Peat Expansion in Arctic Tundra (Baffin Island)--Pattern, Process, and the Implication for the Carbon Cycle

Supplemental Supporting Documentation provided to NIRB

submitted by Philip Camill
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Summary of current and future consultation plans

To date, P. Camill has been in contact with the following individuals for project management and as part of the application process:

- Goump Djalogue (Nunavut Planning Commission)
- Natasha Lear (Nunavut Impact Review Board)
- Mosha Cote (Nunavut Research Institute)

We have not contacted individuals within any of the local communities in the proposed study regions.

Research methodologies

The overall goals of our research include the following:

-sampling soils to measure the amount of carbon stored
-relate the soil carbon storage to the types of vegetation present
-map the spatial area of vegetation types
-measure potential environmental controls that might be affecting the area of peat patches, including air and soil temperatures, soil moisture, and topography.

It is important to note that, since this work is primarily focused on plants, soils, and weather data, our work does not involve research with people/communities or sensitive cultural/archaeological sites. We will avoid areas of cultural significance and would appreciate assistance with help from NPC and NIRB to identify such locations so that we are sure not to fly to or sample in these locations.

The proposed field research would include the following tasks:

(1) Collection of soil cores

At each site, we would collect multiple soil cores from the peat patches and adjacent mineral soil for the assessment of soil carbon. The cores would be approximately 5 cm in diameter and sampled to the basal depth of the peat (most likely 20-75 cm deep). Mineral soils would be

collected to the depth of permafrost. Soils will be bagged and wrapped in protective containers and prepared for shipping back to the USA (in accordance with soils importation regulations/permits). We would likely collect a total of 40 cores (20 peat and 20 mineral) from all of the sites sampled. We are not certain yet the total number of cores that would need to be collected, so if there is flexibility in the permitting process to allow us to sample more than 40, this would help our research sampling be more flexible.

(2) Collection of meteorological data

At each site, we will deploy a small meteorological station capable of measuring environmental properties like air and soil temperatures and soil moisture. These will log data for several days, and we will return to the sites to retrieve all equipment. This information will help us assess the extent to which the peat patches are dependent on certain soil temperatures or moisture conditions.

(3) Mapping of surface topography and vegetation

To assess the spatial scale of the peat patches and the potential landscape controls on them, such as local topographic depressions, we will use high-resolution GPS units to take multiple measurements of topography and peat patch areas.

At each site, we will use small (1-x-1-m) sampling plots to identify different plant species and quantify their areal coverage. Herbarium specimens of different plant types would be collected and shipped back to the USA (in accordance with plant importation regulations/permits)

(4) Imaging surface vegetation

At each site, we will collect handheld and aerial imagery to help us map the coverage and spatial scales of the peat patches and their potential environmental controls, like topography. First, we will take hand-held spectroscopic measurements of the surface vegetation to understand how different plant species alter the reflectance of the landscape. This will help us interpret remote sensing and aerial imagery. Second, we will deploy a drone over a ~20-hectare area to a height of ~250 m (in accordance with all US and Canadian civil aviation testing/certification/permitting requirements). This instrument will be equipped with a multispectral sensor that collects reflectance data from the surface vegetation. These images will provide some of the first high-resolution vegetation maps to help us assess how environmental factors might be controlling the areal coverage of the peat patches. These data will be used alongside satellite-based remote sensing images of the region to help us determine the spatial scales of the peat patches and their potential environmental controls.

Flight plans

Our research team will be based in Iqaluit at the Nunavut Research Institute. Our primary means of transportation will be by helicopter.

In the map of proposed field study sites, we have identified about 16 potential study regions that include the vegetation types we are interested in studying (peat-forming wet tundra). The central location (latitude/longitude) of these of these proposed sites is presented in the following table:

Latitude (N)	Longitude (W)
64.94952	-75.2576
64.32777	-73.7467
67.01717	-71.8631
64.48163	-73.5189
66.85968	-71.3515
66.06937	-71.3283
65.55066	-72.468
64.26511	-72.259
66.54703	-69.0503
63.7444	-69.7654
62.66107	-70.5818
63.3088	-70.6649
64.4	-68.2297
63.95149	-69.1768
62.55404	-68.0877
63.31308	-67.0446

Since we have not yet visited these sites and are not yet sure where the ideal locations will be to collect soil cores, our initial visit to each site will involve ~30 minutes of aerial reconnaissance to determine where the specific peat patches are located. Once we identify possible sites to sample, we will land the helicopter in a safe, remote location and spend a few hours collecting data.

The nature of this kind of field work is highly variable because it is dependent on weather conditions and the locations of suitable sampling locations--neither of which we can know in advance. This means that we are not yet able to provide specific flight plans other than to say we plan to visit each of the sites 1-2 times and spend a few hours at each site over a 10-14-day period.

As our fieldwork begins and we learn more about the best locations to survey and sample, we can provide the Nunavut Planning Commission and Nunavut Impact Review Board with an

additional daily schedule of proposed flights in the event that local communities prefer that we not sample in a region on a given day.

It is our current understanding that fuel for the helicopter will be staged and acquired in Iqaluit and that there will be no need to cache fuel at any of the proposed study locations.

Mitigation plans

As stated above, the only sample collection will involve a few soil cores and vegetation samples at each site, in addition to soil and air temperatures. All soil coring will be done with non-motorized, handheld equipment, and core holes will be backfilled with soil. We expect there to be no long-term environmental consequences that would require mitigation.

Waste Management

No waste will be generated as a result of this project. All of the project supplies and equipment that we being in will be carried out with us.

Images of project location

We do not yet have on-site images of any of the proposed field study sites.