



Trends in Nunavut Climate Change Research: 1997 to 2004

Summary

Trends in the number, regional distribution, and thematic focus (“categories”) of Nunavut climate change research were inferred from a statistical review of research licenses issued under the Nunavut Scientists Act from 1997 to 2004. Climate change research accounted for 20% of all research licenses issued during this period, and the proportion increased over time. During the evaluation period, 83% of all Nunavut climate change research projects occurred in the Qikiqtani region (Baffin and Arctic Islands). The most prominent research themes included glaciology (ice core analysis for climate reconstruction, and mass balance studies) and paleolimnology (reconstruction of past climates from lake sediment cores). Marine and coastal environments were also the focus of significant study. A very small number of projects focused on documenting traditional knowledge and assessing the impacts of climate change on harvesting activities. Socio-economic categories such as community health, tourism, mining, fisheries, harvesting, waste management, received no research during the evaluation period.

Introduction

In 1999, the Northern Climate Exchange (NCE) initiated an assessment of the current state of knowledge about climate change in Northern Canada and its impacts in 16 economic, natural and community systems important throughout the North. The assessment revealed inequalities in the amount of existing information across systems and in the distribution of climate impact knowledge and research effort between the three Northern territories (Yukon, NWT, and Nunavut) studied. The level of climate impacts research in Nunavut was found to be underrepresented for many of the systems evaluated. In an effort to better describe the distribution of climate research projects and research gaps in Nunavut, the Nunavut office of CCIARN North 6 years of Nunavut research licensing data to determine the number of research projects that were undertaken in each of the 16 NCE subject areas in Nunavut’s three sub-regions from 1995-2001.

Limitations

The gap analysis results are derived exclusively from licenses issued under the *Nunavut Scientists Act* and do not account for climate research projects exempt from licensing under this particular legislation; for example wildlife studies undertaken by wildlife management agency staff and licensed under other legislation such as the Fisheries Act or the Territorial Wildlife Act.

Methodology

Annual compendia of research licensed in Nunavut under the Nunavut Scientists Act for the period 1995-2001 were searched for references to climate change, environmental change, global change, and global warming to identify relevant climate change projects.

Each relevant project identified was then classified by location (sub-region) and subject area (category) for each year and all years combined, using a two way matrix based on the matrix used for the NCE project. The data were analysed to determine the total number of climate change projects as a proportion of total research licenses issued in each year and for all years combined, and to determine the breakdown in climate research by region and type of research. The project had to describe, in their objective summary, an overall primary or secondary goal of assessing or contributing to the assessment of climate change, Climate monitoring, climate modeling or research that pertained to the reconstruction of paleoclimatic conditions.

To establish research area categories and sub-categories, this report has adopted those used by the NCE (Northern Climate Exchange) for simplicity. The NCE has established 15 categories under 3 major systems (The Natural, The Economic and The Community). Some of the sub-categories used by the NCE have been altered or modified to best suit the parameters of this region.

Those projects that did fit the above screening criteria were put into one of 15 main categories. The Climate Change research projects were then further divided into sub-categories according to their subject area/discipline. Because many research projects were multidisciplinary, the main resource/source of data collection used in a research project was the defining factor for selecting sub-categories. The number of research projects represented in each category and sub-category were then analyzed and compared to the total numbers of research projects conducted, and also compared to the number in each region.

Results

Overall:

Generally, climate change related research projects in accounted for 20% of all research licensed under the Scientists Act from 1997 to 2004. However, the new millennium has seen an increase in the number of Climate change research projects with over 20% representation each year except for a slight waver in 2002 which may have been due to licensing glitches.

