ANNUAL REPORT OF RESEARCH AND MONITORING IN

# WAPUSK NATIONAL PARK

## 2007-2008

Parks Canada Parcs Canada

Canada

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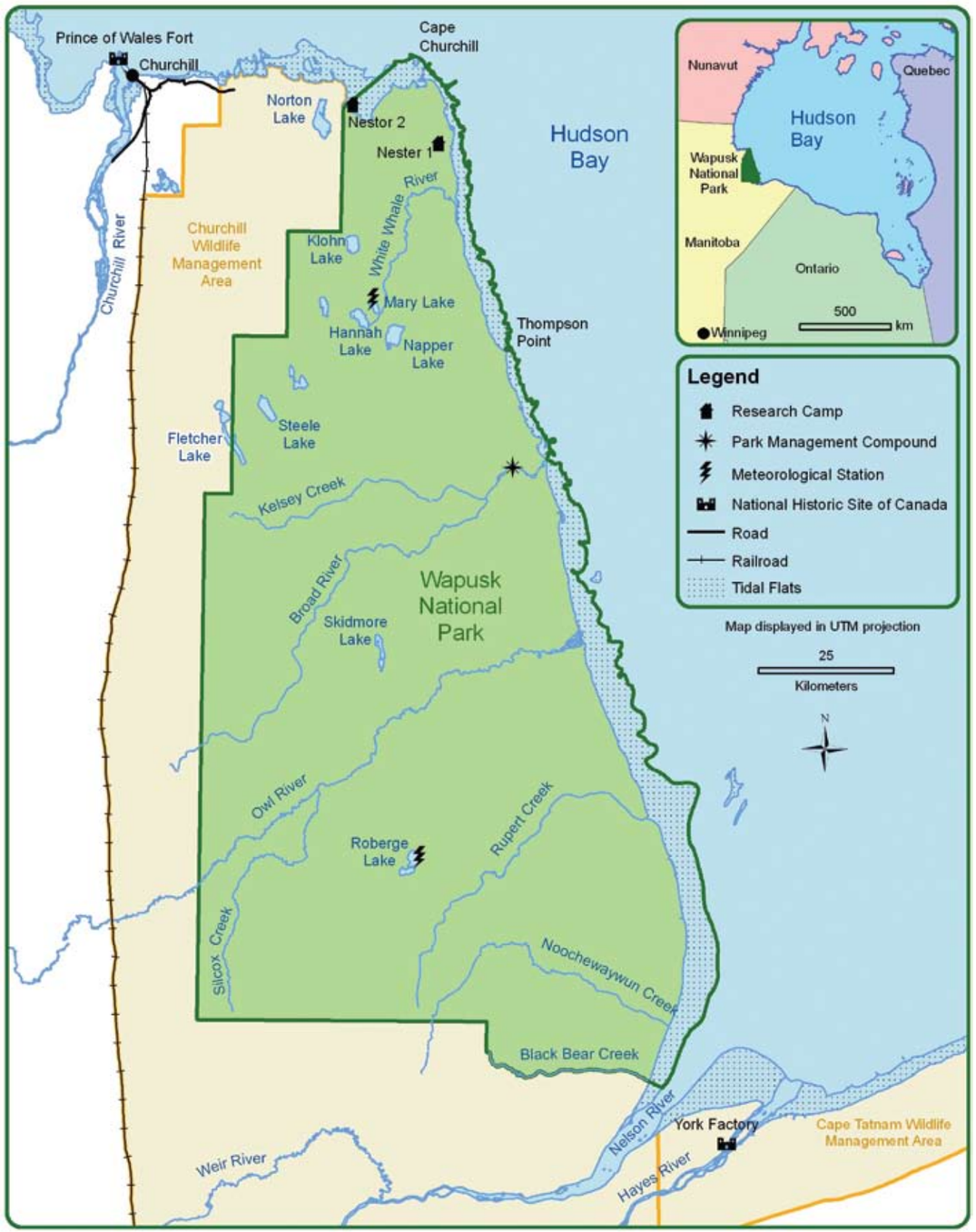


## INTRODUCTION

Research and monitoring programs are important tools that can be used to gain an understanding of ecological resources and processes in the park. Research projects enable scientists to study conditions and species within the park to determine whether they are unique or specific to this landscape or are behaving in a way that has not been documented elsewhere. Monitoring programs enable scientists and managers through repeated assessment to look at the systems and determine if they are changing over time and whether these changes are related to natural processes or are due to human impact. Monitoring also allows park managers to determine the effectiveness of management actions.

One of the most important aspects of research and monitoring is communicating the results and information to the people outside the science program, to local communities, and to assist in making other researchers aware of the research and monitoring going on in the park. With this "Annual Report of Research and Monitoring in Wapusk National Park" we have focused on research and monitoring carried on within Wapusk National Park in 2007 – 2008 fiscal year.

This report represents the first research and monitoring report for Wapusk National Park since the Wapusk National Park Management Plan was approved by the Federal Environment Minister (October 2007). The Management Plan highlights the importance of maintaining research partnerships to enhance our understanding of ecological integrity in the park.

Prior to the establishment of Wapusk National Park in 1996, partnerships played a key role in the research and monitoring initiatives that were implemented in the Churchill Wildlife Management Area. The areas of focus for these long-term monitoring programs were primarily on Polar bears, Lesser Snow geese and Canada geese. These projects were supported through Environment Canada (CWS), partners of the Hudson Bay Project and members of the Mississippi and Central Flyway Councils as well as Manitoba Conservation. These partners still remain active in monitoring those species and new monitoring partnerships have been developed to address new priorities.

The following summaries have been prepared by the various research partners to provide an overview of their research and monitoring activities in Wapusk National Park. We hope this report improves your understanding of the diversity of research and monitoring programs carried out in Wapusk National Park in 2007 - 2008. If you wish to learn more about a specific research and monitoring program you should contact the lead researcher. We welcome any questions or feedback on this program and we hope you enjoy this report.


## ACKNOWLEDGEMENTS

- Three parks (Kejimkujik National Park, Torngat Mountains National Park and the Western Arctic Field Unit ) facilitated the completion of this document through design templates and encouragement.
- All the researchers, graduate students and volunteer assistants, who put in long hours both onsite through challenging conditions and back at their institutions to ensure the success of the projects.
- The funding agencies for providing the financial support to all these people, therefore enabling the projects to be carried out.
- The Wapusk Management Board for approving all the research proposals and permits and offering helpful comments.
- The Churchill Northern Studies Centre for assisting with project administration and housing many of the researchers during their stay at Churchill.

## RATIONALE:

While classroom learning provides an important basis for understanding ecological processes and the role of humans in the environment, practical hands-on fieldwork is also a critical component of training the next generation of researchers and park managers. The Wildlife and Ethnoecology program provides the opportunity for students to immerse themselves in the Hudson Bay Lowlands Ecosystem and learn from local people. Participants in the program work together as an interdisciplinary team of researchers working to produce outcomes that are of real value to natural resource managers and the local community.

# UNIVERSITY OF MANITOBA WILDLIFE AND ETHNOECOLOGY FIELD COURSE IN WAPUSK NATIONAL PARK

## OBJECTIVES:

- Expose students to the unique ecology, wildlife, human impacts and challenges of working in Wapusk National Park.
- Develop critical thinking, communication and practical field research skills.
- Consider the role of protected areas in tourism and conservation and identify ways to use science as a tool to support management.
- Present the results of our research to Parks Canada, Manitoba Conservation and the broader scientific community through presentations and written reports.

## METHODS:

- Students spend one week at Nester One camp in Wapusk National Park and one week at the Churchill Northern Studies Centre learning and conducting research.
- Measure permafrost active layer thickness at three fen sites annually and associated vegetation cover.
- Sites are sampled and resampled to determine species and life form cover to support vegetation mapping and change detection.
- Map the locations of Arctic and Red fox dens annually. Determine if they are active each year, what species are present in each and monitor number of entrances, entrance size and vegetation cover.
- Assess tourism options for Wapusk National Park.
- Students choose individual or group research projects to conduct on an area of interest.

## YEARS OF DATA COLLECTION:

- Year 3 of a 10 year project
- Ongoing project since 2005

## PARTNERS:

- Parks Canada
- Manitoba Conservation
- Canadian Wildlife Service
- Canada Centre for Remote Sensing

## RESULTS:

- From 2005 to 2007, 56 undergraduate and graduate students have visited Wapusk National Park as part of the course and have contributed individual projects and collected field data for the permafrost active layer and vegetation datasets.
- Sampled 910 measures of active layer thickness and documented associated vegetation cover. This is the first year of a collaborative project with the Canada Centre for Remote Sensing that will attempt to predict peatland active layer thickness using ALOS satellite imagery combined with these field measures of active layer thickness.
- Developed a database of vegetation communities and permafrost active layer thickness for a total of 1,238 sites within the Greater Wapusk Ecosystem.

