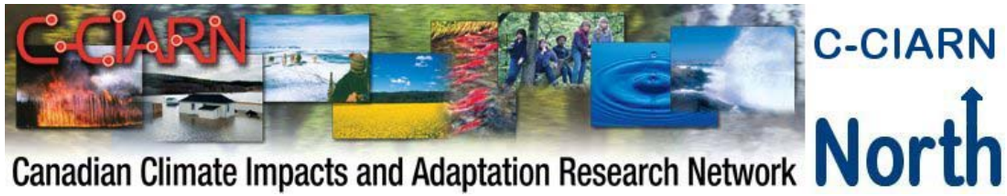


A SUMMARY OF RESULTS FROM CLIMATE CHANGE RESEARCH UNDERTAKEN IN NUNAVUT DURING 2004

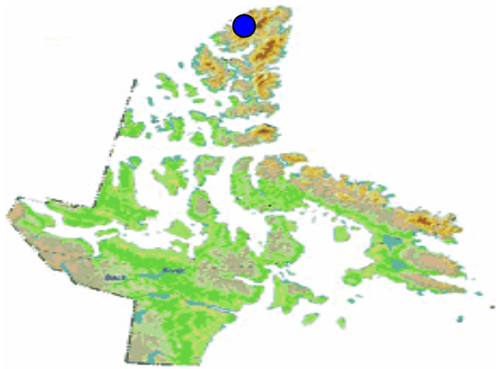
Compiled by: Nunavut Research Institute

Note: The research results provided below were derived from annual summary reports submitted to the Nunavut Research Institute by researchers licensed under the *Nunavut Scientists Act* in 2004. As such the results should be treated as preliminary findings only (many of the studies are ongoing). Please gain the permission of the study proponent(s) before quoting from or citing the project summaries. This compendium does not account for all climate change research undertaken in Nunavut in 2004. Research projects licensed under the *Migratory Birds Convention Act*, *Fisheries Act, NWT Wildlife Act* and/or other legislation not included in this report.

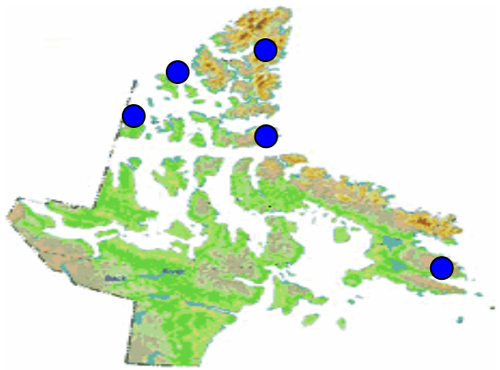
Proponent and Affiliation	*Project Title*	*Research Location and Dicipline*	*2004 Results*
Forbes, D.L.; Geological Survey of Canada	***Coastal hazards, relative sea-level change and climate impacts on northern coasts***	Inuvik, Sachs Harbour, Tuktoyaktuk, Holman NWT; Resolute, Kugluktuk, NU; Geology 	**Climate warming in the Arctic is associated with rising sea levels in some areas, decreased sea-ice thickness and extent, and increased open-water wave energy. These changes are expected to result in increased thaw subsidence and accelerated coastal erosion, thinner and more mobile sea ice. Global positioning system stations and tide gauges are located in various locations and are used to measure subsidence and uplift. The data collected will be used to estimate future sea-levels and coastal erosion. Uplift has been recorded in Resolute, subsidence has been recorded at Inuvik, and little vertical movement at Holman. In 2003, one site was added, and existing sites resurveyed near Resolute, Nunavut. Surveys at Resolute demonstrate that sea ice and storm waves can overtop the beach, causing landward movement of sediment and posing a risk to any shorefront infrastructure (even in areas of rapid uplift and falling relative sea level.) Observations near Kugluktuk indicate some shoreline erosion along low bluffs in front of the hamlet, as well as beach overwashing and beachface erosion alongshore to the west.**
Henry, G.; Department of Geography, University of British Columbia	***Climate Change and Tundra Ecosystems: Species-Level Responses and Consequences for Ecosystem Processes and Feedbacks***	Alexandra Fiord, Ellesmere Island NU.; Ecology 	**To investigate the effects of climate warming on tundra ecosystems, open-top greenhouses were placed on plots 1.5m in diameter. The presence of these greenhouses warmed the area by about 2-3 degrees C. This generally caused the plants to grow larger and faster, and also produced bigger and better seeds. In some plots, small amounts of fertilizer were added, and produced great results. This indicated that nutrient supply is important in determining how tundra ecosystems will respond to climate change. Nutrient levels have increased in the warmed areas, especially in the wetter areas. These experiments show that the number and types of tundra plants may change in a warmer climate. Changes in the diversity of plants will affect the animals that eat them and the nutrients in the soil. The changes in these plots will be measured over may years to help understand what happens to the tundra when species diversity changes.**

