEE and GEP were caused by N-induced accumulation of standing litter, which limited light availability for plant growth under high N addition. The saturation response of ER was mainly due to decreases in aboveground plant respiration and soil microbial respiration under high N addition, while the N-induced reduction in soil pH caused declines in soil microbial respiration. We also found that various components of ER, including aboveground plant respiration, soil respiration, root respiration, and microbial respiration, responded differentially to the N addition gradient. The results reveal temporal dynamics of N impacts and the rapid shift of ecosystem C cycle from N limitation to N saturation. These findings are helpful for better understanding and model projection of future terrestrial C sequestration under rising N deposition.