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Students learn about the pre-history of Wapusk National Park at an archaeological site with interpreter Karyne Jolicoeur. – Photo: Ryan Brook

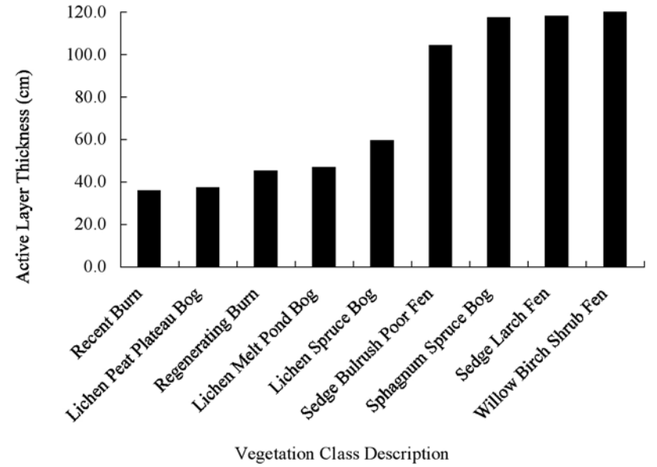



**Figure 1.** Average active layer thickness measured for nine vegetation classes within the Greater Wapusk Ecosystem.

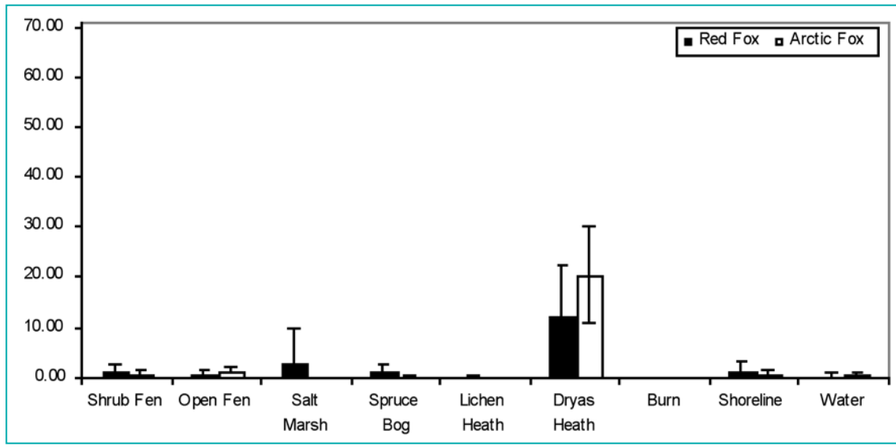



**Figure 2.**
Habitat selection of denning Arctic and Red foxes within the Greater Wapusk Ecosystem. When habitat selection ratios are greater than 1, foxes are selecting that habitat and when the ratios are less than one, the habitat is avoided.

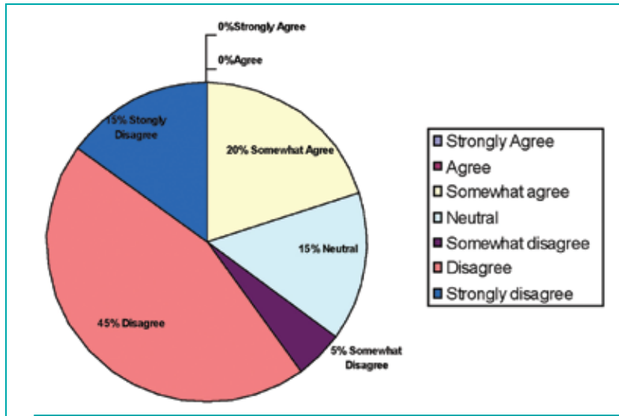
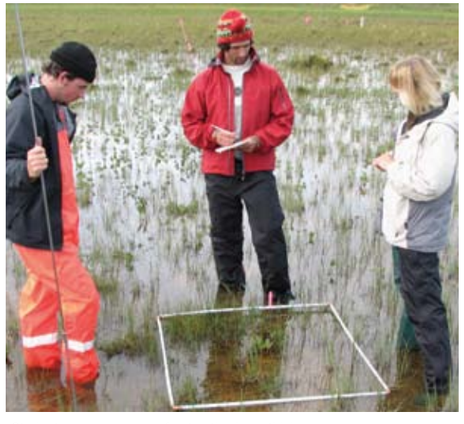



**Figure 3.** Attitudes of students participating in the field course toward the statement: *"I felt that my presence had a negative impact on the polar bear."*



Students measure permafrost active layer thickness. – Photo: Ryan Brook

## RATIONALE:

Over the past several decades, there has been documented reductions in sea-ice cover in parts of the Arctic, thinning of multi-year ice in the polar basin and seasonal ice in Hudson Bay, and changes in dates of sea-ice breakup and freeze-up as a consequence of climate warming. If the Arctic continues to warm as projected, then diminished ice cover and extended ice-free seasons will have profound negative impacts on Polar bears. As a keystone species, Polar bears provide insight into overall health of biodiversity within the Arctic marine ecosystem.

Environment Canada initiated a long-term study of Polar bears in western Hudson Bay in 1980 that has resulted in an ongoing, consistent record from which to examine past, present, and future trends and impacts. The research increases scientific knowledge of population dynamics, furthers understanding of barriers to potential recovery, and aids development and implementation of effective conservation actions.

# POPULATION ECOLOGY OF POLAR BEARS IN RELATION TO ENVIRONMENTAL CHANGE

## OBJECTIVES:

- Continue ongoing, long-term research on the Western Hudson Bay sub-population to monitor key reproductive parameters and the condition of Polar bears in order to assess impacts of climatic change.
- Obtain information on the distribution, home range, and habitat use of Polar bears out on the sea-ice during the winter and spring through the application of telemetry.

## METHODS:

- Polar bears (150 individuals in Autumn and 25 family groups in Spring) are located and captured from a helicopter using standard immobilization techniques.
- Polar bears are caught and handled in locations that are safe for their overall well-being. During handling procedures, vital signs and responses are monitored.
- Standard measurements are taken from each animal; those captured for the first time are permanently identified by unique numbers applied as both tattoos and eartags.
- Blood, hair, fat and skin samples are collected.
- VHF or satellite collars are fitted to a sample of adult females.
- A small mark is placed on the back with a removable paint that wears off over time to ensure that it is not handled more than once in the season.

## YEARS OF DATA COLLECTION:

- Ongoing Project since 1981

Polar bear, Wapusk National Park of Canada, November 1999
Photo: Bela Baliko



Triplet litter, Wapusk National Park of Canada, March 2001 – Photo: Bela Baliko

## PARTNERS:

- Environment Canada
- Care for the Wild International
- Parks Canada
- University of Alberta
- World Wildlife Fund Canada
- World Wildlife Fund International Arctic Programme
- Churchill Northern Studies Centre
- Manitoba Conservation

## RESULTS:

- Breakup of sea-ice is occurring 3 weeks earlier in the mid-2000s than in the early 1970s.
- Earlier breakup has resulted in Polar bears having less time to hunt during critical spring hunting period when seals are most abundant.
- There is a significant correlation between date of sea-ice breakup and overall condition of Polar bears when they come ashore; earlier breakup results in Polar bears coming ashore with less fat resources.
- Earlier breakup and decline in condition have had negative impacts on litter size, cub mass, age of cubs at weaning, and reduced survival of dependent young, independent juveniles, and older adults.
- The Western Hudson Bay sub-population of Polar bears has declined from 1,200 animals in 1987 to 935 in 2004; climate change likely initiated and contributes to decline.

Nick Lunn with adult male Polar bear, coastal beach ridge, Wapusk National Park of Canada, August 2004 – Photo: Bela Baliko

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## RATIONALE:

Two species of anurans, the Boreal chorus frog (Pseudacris maculata) and Wood frog (Rana sylvatica), inhabit the tundra biome near Cape Churchill, Manitoba, and potentially are susceptible to changes in vegetative structure and composition. Both species of frogs have extensive distributions, and their current distributions extend into tundra habitats at their northern boundaries.

Relatively little is known about the ecology of frogs inhabiting Arctic and Subarctic tundra, and we initiated this study to assess distribution and habitat relationships of Chorus frogs and Wood frogs in Wapusk National Park in the context of potential effects of habitat change resulting from climate change and goose herbivory.

