Beavers as Arctic Carbon Cycle Engineers: The Impacts of Beavers on Organic Matter Cycling in Permafrost Landscapes

In the Arctic, rising temperatures have led to longer growing periods and the expansion of shrubby vegetation. Wildlife, including beavers, that require this shrub environment have begun to colonize these Arctic tundra regions. Beaver engineering plays a significant role in controlling surface water dynamics, which can increase the rate of permafrost thaw, releasing stored carbon, and thereby exacerbating the effects of climate change. This study examined the influence of beaver activity on regional carbon cycling in Nome and Kotzebue, Alaska. Water samples collected from above, below, and within beaver ponds were analyzed to characterize and quantify the export of dissolved organic matter (DOM) and assess the impact of beavers on regional carbon cycling. UV-visible absorbance spectra and DOM fluorescence excitation-emission matrices (EEMs) were measured to assess DOM composition and fate. Lignin biomarkers were characterized to quantify the input of terrestrial DOM. Fluorescence EEMs were used to identify the molecular changes to the DOM pool and the unique impacts of beavers on the sources, cycling, and fates of DOM in permafrost landscapes. The concentration and composition of DOM varied widely across sites above and below beaver ponds. Across the landscape and gradients of permafrost thaw, we observed changes in the composition of fluorescent DOM indicating that beavers likely are altering the export of terrestrial carbon through these systems. These results suggest beavers have a significant impact on regional carbon cycling and need to be considered when examining recent changes to Arctic tundra landscapes.

Kehoe, Paige, M, University of Alaska Fairbanks, pkehoe2@alaska.edu
Tape, Ken, D, University of Alaska Fairbanks, kdtape@alaska.edu
Jones, Benjamin, M, University of Alaska Fairbanks, bmjones3@alaska.edu
Loranty, Michael, M, Colgate University, mloranty@colgate.edu
Zavoico, Sebastian, University of Alaska Fairbanks, vszavoico@alaska.edu
Johnston, Sarah Ellen, University of Alaska Fairbanks, sejohnston2@alaska.edu