Subarctic peatland ecosystems, which store up to 455 Pg of carbon, stand to change significantly in response to recent warming in high latitudes (MacDonald et al. 2006). The potential for this large carbon pool to be released to the atmosphere, leading to a positive feedback effect on greenhouse warming, makes an understanding of peatland carbon dynamics essential.

Warmer summer temperatures and a subsequently longer growing could allow for faster peat production, leading to increased carbon storage. However, higher winter temperatures could lead to faster rates of decomposition, making peatlands a greater carbon source than sink (Tarnocai 2006). In addition, wildfires have the potential to consume vast areas of peat and release stored carbon to the atmosphere (Zoltai et al. 1998). Because moisture content largely determines whether or not a peatland will ignite after a lightning strike, a warmer and therefore drier climate will likely lead to increased fire severity and frequency (Foster 1983). Therefore, in order to understand how northern peatlands could affect the global atmospheric carbon pool, it is essential to understand how they have responded to past climatic variations. This project focuses on the last major warm period, the Holocene Thermal Maximum (HTM), which occurred in Canada from approximately 6500 to 3500 year BP.

In the summer of 2012, we analyzed 25 cores collected in 2008 from the Nejanilini Lake region of Manitoba, Canada. We used radiocarbon dates and carbon mass to calculate carbon accumulation rates for each core, and used areal charcoal concentration as a proxy for fire severity. We also collected cores from 16 sites in the Hudson Bay Lowlands near Churchill, Manitoba. This summer, we began lab analyses of charcoal concentration on the 2012 Churchill cores and collected additional cores from Goose Bay, Labrador, Canada.

In the Nejanilini cores, we found that warmer temperatures were correlated with elevated rates of carbon accumulation and lower fire severity. There was no indication that fires were consuming significant amounts of peat and releasing stored carbon to the atmosphere, but a lack of data pertaining to fires of a high severity class meant that we could not definitively conclude the overall influence of fires in this region. Charcoal data from the Manitoba cores will help us to broaden our data set and determine the potential effects of large fires on peatland carbon. In addition, a future analysis of the Labrador cores as well as climate reconstructions derived from lake sediment cores will give us a better understanding of carbon dynamics across boreal/subarctic Canada.

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References