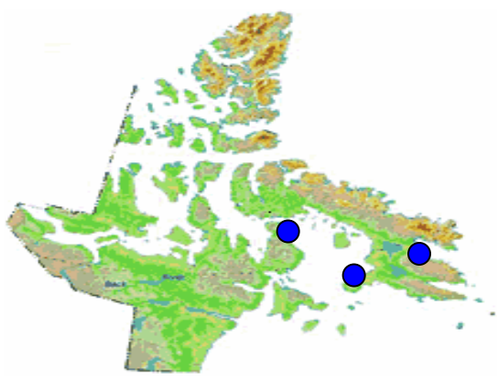
Proponent and Affiliation	*Project Title*	*Research Location and Category*	*2004 Results*
Lamoureux, S.; Department of Geography, Queens University	***Reconstructing Weather from the sediments at Cape Bounty, Melville Island and North Lake, Cornwallis Island***	Cape Bounty, Melville Island, NU; Paleoclimatology 	**Field work consisted of collecting sediment cores, water samples and diatom samples, and measurements of river flow and sediment transport in two lakes and their perspective rivers, as well the maintenance of weather stations that were set up in 2003. This information is used for understanding the relationship between climate, hydrology and ecosystem response at the site. Soil and plant samples were also collected for comparison with satellite imagery to develop methods to measure plant growth with satellites. Together, these data sets are important for understanding the long-term sensitivity and future response of this site to environmental change. In 2004 a cloud-free IKONOS satellite image was acquired, as well as ground based spectral signatures. These will assist in scaling up the site measurements from the local plots to the satellite images. Preliminary results suggest that the lake sediments show a pattern of annual deposition that can be traced back 1000-3000 years. Diatom samples are being analyzed and will be compared to past changes in the diatom community within the sediment records. This will assist in understanding the ecosystem response to hydrologic and climatic changes.**
Pollard, W.; Department of Geography, McGill University	***An Investigation of the Impacts of Global Warming on Permafrost in the High Arctic Polar Desert Ecosystems***	Fosheim Peninsula, Expedition Fiord, Hazen Plateau, NU; Geology 	**The goal of this project is to understand and explain how climate change will affect the processes that shape and define cold polar desert environments. The field work has three general aims: 1) to determine if high arctic temperatures are warming; 2) to determine if seasonal ground thaw depths are increasing; 3) to document places where permafrost and ground ice are melting and measure ongoing rates of erosion. Also, the characteristics of the ground ice need to be determined. In 2004, at Eureka Omelon, erosion patterns in sandstone were examined. Aerial surveys mapped several new sites where permafrost is melting, and the team collected data from 7 automatic weather stations. Precision GPS was used to measure changes in landscape due to melting ground ice, and areas of significant thawing and erosion at the north end of Lake Hazen and the Gilman River (Ellesmere Island) were identified. Initial reconnaissance was conducted of coastal permafrost sites as part of the *ArcticNet* program.**