# DISTRIBUTION AND HABITAT RELATIONSHIPS OF FROGS IN COASTAL TUNDRA AT CAPE CHURCHILL

## OBJECTIVES:

- To evaluate distribution and relative abundance of Boreal chorus frogs and Wood frogs across a tundra landscape in relation to habitat.
- To evaluate associations between frog occurrence, vegetative structure and environmental conditions.
- To evaluate the abundance of Boreal chorus frogs and Wood frogs within vegetation patches affected by Lesser Snow geese (Chen c. caerulescens) and Ross' geese (Chen rossii).
- To evaluate plausible methods for surveying frogs, including audile surveys, automated call recorders and broadcasting breeding calls during surveys.
- To assess factors influencing anuran detections diurnally and across the breeding season.

## METHODS:

- In 2004 and 2005, transect surveys from Cape Churchill south to the Broad River, and from the coast of Hudson Bay inland to the transition from tundra to boreal forest were conducted.
- In the spring and summer of 2006 and 2007, surveys at potential anuran breeding sites in two study locations near Nester One were completed to assess anuran-habitat relationships and the potential influence of goose herbivory on frog habitat quality.
- In the spring and summer of 2006 and 2007, the efficacy of potential survey methods was assessed, including broadcasting calls to elicit responses from breeding frogs and counts derived from audible surveys were compared with those from automated recorders.
- In the spring and summer of 2006, automated recorders were used to assess patterns of calling activity and related those to environmental conditions through the breeding season.

## YEARS OF DATA COLLECTION:

- Distribution data were collected in 2004 and 2005. Data regarding frog-habitat relationships and survey efficacy were collected in 2006 and 2007.

## PARTNERS:

- Mississippi Flyway Council Technical Section
- Manitoba Conservation
- Minnesota Department of Natural Resources
- Iowa Department of Natural Resources
- Missouri Department of Conservation
- Arkansas Game and Fish Commission
- U.S. Fish and Wildlife Service
- Canadian Wildlife Service
- Texas Tech University
- Texas Cooperative Fish and Wildlife Research Unit
- Minnesota Cooperative Fish and Wildlife Research Unit
- Parks Canada

Wood frog – Photo: Clint Boal

Measuring vegetation and frog breeding sites – Photo: Nick Mannan

## RESULTS:

- Both Boreal Chorus frogs and Wood frogs are distributed across the tundra landscape from the coast of Hudson Bay inland to the boreal forest, and from Cape Churchill to the Broad River, but their abundance varies across this landscape.
- Both Boreal Chorus frogs and Wood frogs selected sites where vegetation was taller, had a higher composition of sedge and willow and with relatively low pH.
- Wood frogs and Boreal Chorus frogs were found more commonly in sites with no evidence of recent goose herbivory.
- The number of frogs detected increased following broadcast of conspecific advertisement calls for Wood frogs but not Boreal Chorus frogs. Using automated recorders, we detected fewer Wood frogs but the same number of Chorus frogs when compared to simultaneous surveys with human observers.
- Both Wood frogs and Boreal Chorus frogs exhibited seasonal calling activity patterns consistent with explosive breeding behaviour. Calling activity of Boreal Chorus frog was influenced by temperature, but no meteorological variables were associated with Wood frog calling activity.

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## RATIONALE:

A key theme of the Canadian International Polar Year project "Climate Change Impacts on Canadian Arctic Tundra Ecosystems" is vegetation mapping and detection of environmental change. Changes in ground-cover and species of plants and lichens will provide indicators for changing environmental conditions and permafrost coverage.

Plant and lichen collections were made near permafrost wells (Nester One and Fletcher Lake) to detect changing conditions. This information will document floristic characteristics; serve as a basis for conservation planning; and provide baseline data on the distribution of rare species..

# BOTANICAL SURVEY OF WAPUSK NATIONAL PARK: ESTABLISHMENT OF VEGETATION MONITORING SITES

## OBJECTIVES:

- To select appropriate locations for vegetation plots for long-term monitoring.
- To sample vegetation by habitat type.
- To provide an inventory of plant and lichen species.

## METHODS (MODIFIED FROM IPY CICAT):

- Sites (90m x 90m), were selected near the proposed or actual permafrost wells.
- Permanently marked plots (30m x 30m) were chosen within the 90m x 90m sites to record vegetation communities.
- Five 1m x 1m quadrats were laid out within each plot; circular plots represented the shrub community and forested habitats.
- Percent ground cover was recorded for each species in each quadrat.
- Other features recorded were tree/shrub height, substratum for bryophyte/lichen and growth forms.

## YEARS OF DATA COLLECTION:

This is the first and only year for the ecological integrity monitoring. The botanical inventory is in year six of a ten-year project.

## PARTNERS:

- Parks Canada
- University of Manitoba

## RESULTS:

- 127 species of vascular plants, 87 lichens and 34 bryophytes were recorded.
- The Nester One sites consist of alternating beach ridges and low-lying fens.
- Beach ridge plants; White mountain-avens, Glacier sedge, Purple saxifrage, Canada buffaloberry, Lichens; White-worm, Yellow snow, Witch/Foxhair, Sunburst and Black crustose lichens.
- Fen plants; Water-sedge, Cespitose club-rush, Red bearberry, Trailing and Net-veined-willow, Lapland-rosebay, Bog-whortleberry and White mountain-avens. Mosses; Brown bog, Forest-floor, Broom, Black golf-club moss, Thyme, Thread mosses and a Thalloid liverwort. Lichens; Pixie-cups, Saucer lichens, Oakmoss, Rim lichens, Shield, Starburst, Brown and Yellow ruffle, and Tube lichens.
- Fletcher Lake consists of polygonal peat plateaux, shallow troughs, small ponds, with Tamarack, Black spruce, Flat-leaved willow, and Dwarf-birch and other vascular plants. Lichens; Yellow snow, Witch/Foxhair, Iceland, Tundra-horsehair, Reindeer, Pink-candy, Wart, Saucer, Rim, Oakmoss, Brown/Yellow ruffle, Tube, Horse-hair, Camouflage, and Green pelt lichens. Mosses: Forest-floor, Broom moss, and three Peat mosses.

Fletcher Lake showing recording of species for lichen-covered polygons (background) and a vascular plant dominated low-lying area. – Photo: David Punter

Fletcher Lake showing peat polygons – Photo: David Punter

Nester One showing general habitat, recording of species and ground cover. – Photo: David Punter

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Quadrat at Nester One showing plant and lichen diversity on beach ridge. – Photo: David Punter

## RATIONALE:

Breeding Eastern Prairie Population (EPP) Canada geese occur in their highest densities along western Hudson Bay, but have experienced localized declines in nest density over the last 30 years. Concurrently, breeding Snow geese have expanded their nest distribution and increased in abundance considerably in northern Manitoba. Little information exists on the direct or indirect interactions of large populations of Snow geese with other bird species, particularly nesting EPP Canada geese.

Interactions among nesting birds are often realized indirectly through local dynamics among shared predators and prey. Large groups of nesting Snow geese likely modify the abundance and behaviour of goose nest predators (e.g. Arctic fox), thus potentially indirectly influencing the survival of Canada goose nests.

# INTERACTIONS BETWEEN NESTING CANADA GEESE AND LESSER SNOW GEESE

## OBJECTIVES:

- To test competing hypotheses of how aggregations of nesting Snow geese affect nest survival of co-occurring Canada goose nests at 2 study sites in Wapusk National Park.
- To test which factors, including habitat type and Snow goose nest density, influence the spatial distribution of Canada goose nests at 2 study sites over the previous 8 – 30 years.
- To assess what factors influence the distribution of nesting EPP Canada geese across their range, and identify how their spatial distribution at a landscape scale has changed over time, especially in relation to increasing aggregations of Snow goose nests.

## METHODS:

- Data was collected (2005 – 2007) on Canada goose and Snow goose nest distribution, density, and fate (e.g. successful versus unsuccessful nest), predator pressure on nests, Arctic fox den occupancy and Arctic fox alternative prey abundance (e.g. lemmings), to model factors influencing the survival of Canada goose nests.
- Spatial coordinates of goose nests were collected with a global positioning system (GPS), and spatial statistics for point patterns were used to evaluate the relative spatial distributions of Canada goose nests, Canada goose nest fate and Snow goose nests at multiple spatial scales.
- A long-term dataset (1976 – 2006) was used and habitat variables derived using a geographic information system (GIS) to test hypotheses of factors influencing the density of nesting Canada geese in the coastal tundra landscape.
- Snow geese and Canada geese were assessed to determine whether they exhibit differences in nest habitat use and distribution at a spatial scale larger than that of historic study areas using aerial survey data (1981 – 2003).

