Carbon Storage and Paleoclimate in Alaskan Peatlands

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Peatlands are tremendous stores of terrestrial carbon, anywhere from 180-455 Pg C. Though it is know that these environments are vitally important players in the global carbon cycle, the specific role they play is poorly understood. A critical question that has yet to be answered is how past, present, and future climate change will impact these important carbon reservoirs. The effects of current greenhouse warming are likely to be complicated due to complex interactions among primary production, decomposition, fire frequency, water table changes, and permafrost. Because peatlands are excellent archives of past climate change and are the largest terrestrial carbon stores per unit area, studying the relationship between past climate shifts and peat carbon storage is key to understanding the impacts of future climate shifts on carbon sequestration. Our primary hypothesis is that climate (e.g., changes in strength and position of the Aleutian Low) controls carbon storage in peatlands through shifts in temperature- and hydrology-related processes of production and decomposition. Since peatlands are overall net sinks for carbon it is important to know what our paleovegetation and paleoclimate perspective can provide when coupled with past carbon sequestration. We will reconstruct both paleoclimate and carbon sequestration from a series of peatland sites across Alaska. We will use pollen, macrofossils and stable hydrogen isotope measurements of leaf waxes to constrain changes in vegetation and hydrogen isotopes of precipitation respectively. Climate Center funds will be used to analyze hydrogen isotopes of leaf wax biomarkers from cores collected from peatlands in southern Alaska: Bear Bog (near Cordova, AK) and Middleton Island (at the shelf/slope break in the Gulf of Alaska). These sites are ideally situated for recording variations in the Aleutian Low, the main atmospheric phenomenon affecting climate of the region.