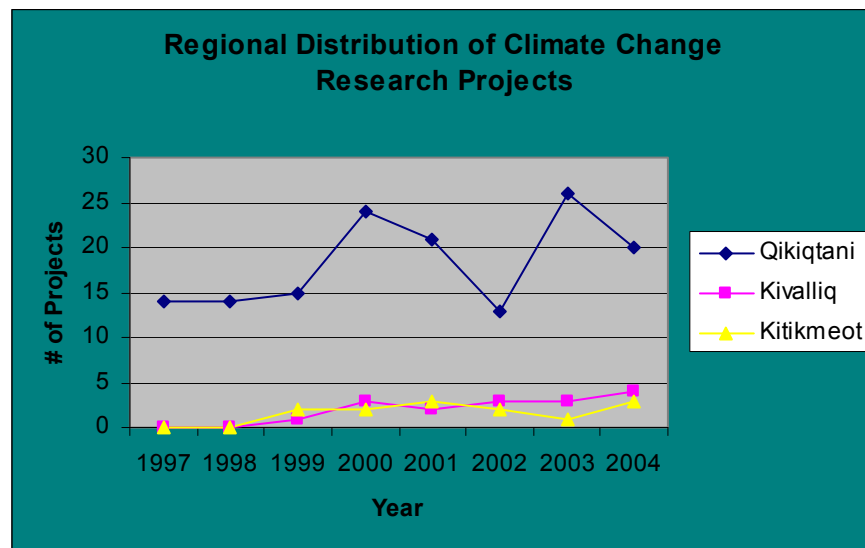
Table 1: Total number of projects related to climate change compared to total number of research projects in all of Nunavut 1997-2004.

Year	Number of climate change related projects*	Total number of projects	% of projects that are climate change-related
1997	14	116	12.0
1998	14	109	12.8
1999	16	89	17.9
2000	26	93	27.9

2001	23	81	28.3
2002	18	115	15.6
2003	28	103	27.1
2004	27	127	21.2
All years	166	833	19.9

Regional Distribution of Research:

It is apparent that the distribution of Climate Change Research projects throughout the Nunavut Territory is not equal. The region of Qikiqtani (North and South Baffin) received the majority of all the climate change research conducted. It should be noted that some research projects took place in more than one region of Nunavut; and therefore are represented more than once in regional distribution charts and tables.



	1997	1998	1999	2000	2001	2002	2003	2004
Qikiqtani	14	14	15	24	21	13	26	20
Kivalliq	0	0	1	3	2	3	3	4
Kitikmeot	0	0	2	2	3	2	1	3

Figure 1: Distribution of Climate Change research projects in the 3 regions of Nunavut and the corresponding table indicating the exact quantity of research projects in each region in each year.

Category of research:

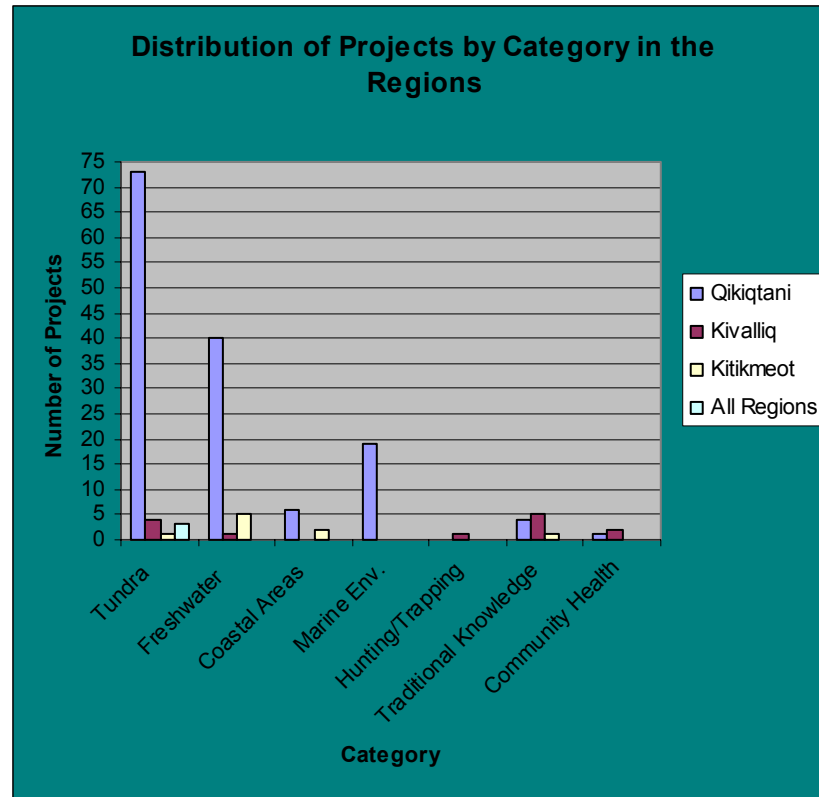
The Climate Change Research conducted in Nunavut over the time frame of 1997-2004 only touched upon 7 of the 15 NCE categories used as guidelines in this report. Five of the 7 categories were within the Natural Systems theme. Evidently, climate change research on biological systems is plentiful in Nunavut. Almost 50% of all climate change research done in Nunavut encompasses the biophysical entities of the tundra category. Contrarily, there were very little to no research conducted in fields pertaining to the Economics and Community factors of the arctic regions.