Processing a successfully hatched Canada goose nest.
Photo : Tim Pearson

Weighing a Canada goose egg – Photo : Matt Reiter

## YEARS OF DATA COLLECTION:

Primary data collection for this project was completed in 2007. Historical data have been collected since 1976.

## PARTNERS:

- Mississippi Flyway Council Technical Section
- Manitoba Conservation
- Minnesota Department of Natural Resources
- Iowa Department of Natural Resources
- Missouri Department of Conservation
- Arkansas Game and Fish Commission
- U.S. Fish and Wildlife Service
- Canadian Wildlife Service
- Parks Canada

## RESULTS:

- Canada geese nesting close to Snow goose nests and those nesting further away suffer different probabilities of nest survival.
- However, Canada geese appear to benefit from Snow goose nests when Snow geese are abundant but suffer reduced nest survival when there are few Snow goose nests.
- Density of nesting Canada geese is strongly influenced by the proximity of adequate habitat to raise their young.

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## RATIONALE:

The partnership with Wapusk National Park and Parks Canada staff on this project will demonstrate the important role that polarimetric RADARSAT-2 can play, as a sole and primary data source, for monitoring the ecological integrity of wetlands in northern national parks, and assessment of the negative effect of climate change on northern wildlife habitats. Parks staff will participate in collection of the field measurements and the assessments of the accuracy of the final results obtained with polarimetric RADARSAT-2 and Advanced Land Observing Satellite (ALOS) on the characterization and mapping of the park wetlands and their surrounding environment. Depending on the outcome of this work, the Radarsat-2 based approach, could serve as a common baseline for assessing wetland ecosystem change at local (ground plots) and landscape (remote sensing) scales in Arctic national parks.

# POLARIMETRIC RADARSAT-2 FOR OPERATIONAL MONITORING OF WETLANDS AND THEIR SURROUNDING NATURAL ENVIRONMENTS

## OBJECTIVES:

- Investigation of polarimetric ALOS and RADARSAT-2 data for park wetland mapping and monitoring.
- Investigation of the complementarity of L and C band for wetland characterization using ALOS and RADARSAT-2.
- Investigation of polarization information and permafrost active layer thickness for fen-bog discrimination and for treed upland/bog separation.
- Investigation of interferometric ALOS for permafrost active layer thickness measurement.

## METHODS:

- RADARSAT- 2 and ALOS polarimetric capability provides unique information for target scattering classification. This significantly improves the characterization of wetlands and their surrounding natural environment.
- The Touzi decomposition will be investigated for characterization and classification of wetlands.
- Previous application of the Touzi decomposition on the Mer Blue wetland site led to the conclusion that the Touzi scattering type phase $\Phi\alpha s$ of the dominant scattering may be very promising for wetland classification, and in particular for poor fen-bog discrimination.
- This analysis will be validated in this study and the complementarity of L and C band information provided by ALOS and RADARSAT-2 will be investigated for optimum characterization of the park wetland indicator and the operational use of these satellites for better monitoring of ecological integrity and assessment of the impact of global warming on the park habitat.

## YEARS OF DATA COLLECTION:

- Year 1 of a 3 year project

## PARTNERS:

- Parks Canada
- Canadian Space Agency: partial funding under the Earth Observation- Government Related Initiatives Program (GRIP) project
- University of Calgary: Ryan K. Brook

## RESULTS:

- Ground field measurements were collected during the week of the 16th of August 2007.
- This field data will be used to validate the Japanese ALOS Phased Array L-band Synthetic Aperture Radar (PALSAR) image data collected on the 16th of August 2007.
- To date the work is still in progress with the analysis of ALOS PALSAR data in collaboration with Ryan Brook and Sheldon Kowalchuk.

Ryan Brook, Murray Gillespie and a student collecting information for ground control plots

University of Manitoba students collecting active layer depths for ground control plots

Dr. Touzi and a student

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## RATIONALE:

With increasing evidence that global warming is influencing Arctic regions, understanding the behaviours of Polar bears during this period is critical to the conservation of this species. Thirty years ago a behavioural study of Polar bears conducted from the Cape Churchill tower found that older bears spatially clumped into groups and inhabited the coastal areas, whereas subadult males occurred more inland (near the tower) and females with cubs avoided the area (Latour 1981). It has been suggested (Stirling, pers. comm.) that the sex/age distributions of bears has changed since this previous study as a direct consequence of global climate change.

# NON-INVASIVE OBSERVATION OF FREE-RANGING POLAR BEARS NEAR CAPE CHURCHILL IN WAPUSK NATIONAL PARK

## OBJECTIVES:

- Thus, an objective of this study is to collect time budget and spatial data of different age/sex bears in the Cape tower region and compare them to the data from the 1977 study.
- A second objective of our study is to assess the use of the remote cameras as an education tool in science, with the long-term goal of integrating Polar bear research with education organizations globally.

## METHODS:

- Three remote-controlled cameras (SeeMore Wildlife Systems, Homer, Alaska: www.seemorewildlife.com) were installed by Polar Bears International on top of an observation tower at Cape Churchill.
- Fifty-four undergraduate students ranging from 1st year to 4th year, were recruited to collect behavioural data.
- Polar bear behavioural data was collected using scan (all behaviours of all bears were collected every 15 minutes) and focal (all behaviours of a single bear were collected for 15 minutes) data collection.

## YEARS OF DATA COLLECTION:

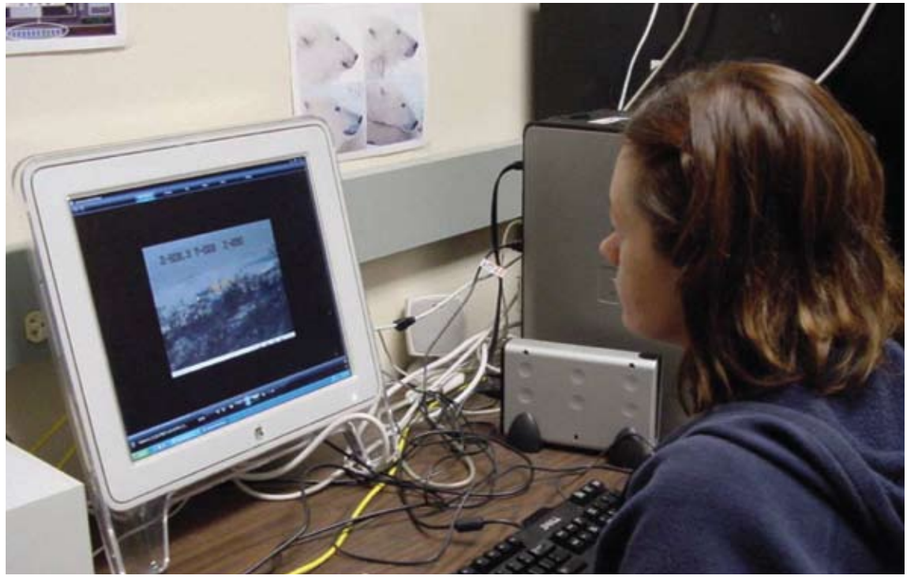
- Ongoing Project since 2006

## PARTNERS:

- Polar Bears International
- University of Central Florida

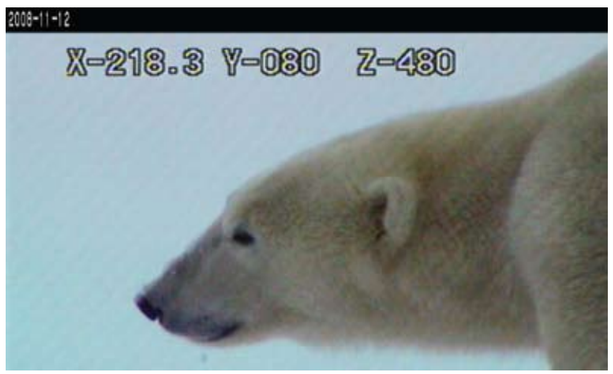
## RESULTS:

- Data from 2008 have not been analysed. However data from 2007 is available. We collected 194.25 hours of observational hours, of which 32 hours were excluded from analysis because either cameras not functioning or fog impeded observations.
- On any given 15-minute scan survey, the observer (student) had a 64.9% chance of observing a Polar bear.
- The pattern of detection of bears throughout the day was bimodal, with more bears seen early and late than during the midday period.
- The behaviour of bears during observations was similar to bears in the tourist region of Gordon Point (Ehkardt 2005), with lying being the most common behaviour (45%) and walking being the next most common (30%).
- We expected the activity of bears would increase with decreases in ambient temperature. However, when we compared the detection of bears with average temperatures during the sampling periods (downloaded from Environment Canada), we did not find a tight relationship.



