Geophysical Research Abstracts
Vol. 15, EGU2013-1037, 2013
EGU General Assembly 2013

The influence of shrub canopies on soil temperatures across northern Canada

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Shrub species are the largest plant life form in tundra ecosystems; therefore, changes in the abundance of shrubs will likely create feedbacks to influence biodiversity, ecosystem function and climate. Shrub canopies have been hypothesized to influence ground temperatures by trapping snow in winter and shading soils in summer. However, generalizable relationships have yet to be identified among species, soil types and regions. We present data from seven shrub tundra sites in the Yukon, Northwest Territories and Northern Quebec. Summer soil temperatures were often cooler under shrub canopies; however, there was no clear relationship with canopy height. In contrast, we found a significant positive relationship between canopy height and winter soil temperatures. The difference in the minimum winter soil temperatures at 5 cm depth under shrub versus open tundra was $\sim$1°C greater for every additional 10cm of canopy height, despite differences in air temperatures, snow pack, soil characteristics and species composition between sites. Our results highlight the important influence of canopy cover on soil temperatures. By combining data in this manner across regions, we will be able to better estimate the relative magnitude of positive and negative feedbacks of shrub increases to climate warming and thus will improve estimates of future vegetation change and permafrost stability.