Table 2: Categories of research and their affiliated system with the number of research projects conducted in that category and their percentage.

System	Category	Total in all Regions 1997-2004	Percentage of all Climate Change Research
Natural	Freshwater	46	27.3
Natural	Tundra	81	48.2
Natural	Coastal Areas	8	4.7
Natural	Marine Systems	19	11.3
Economic	Hunting/Trapping	1	0.6
Community	Traditional Knowledge	10	5.9
Community	Community Health	3	1.8
Economic	Fisheries	0	0
Economic	Mining	0	0
Community	Tourism/Recreation	0	0
Community	Energy Development	0	0
Community	Infrastructure	0	0
Community	Transportation	0	0
Community	Waste Management	0	0

Categories of Research by Region:

Considering the breakdown of climate change research conducted in each region of Nunavut, the Qikiqtani region hosted by far the most research projects from all the categories. In the Qikiqtani region research that involved Tundra, Freshwater and Marine disciplines were predominate. This is understandable considering the region contains both North and South Baffin which contains the vast majority of the polar glaciers and ice caps in the Territory.

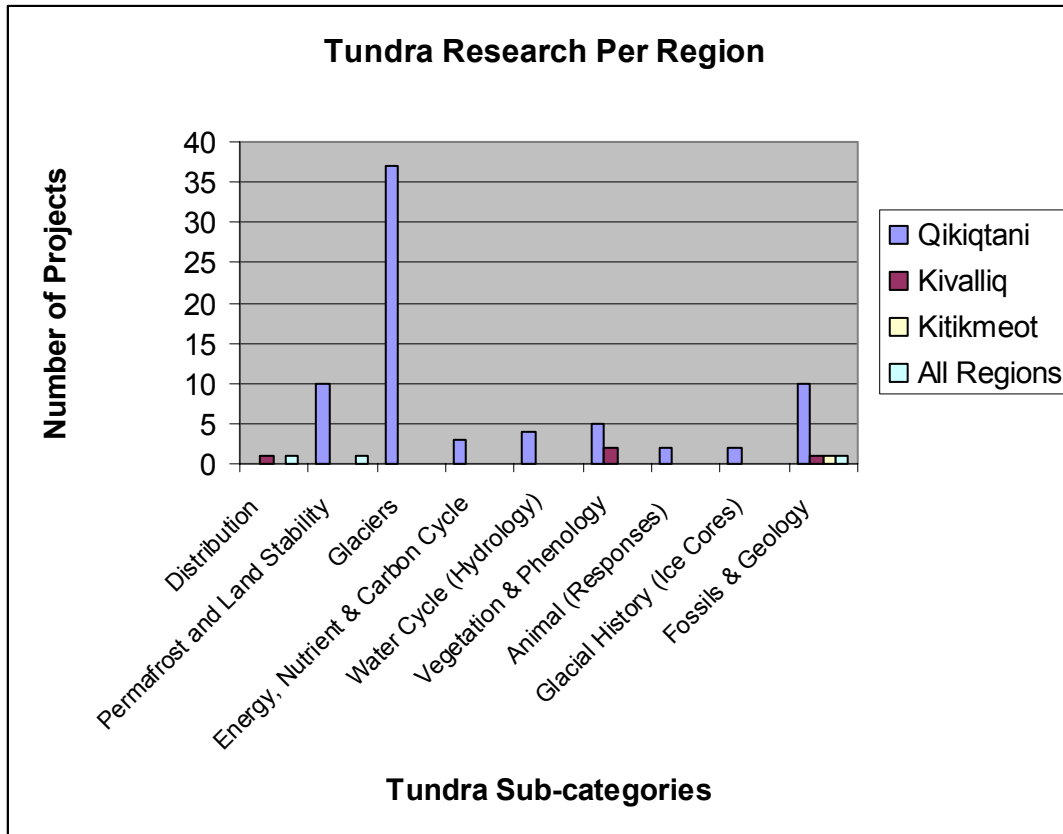


	Tundra	Freshwater	Coastal Areas	Marine Environment	Hunting & Trapping	Traditional Knowledge	Community Health
Qikiqtani	73	40	6	19	0	4	1
Kivalliq	4	1	0	0	1	5	2
Kitikmeot	1	5	2	0	0	1	0
All Regions	3	0	0	0	0	0	0

Figure 2: The distribution of projects by category throughout the regions and the corresponding table with the number of projects from each category in each region.