Student collecting behavioural data in the laboratory. Photo: UCF Polar Bear Project


Two bears resting after a play interaction, taken via remote. Photo: UCF Polar Bear Project




Facial image of polar bear taken via remote cameras. Photo: UCF Polar Bear Project

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## RATIONALE:

The Hudson Bay Lowlands contain the most extensive wetlands and thickest peat deposits in Canada. The region is home to unique concentrations of wildlife, most notably Polar bears, caribou, and migratory birds. This wetland environment includes permafrost but the ecological role of permafrost in a peatland setting is not clear. Bears rely on inland denning habitat, caribou are tied to peatland vegetation and birds intensively graze coastal herbaceous tundra. How the disappearance of permafrost under a change in climate would effect this fauna and the wetland environment the fauna depends upon is unknown.

In conjunction with research staff of Wapusk National Park, the role of permafrost in maintaining ecosystems, governing visitor accessibility and determining vulnerability of heritage properties to climate change will be investigated. The results of this research will be used to anticipate the behaviour of important species, in particular migratory birds and Polar bears, manage access to the park and adjacent lands by visitors and devise strategies for heritage site maintenance.

# IMPACTS OF PERMAFROST DEGRADATION ON THE ECOLOGY OF WAPUSK NATIONAL PARK

## OBJECTIVES:

- Characterize the temperature and distribution of permafrost from coastal to inland sites across Wapusk National Park.
- Improve the accuracy of the wetland classification map for Wapusk National Park.
- Prepare a permafrost distribution map for Wapusk National Park and vicinity.
- Document past changes and forecast future changes in wetland habitat.

## METHODS:

- Thermistor cables will be installed at representative locations to document the ground thermal regime.
- Measurement of ground electrical conductivity will be used to extend measurements made at specific locations with thermistor cables.
- Remote sensing, in particular black and white air photography, satellite radar and optical wavelength imaging will be used to map attributes of the terrain that control permafrost distribution.
- Vegetation communities will be identified by ground plot surveys to help in the interpretation of remote sensing data.
- Permafrost will be mapped using GIS-based computer modeling that incorporates ground surface vegetation and moisture distribution into a calculation of how much heat enters or leaves the ground.

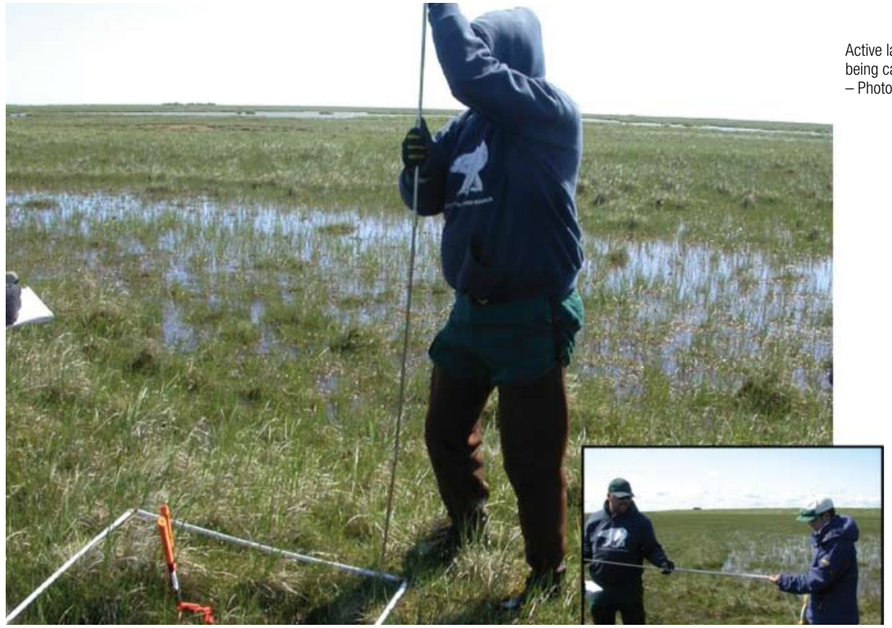
## YEARS OF DATA COLLECTION:

- Year 1 of a 3 year project

## PARTNERS:

- Geological Survey of Canada
- Canada Centre for Remote Sensing
- Churchill Northern Studies Centre
- Parks Canada

Fenlands near Nester One – Photo: Yu Zhang



Active layer probing and vegetation description being carried out in fenlands near Nester One – Photo: Yu Zhang

## RESULTS:

- Review of existing ground temperature data in the Churchill area indicates that permafrost begins to form in the tidal zone and is well established at the high tide level.
- However, although permafrost is mapped as continuous in the Churchill area, snow accumulations in depressions and willow stands provide enough insulation to remove permafrost.
- Thermistor cable installation near Fletcher Lake (70 km south of Churchill and 50 km inland from the coast) in April, 2007 provides an additional indication that permafrost distribution is very sensitive to lake depth and presence of snow drifts.
- Based on analysis of black and white airphotos taken in 1948, 1973 and 2005, there are indications of general drying: decreasing areas of open water in individual tundra lakes; rare cases of complete drainage of lakes; increasing extent of raised bog as indicated by light tones on B&W photos.
- Preliminary analysis of radar and optical imagery suggests that year-to-year and seasonal wetland changes can be detected. Detailed analysis of these imagery types will help to verify if lake water level changes are seasonal or are occurring over longer time intervals.
- Preliminary modeling of ground temperature changes shows that permafrost will approach the melting temperature if climate warms according to global circulation modeling predictions. However, the distribution of permafrost in the wetter areas is not well understood and must be determined before permafrost response to climate change for the entire park can be predicted.

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Drilling borehole for thermistor cable installation, peatlands near Fletcher Lake – Photo: Wendy Sladen

# NON-INVASIVE POLAR BEAR MONITORING IN WESTERN HUDSON BAY

## RATIONALE:

Polar bears in Western Hudson Bay are already being affected by changing ice and climate conditions and need to be monitored to track population changes over time. During summer when the ice melts, Polar bears are forced ashore in large numbers, where they leave scat (feces) and hair (in beds) as they move across the tundra. Using molecular analyses of scat (collected using a trained dog) and hair we employed an innovative way to estimate abundance, survival and other population parameters of Polar bears so that no animals needed to be handled or marked. Data are then analyzed using the same mathematics as traditional capture-mark-recapture approaches allowing for direct comparison of results.

With longer ice-free seasons, Polar bears will likely seek alternative foods while on land. By documenting items in scat piles, we can identify past and future shifts in diet, especially in response to changing food supplies.

## OBJECTIVES:

- Monitor local population size of Polar bears within the sampling area.
- Determine individual and sex-specific movement patterns of Polar bears along the coast of western Hudson Bay.
- Examine relatedness of Polar bears that gather in large groups along the coast or that den in clusters.
- Establish baseline data on Polar bear diet during the ice-free season to document past and future shifts in response to climate change.

## METHODS:

- Complete molecular analyses of hair (from beds and dens) and scat (collected using a trained dog) to generate DNA fingerprints for individual Polar bears.
- Use traditional mark-recapture and rarefaction analytic approaches to estimate abundance and survival of Polar bears using DNA fingerprints from samples.
- Use spatial coordinates, DNA fingerprints and sex-specific markers to track movement patterns of bears while on land.
- Use both nuclear and mitochondrial DNA to examine relatedness of bears from hair collected from clusters of beds or dens to infer genetic structuring across the landscape.
- Identify and quantify both vegetation and animal items in Polar bear scat piles; compare data with previous studies to document foraging shifts that may have occurred in the last 40 years, perhaps due to climate change.

## YEARS OF DATA COLLECTION:

- Year 3 of a 3 year project

## PARTNERS:

- American Museum of Natural History
- Arctic Institute of North America
- Churchill Northern Studies Centre
- City University of New York
- Great White Bear Tours
- Manitoba Conservation - Sustainable Development Innovations Fund

## RESULTS:

- We collected a total of 896 samples (476 hair, 420 scat) from the west coast of Hudson Bay and inland denning sites in 2007.
- We collected a total of 1,602 samples since the project began in 2006.
- Polar bear DNA has been successfully amplified from both spring and summer scat samples; further genetic analyses are currently ongoing.
- 362 scat piles were analyzed for diet; geese and caribou remains were found more frequently than in a previous study.

