Title: High Arctic permafrost landscape stability and water quality, Sabine Peninsula, Melville Island, Nunavut

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Site: Drake Point area (76 deg 27' N, 108 deg 33' W), northeastern Melville Island

Project Description

The aim of the research project is to develop knowledge to help predict what landscape controls affect water quality. In particular, we will study the impact of natural permafrost and vegetation disturbances. We will map permafrost disturbances (1954-present) with satellite images and aerial photographs, and develop a landscape model to predict future disturbances across different rock, slope and plant surfaces. We will also integrate water quality monitoring to create models to predict changes in water quality associated with permafrost disturbance. These models will be of primary value to effectively manage this region of the High Arctic in a changing climate and to support the development of natural gas resources in the region in the future.

The research project will have three field seasons: 2010, 2011, and 2012. Our 2010 field objectives are to map permafrost disturbances to identify patterns and primary controls. We will also develop and validate methods to map vegetation cover and soil moisture with satellite images.   We will measure water quality (sediment, nutrients, salts) across environmental gradients and different degrees of permafrost disturbance, and sample water quality and vegetation changes associated with different ages of landscape disturbance (pre-1954, 1954-1974, 1974-2007 and post-2007) to establish the long-term impact of water quality changes.

Methodology

Three rivers will be instrumented with electronic sensors to measure flow, level, temperature, and turbidity during the summers. Water sampling will be carried out at approximately 100 sites. Samples of approximately 1 litre or less that will be collected by hand from each stream and used for analysis. All river stations require temporary structures that are located on existing banks or shores. Sampling does not change the flow, dam or discharge hazardous materials.

One temporary weather station will be installed and secured with flat plates, loaded with local rocks, and/or metal stakes. All materials will be removed when the work is completed.

Soil moisture will be monitored using thin metal rods inserted into the ground at approximately 100 sites. The rods do not disturb the soils and are removed at the end of each season. Vegetation and soils will be sampled for biomass and nutrient analyses. Shallow soil samples (100 ml) result in minimal disturbance of the landscape. Also, sampling a 5 cm2 area for biomass measurements will have a minimal impact on vegetation.

Ground travel will be by ATV. All driving will be done to have minimal or no impact on the local environment. All materials and waste are removed to Resolute at the end of the season.

Our team anticipates sharing the knowledge gained from this study through visits and presentations to community groups in Resolute during the course of the study. We are also planning to hire a person from Resolute to assist the field research in order to provide an opportunity for a community member to gain experience conducting scientific research.