Tundra Category:

A closer look at the Tundra category reveals that Climate Change research involving glacial dynamics is dominant. The sensitivity of glaciers to changes in climate over time makes them useful agents to gauge trends and monitor changes. The use of Fossils and Geology as well as Permafrost and Land stability as a means of understanding the impacts of climate change were also quite prevalent. Once again the Qikiqtani region had the majority of research projects.

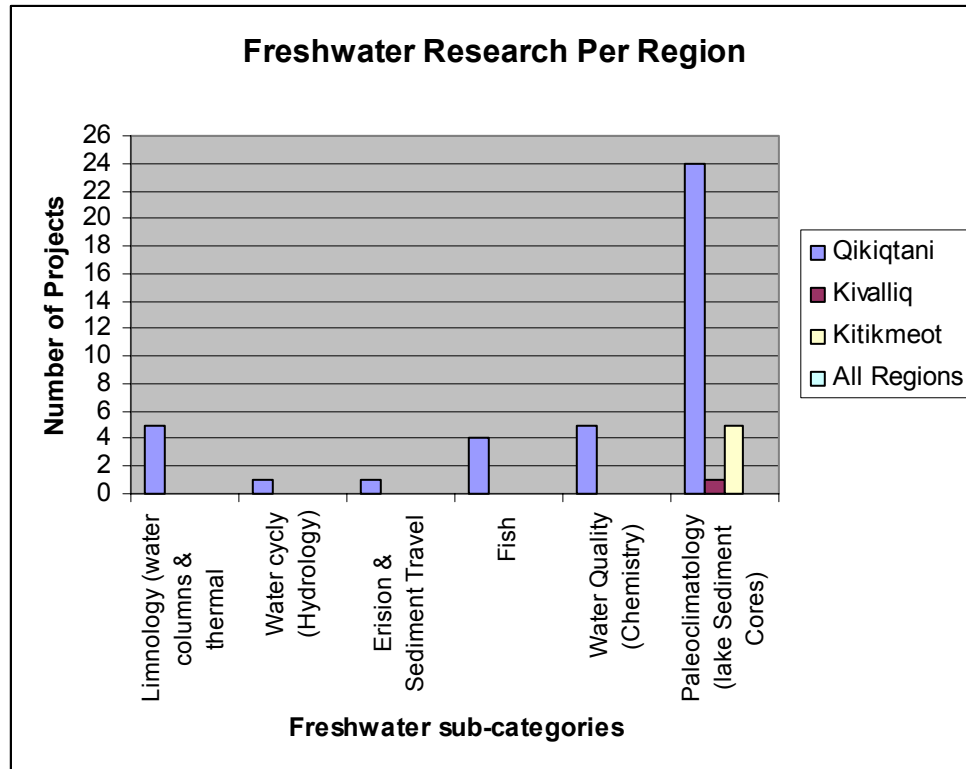


	Qikiqtani	Kivalliq	Kitikmeot	All Regions
Distribution	0	1	0	1
Permafrost & Land Stability	10	0	0	1
Glaciers (dynamics)	37	0	0	0
Energy, Nutrient & Carbon Cycle	3	0	0	0
Water Cycle	4	0	0	0
Vegetation & Phenology	5	2	0	0
Animal (responses)	2	0	0	0
Glacial History (ice Cores)	2	0	0	0
Fossils & Geology	10	1	1	1

Figure 3: The sub-categories of the Tundra subject area and the corresponding table indicating the numbers in each sub-category within each region.

Freshwater Category:

Within the freshwater category, research involving paleoclimatic reconstruction via lake sediment cores was the most abundant and occurred mostly in the Qikiqtani region with some representation in the Kitikmeot region. Research concentrating on the monitoring and measuring of present day climate scenarios were predominately conducted under the disciplines of water quality and limnological (water column & thermal regimes) research.



	Qikiqtani	Kivalliq	Kitikmeot	All Regions
Limnology (Water Column & Thermal Regimes)	5	0	0	0
Water Cycle (Hydrology)	1	0	0	0
Erosion & Sediment Travel	1	0	0	0
Water Quality (Chemistry)	5	0	0	0
Paleoclimatology (lake Sediment Cores)	24	1	5	0
Fish	4	0	0	0

Figure 4: Freshwater sub-categories and their distribution among the regions with corresponding table showing the number of research projects in each sub-category in each region.