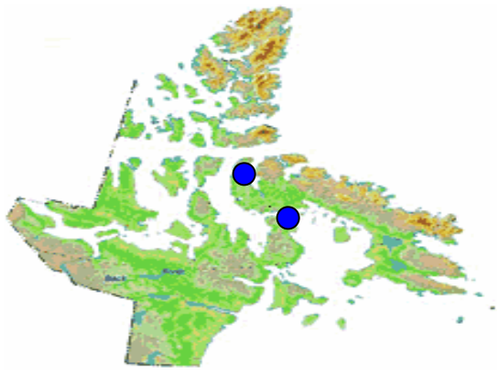
Proponent and Affiliation	*Project Title*	*Research Location and Category*	*2004 Results*
Leduc, T.; Faculty of Environmental Studies, York University	***Inuit Quajimajatuqangit, Climate Change, and Western Knowledge*** ***Chesterfield Inlet Research Report***	Chesterfield Inlet, NU; Anthropology 	**In Chesterfield Inlet, NU on October 11-October 12, 2004, a workshop was held with 8 community residents to share understandings, concerns, and needs in relation to climate change and its affects on the community. Residents report a decline in water levels (rivers, streams, ponds, lakes) by as much as a 1m. Spawning Char have scratches and bruises casued by moving through shallow waters. Climate warming has been pronounced over the past two years. Insects, birds and even grizzly bear are reported to be migrating northwards. The warming temperatures are affecting sea ice, resulting in more polar bears in the area. Also, there have been more extremely cold days in the winter, and excessively hot days in the summer, more snow storms and powdery snow. The changing weather has also affected birds laying eggs in the area. Participants felt that scientists are not sharing their knowledge about the changing climate with Inuit communities. A few things that the participants felt needed to be done are: 1) A clean up of wastes like toxins, garbage etc. needed to be done to show that change is possible and to respect the land. 2) Researchers could write a short report about their findings in regards to relevant climate change issues in the area. 3) Elder knowledge should be harvested over time in regards to climate change. Another area that should be looked into is proposed by T. Leduc: Educational sessions about IQ and science that inform and engage concerned people in Nunavut.**
Smol, J.P.; Department of Biology, Queens University	***Water assessment and climate history of lakes and ponds in northern Ellesmere Island***	Ellesmere Island, NU; Hydrology/ Limnology 	**The goal of this research is to determine if the water quality of these sites is changing due to climate change or other factors. Water quality data was collected from 55 different sites on Ellesmere Island, NU, to determine ph levels, conductivity, chemical presence, and temperature. Also collected were sediment cores, algae, and zooplankton. The data collected will be used to correlate dominant species to measured limnological variables, and subsequently used to interpret the recent environmental histories of the region using sediment cores. This data will be added to the growing database of water quality variables for the Arctic. This baseline information will assist in assessing the rate, magnitude, and direction of environmental change both within and across various regions in the Arctic.**

Proponent and Affiliation	*Project Title*	*Research Location and Category*	*2004 Results*
Warwick, V.; Department de Biologie, University of Laval	***Northern Ice Shelf Ecosystems***	Ward Hunt Island, Ellesmere Island, NU; Limnology 	**The aim of this work is to monitor long-term trends, evaluate ecological responses to the threshold effects, and to define the structure, biodiversity and functioning of northern ice shelf ecosystems (on Ward Hunt Islad) as they response to accelerated climate change. During 2004, a climate and lake monitoring station was downloaded and improved. An instrument to measure UV radiation intensity was installed, and will be used to assess potential impacts on biological systems. A climate station was prepared on Ward Hunt Island, and the sites of future limnological and microbiological measurement sites were visited by helicopter. Microscopic algae was collected from the ice shelves for DNA analysis, so as to determine what species are present. The temperature and salinity gradients were measured in Disraeli, Markham and Milne Fiord. Lakes on the ice shelf were also measured with the Fiords to assess changes in stratified aquatic environments that could be related to ongoing climate change. Plankton samples from Disraeli Fiord will indicate if the crustaceans have been impacted by catastrophic drainage and loss of the surface freshwater layer in the fiord. The stake network in the Ward Hunt region was upgraded as well.**
Zdanowicz, C.; National Glaciology Programme, Geological Survey of Canada	***Glacier-climate studies on Grinnell ice cap***	Grinnell Ice Cap, Baffin Island; Glaciology 	**The glacier was accessed by air and was then surveyed for 20 days. Observations were made of steep slopes and ice cliffs resulting from recession of the edges in recent years. 25 stakes were set up to measure snow accumulation, and were accurately measured and recorded by GPS. An average of 1.80 m of snow accumulation since the previous summer was measured. To calculate the mass of water accumulating on the ice cap the snow density was measured. An automated weather station was installed near the summit, and will require annual visits for maintenance and to downloaded data. The summit height was determined by using a temporary reference GPS and receiver. Measurements were taken by foot along 3 survey lines of stakes. This data will be compared with the height of the same survey lines recorded in the 1950s. This comparison shows significant recession and thinning. Snow samples were collected and sent out for analysis of acids, lead, cadium, mercury, and pollens. Mercury levels of 0.5-2ng/l were measured. These levels are about two times higher than snow measured on High Arctic ice caps.**

