Agu abstract

**Could 4 degrees warming change Arctic tundra from carbon sink to carbon source?**

We have set up a controlled, active warming experiment in permafrost soils on the North Slope of Alaska. The aim of this micro-warming experiment is to investigate the direct effect of soil warming on microbial decomposition of soil organic matter. We tested the feasibility of in situ warming of the active layer and permafrost, designed to preserve plant-soil relations and natural variability in temperature and precipitation. One resistance heater cable per plot (25 cm diameter plots; n=4 blocks) was inserted vertically to 50 cm, spanning the full active layer of the tundra soil (maximum thaw depth was 40 cm in 2014). Heaters were turned on August 1, 2015, and heated plots reached 4oC warming within 1-3 three days. We are measuring soil microclimate, thaw depth, CO2 and CH4 fluxes, and microbial composition, as part of the DOE Next Generation Ecosystem Experiments (NGEE-Arctic). Based on preliminary results, the approach looks promising.

Ecosystem respiration was immediately higher in all heated plots, and net ecosystem exchange under clear chambers changed from net uptake to positive flux to atmosphere in two of the four blocks. This rapid response of the extant microbial community and substrates avoids the complication of separating the direct responses from acclimation and changes in substrate availability. However, future Arctic tundra carbon balance will depend on both short term and long term microbial responses, as well as the links between warming, decomposition, nitrogen mineralization, and plant growth. Thus, we envision that distributed active warming plots could be combined with longer term passive warming, gradient studies, and modeling approaches.

**Arctic warming**

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