Coastal Category:

Research in the category of coastal areas was not well represented in any of the regions in Nunavut. Only the study of sea level changes in the coastal category was utilized as an avenue to further understand variability in climate and climate changes. Six research projects occurred in the Qikiqtani region and only two in the Kitikmeot region.

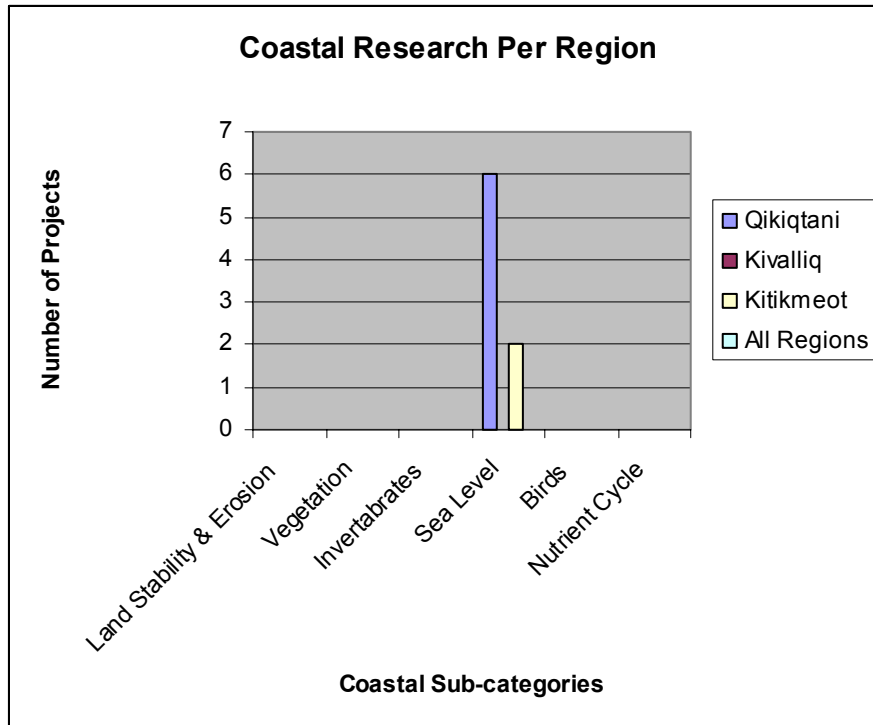


Figure 5: The number of research projects in each of the Coastal sub-categories in each region.

Marine Category:

Research in Marine environments was restricted to only the Qikiqtani Region, 100% of the projects. Sea Ice and Oceanographic features were the main two areas of research exercised in the Marine Environments. Research involving ocean water movements and dynamics were greater in number and represented 68% of all the projects. Research on sea ice and its parameters was limited and represented only 26% of the research conducted in this category. Only 1 research project studied Marine invertebrates to assess climate and climate change.