Proponent and Affiliation	*Project Title*	*Research Location and Category*	*2004 Results*
Marshall, S.; Department of Geography, University of Calgary	***A deep ice core from the Prince of Wales Icefield, Ellesmere Island***	Prince of Wales Icefield, Ellesmere Island, NU; Glaciology 	**The overall goal of this work is to make a 1000 year reconstruction of arctic climate and sea-ice variability, which involves obtaining a deep ice core. In preparation for the 2005 ice coring effort, ice-penetrating radar work, as well as high-resolution snow-pit sampling (for sulphate concentrations and sulphate isotope chemistry) was done in the vicinity of the proposed site. 158 samples were collected in spring 2004, and are presently being analyzed.**
Burges, D.; University of Alberta	***CyroSat Calibration and Validation Field Program***	Devon Ice Cap, Devon Island, NU; Glaciology 	**During 2004, data was collected from the Devon Ice Cap and will be used by the European Space Agency to calibrate the CyroSat radar satellite. This satellite measures surface elevation with a radar altimeter. A radar altimeter was mounted to an aircraft and surveyed the area. This data will be compared with field measurement s to show how the ice cap interacts with the radar signal. Using kinetic global positioning techniques, accurate measurements were taken from the transect. Also collected was the accumulation, compaction rates along with surface slopes. The data is used to calculate the long term rate of change of ice mass. The surface and near surface firn and snow properties were measured, so as to understand their interaction with the radar signal. Subsurface properties were also quantified by measuring layer thickness, density, grain size, temperature, and crystal type. 3 weather stations were also set up to record air temperature, relative humidity, net radiation, snow depth, wind speed, and wind direction. 15 HOBO™ data loggers were also set up to record air temperature only. The data from these devices will be used to provide insight into the effect of the dominant weather conditions near the surface of the ice cap.**

Proponent and Affiliation	*Project Title*	*Research Location and Category*	*2004 Results*
Koerner, R.M.; Geological Survey of Canada	***Glacier Mass Balance and Pollution***	Various Locations, High Arctic NU; Glaciology 	**Contaminant samples were taken from Penny Ice Cap, Agassiz Ice Cap and Devon Ice Cap to test for trace metals, sulphur isotopes, density and pollen levels. This data has been compared with levels that were recorded in 1998. At Penny Ice cap, there was a significant increase in ice layers with depth, due to recent warmer summers. Analysis of samples from Agassiz Ice Cap revealed a drop of pollutants by as much as 50% since the early 1990s at this site on northern Ellesmere Island. The Meighan Ice cap showed a loss of about 50 cm due to 2003 melting. Melville South Ice Cap showed a gain of ice thickness. This is the second year in a row that this ice cap showed an increase in mass, following 10 years of mass decline, stressing the increasing variability of summer climate from year to year and from ice cap to ice cap. Glacier melt on Assagiz Ice Cap, on Northern Ellesmere IslandAn ice cap, was the third highest since 1977 when records began. Devon Ice Cap, about 2km from Grise Fiord, showed less melt this summer than any year since 2000. Students from Umimmak school in Grise Fiord were showed how to use a climate station and discussed the how the glacier was responding to climatic change.**
Demuth, M.; Geological Survey of Canada	***Validation of CyroSat Satellite – New Techniques for Glacier Mass Balance Observation***	Devon Ice Cap to South Croker Bay Glacier; Glaciology (Mass Balance) 	**Field measurements were conducted on Devon Ice cap along the modeled Reference Orbit Track 12. Reference sites were set up in the dry snow/percolation zone, wet snow zone, superimposed ice zone, and the ablation zone, each with aluminum pole grids along the reference orbit track. Each grid of poles was measured precisely using a Differential Global Positioning System (DGPS). Mass balance poles were installed along the track and measured with the DGPS. Using digital photography, LASER leveling and kinematic GPS surveys surface roughness was determined. Temperature and moisture profiles within the snow pack were obtained from snow pits that went to the 2003 summer surface. Ground Penetrating Radar and Neutron Probe surveys were conducted to gather data describing near-surface structure and variation.**