Linda Gormezano collects hair from a Polar bear den dug into the banks of Skidmore Lake in Wapusk National Park. – Photo: RF Rockwell

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Linda Gormezano and her scat detection dog, Quinoa, look for scat east of Churchill. – Photo: RF Rockwell

## RATIONALE:

There is a lack of information on the past and present climate in Wapusk National Park. Prior to the start of this project, there were no permanent weather stations within the park. Mid-winter snowpack conditions significantly impact ecological and permafrost characteristics.

# PAST/PRESENT CLIMATE – PERMAFROST STATUS: ASSESSED BY GROWTH RINGS, MICROCLIMATE AND SNOWPACK

## OBJECTIVES:

- Establish and maintain microclimate monitoring stations.
- Establish snowpack monitoring sites.
- Develop a proxy climate record using annual growth rings of trees and shrubs.
- Produce a record of permafrost thaw using annual growth rings.

## METHODS:

- Install and maintain microclimate recording stations that operate year-round. Sensors measure snow depth, rain, wind speed, wind direction, air temperature, air relative humidity, near surface soil and permafrost temperature.
- Using Adirondack snow core and RAM penetrometer equipment, measure snowpack depth, density, snow water equivalent and hardness.
- Annual growth rings in shrubs and trees can be used to reconstruct past climate and permafrost thaw.
- Growth rings from dead trees and shrubs in thaw ponds can be cross-dated with live individuals to establish the date of death which coincided with ponding of water upon permafrost thaw.

## YEARS OF DATA COLLECTION:

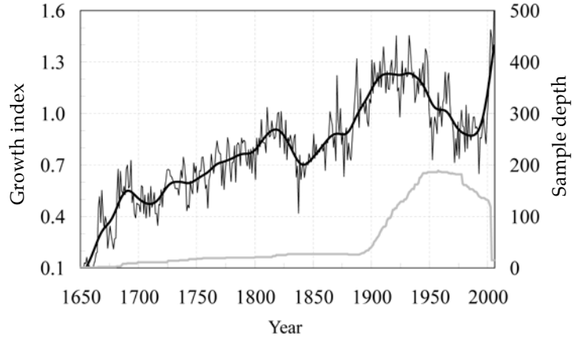
- Year 4 of a multi-year project
- Ongoing project since 2004

## PARTNERS:

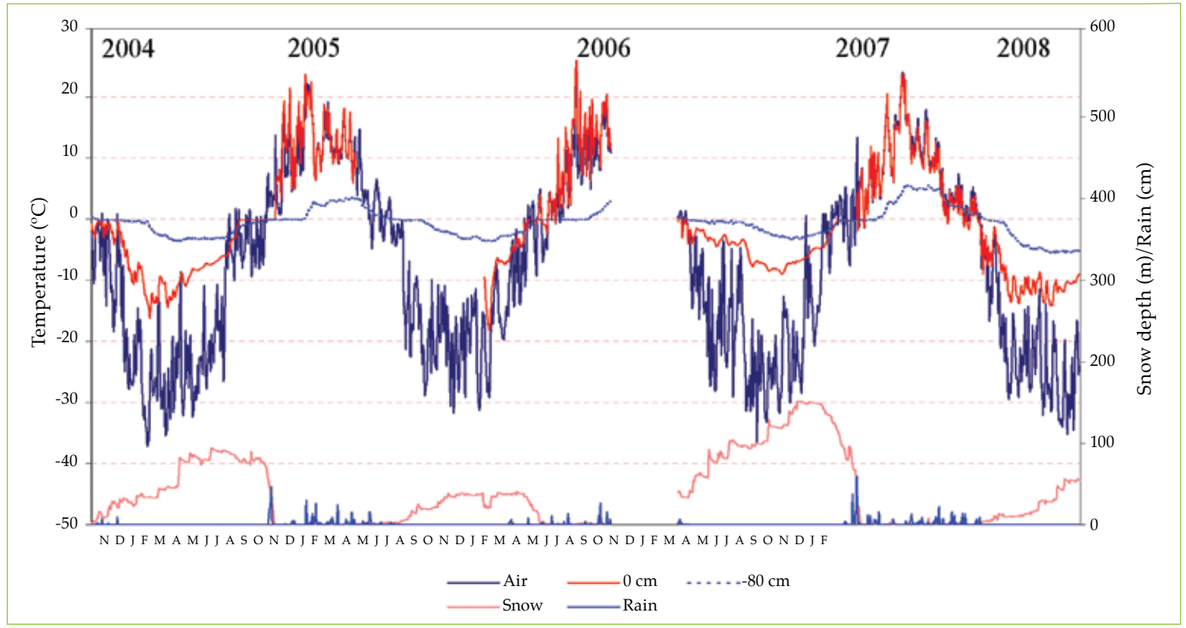
- International Polar Year – PPS Arctic Canada, Government of Canada
- University of Alberta
- Churchill Northern Studies Centre
- EarthWatch International
- Parks Canada

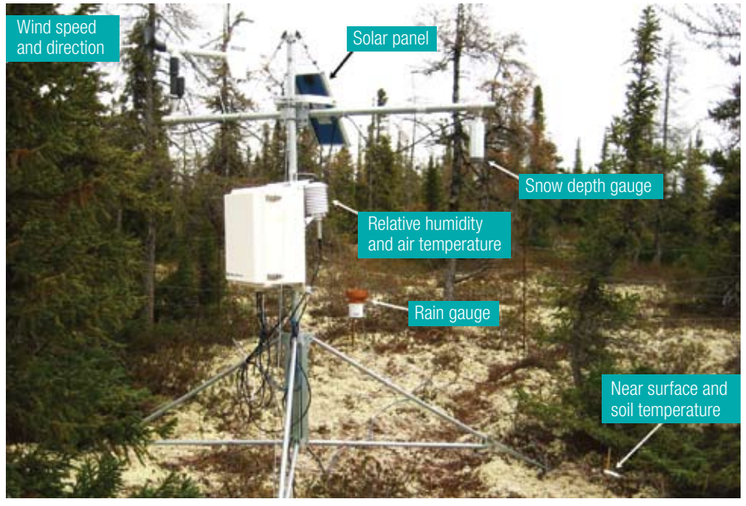
## RESULTS:

- Two microclimate stations have been established within Wapusk National Park – Mary Lake and Roberge Lake.
- Permanent snowpack monitoring sites have been established in association with the microclimate stations.
- A preliminary dendroclimatology interpretation has been completed based on 220 trees sampled along a transect running through the center of the park in addition to a number of treeline sample sites.




This multi-species tree ring chronology reveals periods of enhanced and suppressed growth back to ~1650 (bottom line is sample depth or sample size). The dark line (spline which preserves 50% of the variance at wavelengths of 10%) is a smoothing of the lighter, more variable growth index line. The data confirm a positive response to warming. Credit – Steve Mamet.




Mary Lake microclimate station (June 2007). The site is a mixed stand of White & Black spruce with Tamarack on a subdued beach ridge surrounded by polygonal peat plateaus. – Photo: Peter Kershaw.

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A snow profile was described at each of the snow sampling sites (Feb. 2008).– Photo: Peter Kershaw

# ECOLOGY AND IMPACT OF LESSER SNOW GEESE

## RATIONALE:

Traditional knowledge indicates Lesser Snow geese have nested at La Pérouse Bay since at least 1933. We began studying the colony of 2,500 pairs in 1969 and have seen it increase numerically to >50,000 pairs and geographically from 4 km2 to more than 300 km2, extending now to at least the Broad River. The goals of this long-term study are to examine the interplay of this keystone herbivore and its habitat, especially in response to increases in goose numbers and climate change.

## OBJECTIVES:

- Monitor the size and nesting density of Snow geese.
- Determine the impact of Snow geese on vegetation and other animal species.
- Ascertain the recovery potential of degraded salt and fresh water habitat.
- Examine whether reproductive success changes over time and space and relate this to habitat quality.
- Estimate survival of adult Snow geese and determine its dependency on habitat quality.

## METHODS:

- Conducted aerial surveys of nesting colony boundaries.
- Monitored permanent nesting plots.
- Scored 12 recovery exclosures and associated control plots.
- Collected soil samples and returned them to lab for analyses.
- Established an aerial survey for Arctic foxes.
- Continued aerial photography of brood flocks started in 1995.
- Continued standard banding and recapture operation.