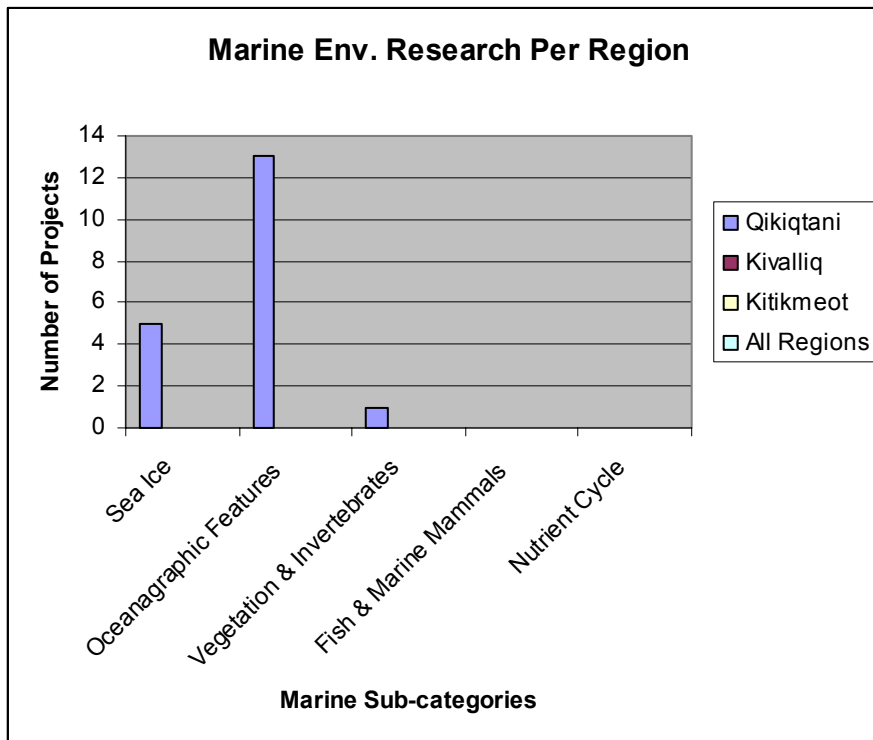


Figure 6: The number of research projects undertaken in the Sub-categories of the Marine Environment field.

Hunting & Trapping:

In the category of Hunting and Trapping, there was only one research project undertaken within the period from 1997-2004. The sole research project in the Hunting & Trapping category examined the numbers of caribou harvested and the availability of the caribou to hunters. This research was conducted in the Kivalliq region of Nunavut in 2002.

Traditional Knowledge:

Traditional Knowledge is a relatively new category being used to monitor and assess past and present climates and climate change; hence the numbers of projects are very few. All regions of Nunavut experienced at least one of these types of research; however the Kivalliq region had the majority. At this point only two sub-categories of traditional knowledge have been researched; observations and recollections of past climate and climate changes and observations and knowledge of local ecology or ecosystems.

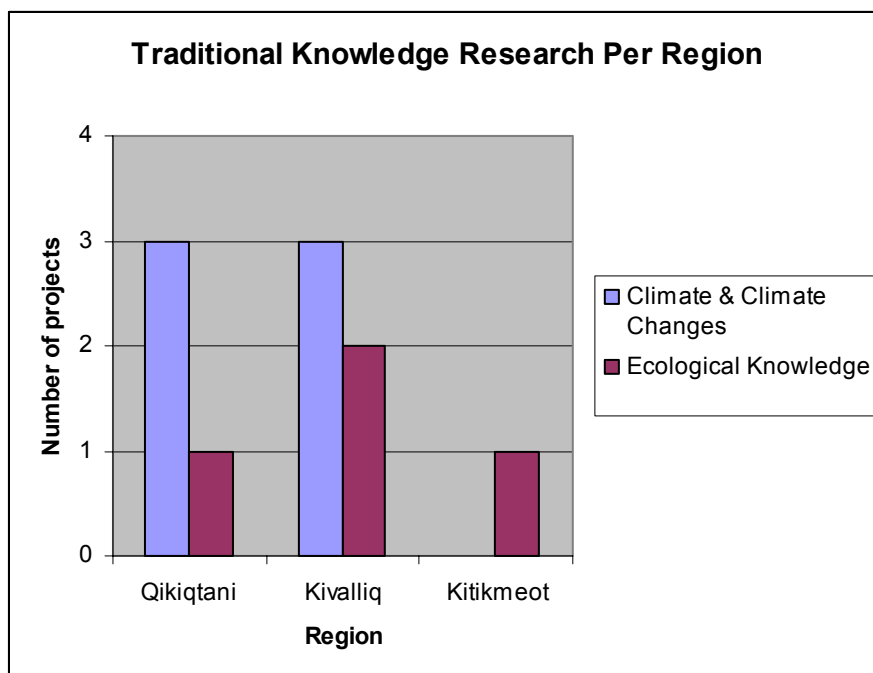


Figure 7: The number of research projects in the regions concerning traditional knowledge and the source of knowledge used.

Community Health:

A limited amount of research (3 projects) was conducted in the field of community health. The Kivalliq region experienced two projects related to community health and climate changes and the Qikiqtani region had only one. The areas of study included assessing the impacts and risks of climate change on community health and assessing the political and economic impacts of conducting climate change studies on a community.

Table 3: Number of research projects in the category of Community Health by region and by sub-category.

	Qikiqtani	Kivalliq
Impacts & Risks	0	1
Politics & Economy	1	1

References:

Environment Canada. Glacial Distribution.

