The main purpose of our research is to reconstruct past climates using sediment records from a series of lakes in the Foxe Basin region. Using biological and physical data extracted from these records, we will determine the potential responses of northern lakes and their watersheds to past climate changes, in order to predict future impacts of climate change. We will couple this research to sampling and analyses of the modern-day limnological properties of freshwater ecosystems in this little studied transition region.

Lakes and ponds are a major feature of the arctic landscape, and these contain sediment archives from which biological, physical and chemical proxies can be extracted to reconstruct climate and environmental changes through time. To explore the past natural environmental climate fluctuations of the regions of interest, we are planning on collecting sediment cores from a series of lakes located in the vicinity of Koukdjuak, Nikko Island (Lake Nettilling; 66°35'42.10"N, 71°31'23.87"W). We will focus our sampling not only on large postglacial lakes but also on "thermokarst lakes" located in the Dewey Soper Bird Sancturary. Resulting from a partial and local melting of the permafrost in subarctic regions, these lakes are believed to be responsible of releasing high amount of greenhouse gases (CO_2 and CH_4), initially trapped in the organic rich-permafrost. The faunal (chironomids) and floral (diatoms) fossil assemblages within each sedimentary sequence will be analyzed, along with sedimentological and geochemical analyses to quantitatively track long-term environmental changes during the postglacial period and/or since the creation of these "thermokarst lakes". The combination of both biological and geochemical indicators remains uncommon but provides a deeper understanding of the environmental parameters that determine the functioning of aquatic ecosystems. Sediment and water samples from each study site will also be collected for our collaborators on studies of northern lake contaminants (Dr. Derek Muir, Water Science and Technology Directorate, Environment Canada; Burlington, Ontario). Also, as part of CEN's SILA network, a new automated weather station will be installed on Nikko Island.

The proposed sampling activities will be logistically challenging because of the remoteness of the study region, which also explains the lack of environmental information from this vast area at the centre of the eastern Canadian Arctic. The short survey of this region carried out during our 2009 mission revealed that overnight stays at or near the CWS station on Nikko Island are necessary to complete the planned fieldwork. We will access the study regions via helicopter and Twin-Otter support provided by PCSP. Our research team and gear will be transported from Iqaluit to the camp on July 30 and we will return from the area on August 03. Two of our team members (Denis Sarrazin and Warwick Vincent) will install a new CEN weather station at this site and will conduct limnological sampling. This region is currently a major gap in the CEN Network of climate and aquatic observation sites, and the Nunavut Research Institute has requested that CEN become more active in this part of Nunavut.

To assure the success of this long-term arctic paleoenvironmental monitoring program, one post-doctoral researcher (Dr. Nicolas Rolland), one graduate student (TBA) and at least one undergraduate student (Anne Beaudouin) will be involved and trained in all aspects of our research. This includes the biostratigraphic and sedimentological analyses, the limnological measurements (water column profiling and sampling), as well as the sampling of short and long sediment cores from the sites selected for the paleolimnological analyses.

All the data will be archived as part of Laval University Arctic research program to increase our knowledge of climate impacts in Arctic regions. All samples will be extensively analyzed in our laboratory facilities. Results will be published in science journals and presented worldwide during international symposia and workshops. The resulting database will be made available to the Nunavut Research Institute and the local communities within the study region.