## YEARS OF DATA COLLECTION:

- Ongoing project since 1969

## PARTNERS:

- American Museum of Natural History
- Arctic Goose Joint Venture
- Central and Mississippi Flyway Councils
- Canadian Wildlife Service
- Great White Bear Tours
- US Fish and Wildlife Service
- Parks Canada

## RESULTS:

- The nesting density has stabilized at 4 to 8 nests/hectare.
- The colony boundaries have expanded in the Thompson Point region.
- A new colony may be starting at Rupert Creek.
- After only 2 years, there is some recovery in exclosed, degraded freshwater habitat.
- There is no recovery in exclosed, degraded salt or supratidal marsh.
- 5,072 Snow geese were processed during banding (726 were recaptures).
- Reproductive success was low (juvenile:adult=0.54).
- Detection probability of fox dens is estimated at p>0.9.
- All occupied fox dens visited were littered with Snow and Canada goose remains.

Nesting density transect being scored in a sedge meadow east of the La Pérouse Bay Research Station. – Photo: RF Rockwell

Flocks of approximately 500 Lesser Snow geese are captured using a helicopter and fleet-footed students during banding operations – Photo: RF Rockwell

The remains of both Snow and Canada geese were found at most occupied Arctic fox dens. – Photo: RF Rockwell

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## RATIONALE:

As the numbers of Lesser Snow geese in Wapusk National Park have increased, their destructive foraging has degraded local habitat. Since their continued success depends on the quality of the habitat, one might expect their survival and reproductive success to decline. This should limit the population's growth and control the population's size through density-dependent regulation. For that to happen, however, the geese must remain in the degraded areas. Our long-term research at La Pérouse Bay indicates this is not likely.

# EXPANSION OF LESSER SNOW GOOSE NESTING IN WAPUSK NATIONAL PARK

## OBJECTIVES:

- Establish and annually monitor the entire coast of Wapusk National Park and the inland interface of the tundra and boreal forest for nesting Lesser Snow geese.
- Perform a preliminary ground inventory of any location that has more than 1 nest/hectare.

## METHODS:

- Surveys are flown in a Bell 206B Jet Ranger at 30 to 50 m and 100km/hr.
- GPS locations of any nesting Lesser Snow geese are recorded.
- Any area with an apparent density of >1 nest/hectare is circled and may be examined from the ground.
- Areas recorded as having been used are specifically checked.

## YEARS OF DATA COLLECTION:

- Ongoing project since 2005

## PARTNERS:

- American Museum of Natural History
- Arctic Goose Joint Venture
- Central and Mississippi Flyway Councils
- Canadian Wildlife Service
- Great White Bear Tours
- US Fish and Wildlife Service
- Parks Canada

## RESULTS:

- The Thompson Point Lesser Snow goose colony now extends from just south of the White Whale River to just north of the Broad River.
- The highest nesting density at two points – one north and one south of Thompson Point.
- Nesting is suspected in the Rupert Creek region for the first time in 2007 and will be re-examined from the air and ground in 2008.

The coast north of Black Bear Creek near the southern end of the Park on 1 June. Note the absence of ice in the bay and the near-absence of coastal salt marsh interior to the most-coastal beach ridge. – Photo: RF Rockwell

Even the Polar bear scat detection dog Quinoa looks for geese. – Photo: RF Rockwell

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## RATIONALE:

Millions of Lesser Snow geese use the east coast of Wapusk National Park for spring staging. In 2001, a large number stayed and nested near Thompson Point. Their offspring consider this “home” and they began a new nesting colony. The destructive foraging of both spring migrants and residents has led to rapid degradation of both coastal and inland freshwater habitat in the area. We have established a monitoring system for the area and are investigating processes underlying degradation in the freshwater habitat.

# HABITAT ASSESSMENT IN THE THOMPSON POINT REGION

## OBJECTIVES:

- Establish a habitat classification system integrating effects of foraging.
- Establish and monitor vegetation transects using that system.
- Establish and monitor nesting density of Snow geese.
- Determine recovery potential.
- Assess soil chemistry of degraded habitat.

## METHODS:

- Score the habitat along 5km transects perpendicular to the coast.
- Score nesting density at two sets of transect plots.
- Erect recovery exclosures and mark adjacent control plots.
- Collect turves along the vegetation transects and return them to lab for analyses.

## YEARS OF DATA COLLECTION:

- Year 2 of a 3 year project

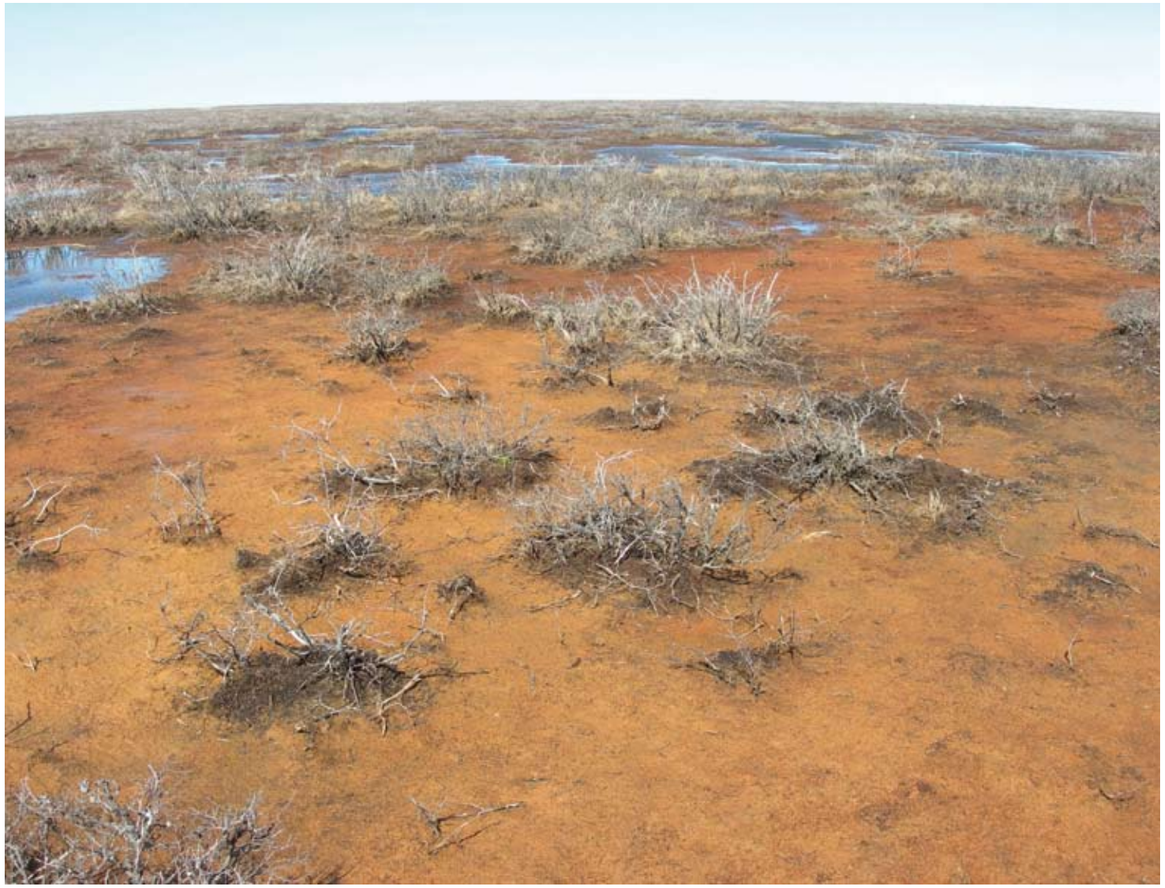
## PARTNERS:

- American Museum of Natural History
- Arctic Goose Joint Venture
- Central and Mississippi Flyway Councils
- Canadian Wildlife Service
- Great White Bear Tours
- US Fish and Wildlife Service
- Parks Canada

## RESULTS:

- Less than 30% of the vegetation in the region is intact.
- Nesting colony has expanded both north and south.
- Nesting density remains stable at 8 nests/hectare.
- Soil salinity in degraded shrub/graminoid areas up to 2km inland is greater than seawater.
- Soil salinity of moss-carpeted (degraded) habitat has freshwater salinity levels.

Elise Gornish and Chris Witte deploy and score recovery exclosures in degraded habitat at Thompson Point. – Photo: RF Rockwell



Panorama of degraded habitat in the Thompson Point region – Photo: RF Rockwell

Emma Horrigan collects soil samples for chemical analyses from a moss carpet area at Thompson Point. – Photo: RF Rockwell

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## RATIONALE:

Eastern Prairie Population (EPP) Canada geese breed in northern Manitoba and migrate to wintering areas historically as far south as Louisiana and Texas. As part of the management of this population, annual information on population size, productivity, and survival has been used to set harvest strategies and hunting season lengths and bag limits in both the U.S. and Canada through the Mississippi Flyway Council. Since the late 1960s and early 1970s, annual information-gathering activities include aerial breeding ground surveys, estimating nest density and reproductive performance at Cape Churchill, and banding flightless geese in late summer.