<http://atlas.gc.ca/site/english/maps/freshwater/distribution/glaciers/1>. April 25,2005.

Environment Canada. http://www.ecoinfo.ec.gc.ca/env_ind/region/climate/climate_e.cfm
April 19,2005.

Global Land Ice Measurements from Space. <http://www.glims.org/Monitoring/>. April
20,2005.

Northern Climate Exchange. www.yukon.taiga.net/matrix/index . April 15,2005

APPENDIX 1

Categories Used:

Same categories were used as used by the NCE (Northern Climate Exchange) network.

- 1-Freshwater = any project dealing with: Lakes and related environments, Rivers and related environments, Biota within these water bodies, Sediment transport or erosion, Wetlands.
- 2- Tundra = any project dealing with: Land, Soils, Rocks, Fossils, Glaciers, Vegetation, and Permafrost.
- 3-Coastal Areas = any project dealing with: Coastal lakes, Inlets, Sea level changes.
- 4- Marine Systems = any project dealing with: Ocean tides/currents, Sea Ice, Marine Invertebrates /fish/mammals.
- 5- Hunting and Trapping = any project that used the products of hunting & trapping to assist in their climate related studies.
- 6- Traditional Knowledge = any project that utilized observations and verbal recollections of Inuit to assist in their climate related studies.
- 7- Community Health = any project that looked at the affects or impacts of climate related issues on the Health or socio-economy of Inuit.

Sub-Categories:

Projects were sorted into sub categories by identifying the main resource (venue) of information utilized in the research project.

Freshwater:

- a) Water column & Thermal Regimes = Limnology; biota and biophysical entities within the water column including profundal zones and litoral zones of water bodies, particularly lakes.
- b) Water Cycling = the movement/cycling pattern of water (Hydrology)
- c) Erosion & Sediment Travel = earth and sediments that have been moved by water/streams.
- d) Carbon & Nutrient Cycling = Cycling of carbon and nutrients in an aquatic system.
- e) Water Quality = water chemistry assessment.
- f) Aquatic Vegetation = plants
- g) Aquatic Invertebrates = benthic, pelagic or others
- h) Birds = Water fowl and shore birds
- i) Paleoclimatology = Lake sediment core sampling, Paleolimnology.

- j) Fish = landlocked fish

Tundra:

- a) Distribution = vegetation distribution patterns.
- b) Permafrost & Land Stability = permafrost measurements and land mass (soil/ground) movements.
- c) Glaciers = monitoring or measurements of glaciers such as glacial snow accumulation/melting/movements, mass balance.
- d) Vegetation & Phenology = Pertaining to plants, plant life cycles and growing events.
- e) Animal = responses of animals to climate changes.
- f) Glacial History = Core sampling of glaciers for reconstructing past climates, Paleoclimatology.
- g) Fossils & Geology = Sampling rocks, soils, fossils on land for knowledge of past climate.

Coastal Areas:

- a) Land stability & erosion = land mass movements and erosion in coastal waters, deltas, estuaries, etc.
- b) Birds = shorebirds
- c) Nutrient cycling & sedimentation = cycle of nutrients through the coastal waters and the sediment deposition from river discharge.
- d) Sea Level = monitoring or measuring changes in sea level.

Marine Systems:

- a) Sea Ice = core sampling sea ice or measuring changes in sea ice thickness.
- b) Oceanographic Features = tides, currents, water movements, heat distribution, salinity.
- c) Vegetation and invertebrates = marine species only.
- d) Fish & Marine Mammals = marine species or anadromous species of fish, seals, whales.
- e) Nutrient cycling = processing/cycle of nutrients in a marine environment.

Hunting & Trapping:

- a) Caribou = the use of caribou that have been hunted to assess climate related issues.
- b) Other large Ungulates = other large mammals
- c) Fur bearers = animals hunted for their skins, bear, fox, wolves etc.
- d) Marine Mammals = seals, whales.

- e) Game Birds = ducks, geese, loons etc.

Traditional Knowledge:

- a) Climate & climate changes = recording and studying Inuit observations on climate and climate changes.
- b) Ecological Knowledge = recording and studying Inuit observations on the changes in the ecosystems. Observed changes in mammal, bird or vegetation behavior or patterns.

Community Health:

- a) Impacts & Risks = assessing affects and potential problems of climate changes to the health of a community.
- b) Politics & Economy = impacts that climate change studies can have on the health and economy of a community.