Proponent and Affiliation	*Project Title*	*Research Location and Category*	*2004 Results*
Ecclestone, M.; Department of Geography, Trent University	***Mass Balance Measurements of White and Baby Glaciers, Axel Heiberg Island, NU***	White and Baby Glaciers, Axel Heiberg Island, NU; Glaciology 	**Snow accumulation ice melt were measured on the White and Baby Glaciers. The amount of ice melt in 2004 along the lower parts of the White and Baby Glaciers was not unusual (1-2m), but was greater than accumulation of snow on the glacier top, meaning that the glaciers lost mass during 2003. These results continue the trend over the past 10 years, wherein these glaciers have experienced more melting (mass loss) than accumulation (mass gain).**
Laidler, G.; Dept. of Geography, University of Toronto	***Ice Through Inuit Eyes***	Igloolik, Kingait, Pangnirtung NU; Local-Traditional Knowledge 	**This project objectives are to: 1) gain a better understanding of the meaning of sea ice to Inuit culture and Identity; 2) better comprehend the traditional and contemporary Inuit means of characterizing sea ice variability; 3) evaulate methods of collecting, analysing, and combining IQ and scientific knowledge; and, 4) establish future collaborative research/monitoring needs. Research is undertaken in Kinngait, Pangnirtung and Igloolik, Nunavut. Preliminary visits to each community were undertaken in 2003 and 2004 to discuss the project with local residents, gather concerns and observations, and refine the research plans. The researcher has conducted preliminary interviews, and is working with community members to develop maps of seasonal sea ice ice use and conditions, and to compile Inuktitut sea ice terminology.**

Proponent and Affiliation	***Project Title***	***Research Location and Category***	***2004 Results***
Ford, J; Dept. of Geography, University of Guelph	*Inuit Adaptive Strategies and Environmental Conditions*	Igloolik, Arctic Bay, NU; Local-Traditional Knowledge 	**This project aims to characterize the nature of vulnerability of Arctic communities to risks related to climate change and to identify effective adaptive management strategies. In Arctic Bay, 100 interviews with community members were conducted. 39 interviews were conducted in Igloolik. The interviews aimed to: learn from community members how climatic conditions affect them, to provide insights into the resource use options and risk management strategies employed manage these conditions, to identify those factors that influence the ability to manage risks, and to identify potential future risks and opportunities and constraints to future adaptation. Based on feedback from the community at the preliminary research stage in Arctic Bay, additional research objectives were formed regarding the links between environmental change and diet. There is widespread feeling in both communities that climatic conditions have been changing, increasing the risks associated with harvesting and reducing access to hunting areas. Both communities are managing these changes in innovative and effective ways. This adaptability is facilitated by traditional skills and extensive knowledge of the environment in which they live, strong social networks, and flexibility in seasonal hunting cycles. The transition of a traditional Inuit lifestyle to an increasingly 'southern based' waged one in the second half of the twentieth century, however, has placed many of the traditional coping mechanisms under stress.**