# MISSISSIPPI FLYWAY EASTERN PRAIRIE POPULATION (EPP) CANADA GOOSE MONITORING

## OBJECTIVES:

- Estimate trend in breeding population size of EPP Canada geese using spring aerial survey.
- Estimate breeding density and productivity of EPP Canada geese in high-density breeding habitat in coastal tundra near Cape Churchill (Nester One).
- Band flightless EPP Canada geese on their breeding grounds in northern Manitoba to provide data to estimate survival.
- Collect information on spring phenology, other breeding birds, frogs, and habitat conditions.

## METHODS:

- Using a fixed-wing survey plane, repeat transects established in the early 1970s to count nesting EPP Canada geese throughout their breeding range.
- Using extensive searches of the Nester One study area, estimate breeding density, nest survival, clutch size and hatching success of breeding EPP Canada geese.
- Using a helicopter and drive nets, capture and band approximately 2,000 – 2,500 EPP Canada geese in mid-to-late summer during the period when they are flightless.
- Record local spring conditions, conduct standardized breeding bird surveys, record frog activity and breeding locations, and qualitatively assess habitat conditions.

## YEARS OF DATA COLLECTION:

- Operational aerial surveys since 1972
- Breeding density and productivity at Nester One since 1976
- EPP breeding grounds banding since 1968

## PARTNERS:

EPP Canada goose monitoring is supported through the Mississippi Flyway Council, whose representatives on the EPP Canada Goose Committee include the U.S. Fish and Wildlife Service, Canadian Wildlife Service, Manitoba Conservation, Minnesota Department of Natural Resources, Iowa Department of Natural Resources, Missouri Department of Conservation, Arkansas Game and Fish Commission and Illinois Department of Natural Resources. The U.S. Geological Survey (Wisconsin Cooperative Wildlife Research Unit and the Minnesota Cooperative Fish and Wildlife Research Unit) have been responsible for Nester One breeding density and productivity monitoring.

## RESULTS:

- Trend in breeding population size of EPP Canada geese is currently stationary.
- Nest density of breeding EPP Canada geese at Nester One decreased from the late 1960s and early 1970s to the 1990s, and currently is stationary at relatively low density.
- 2,000 – 2,500 EPP Canada geese are banded annually to estimate survival, which is used in management and setting harvest regulations.
- Breeding bird surveys suggest changes in species abundance related to habitat changes resulting from goose herbivory.

EPP Canada goose goslings – Photo: David E. Andersen

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EPP helicopter drive – Photo: Vicki Trim

Banding EPP Canada geese – Photo: Vicki Trim

## RATIONALE:

With the signing of the Wapusk National Park (WNP) Management Plan, Parks Canada is able to consider applications for new visitor activities within WNP, in particular new tourist activities. The raised ancient coastal beach ridges, classified as tundra ecosystem in WNP, provide the most suitable areas for these activities to take place. As tundra ecosystems in general are extremely sensitive to impacts, the effects of increased human activities on these beach ridges must be monitored to ensure that ecological integrity is maintained. The specific focus of this study and subsequent monitoring is on the effects of human trampling on tundra vegetation.

# DEVELOPING A MONITORING METHOD FOR THE DRYAS-HEATH TUNDRA ECOSYSTEM IN WAPUSK NATIONAL PARK

## OBJECTIVES:

- Determine the effects of past trampling activity on beach ridge vegetation.
- Define a set of monitoring measures and field measures to monitor future trampling impacts.
- Define a set of recommendations for monitoring trampling impacts and for managing human activities on beach ridges.

## METHODS:

- Field assessment of the impacts of prior trampling on beach ridge vegetation.
- Assessment of the sensitivity of potential monitoring measures.
- Using NDVI from high resolution Quickbird images to define a range of values that indicate that an area has been disturbed by trampling.

## YEARS OF DATA COLLECTION:

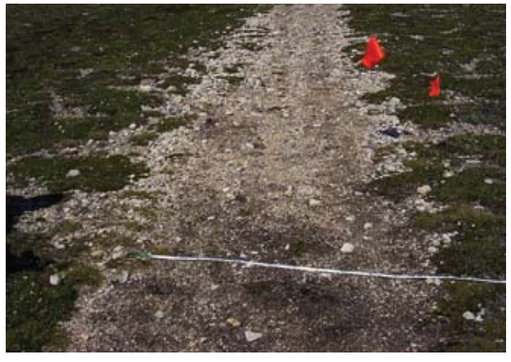
- Single year project - 2007

## PARTNERS:

- University of Calgary
- Parks Canada
- National Sciences and Engineering Research Council of Canada

## RESULTS:

- Generally, results of the impact assessment correspond with the literature in that with increased level of impact, the number of species decreases and the relative cover of vegetation decreases (i.e. more exposed ground).
- Matted graminoids and matted and rosette forbs are the most resistant to trampling with glacier sedge and Arctic avens increasing in cover with low levels of impact.
- Lichens and erect forbs are highly sensitive to impact and can be completely eliminated from an area with low levels of trampling.
- Twelve species common to all community-types found on beach ridges show great promise as monitoring measures as do physiognomic type, species richness, and amount of exposed ground.



Example of high level trampling impacts along an ATV trail outside of Nester One – Photo: Jessica Elliott

Aerial photo of trampling impacts around Nester One – Photo: Jessica Elliott

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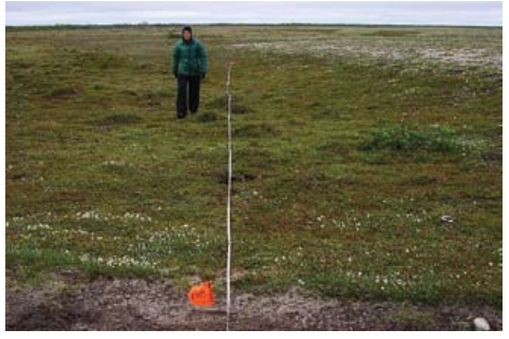


A sample transect laid out perpendicular to an ATV trail north of Nester One – Photo: Janine McGowan

## RATIONALE:

Wapusk National Park is one of four Arctic national parks selected for developing standard approaches for terrestrial (forest, tundra and wetland) ecological inventories using funds made available through the International Polar Year Program (IPY). Terrestrial ecosystem inventories can provide park managers with key baseline information for conducting park management, and for developing and implementing park monitoring programs. The maps developed provide a description of forest and tundra ecosystems, including the plant species/communities that occur in them, the soils and landforms they occur on, and an interpretation of the principle ecosystem processes that establish and maintain them. The ecosystem maps developed have a range of management purposes including habitat mapping, soil sensitivity to disturbance, and modelling. Since ecosystem distribution is linked to the ecological processes that drive productivity and species composition, the maps can also be used to identify and monitor those ecosystems most at risk from climate change and other potential disturbances. This study describes a reconnaissance survey to assess the usefulness of EcognitionTM software and high resolution satellite imagery to delineate and classify forest, tundra and wetland ecosystems in the park. A complete terrestrial inventory will be completed in the 2009-2010 fiscal year.

# TESTING THE USEFULNESS OF ECOGNITION SOFTWARE AND HIGH RESOLUTION SATELLITE IMAGERY TO MAP TERRESTRIAL ECOSYSTEMS IN WAPUSK NATIONAL PARK

## OBJECTIVES:

- Develop approaches for using EcognitionTM software and high resolution satellite imagery for mapping park forest, tundra and wetland ecosystems.
- Conduct a reconnaissance level field study to identify and characterize park terrestrial ecosystems.
- Refine maps and EcognitionTM algorithms.
- Provide an assessment of the methods used for developing ecosystem maps for the whole park.

## METHODS:

- EcognitionTM software was used to segment and classify the Quickbird satellite imagery in 4 target areas across a range of ecosystems.
- Field work was conducted to provide preliminary descriptions (plant communities, soils and landforms) of a sample of ecosystem units following the classification developed by Ryan Brook, and identify the key ecological processes that determine ecosystem composition, structure and function.
- From the 2007 ground-truthing, the maps and Ecognition TM algorithms were refined.
- Final adjustments and assessments were made for input into the next round of mapping.

## YEARS OF DATA COLLECTION:

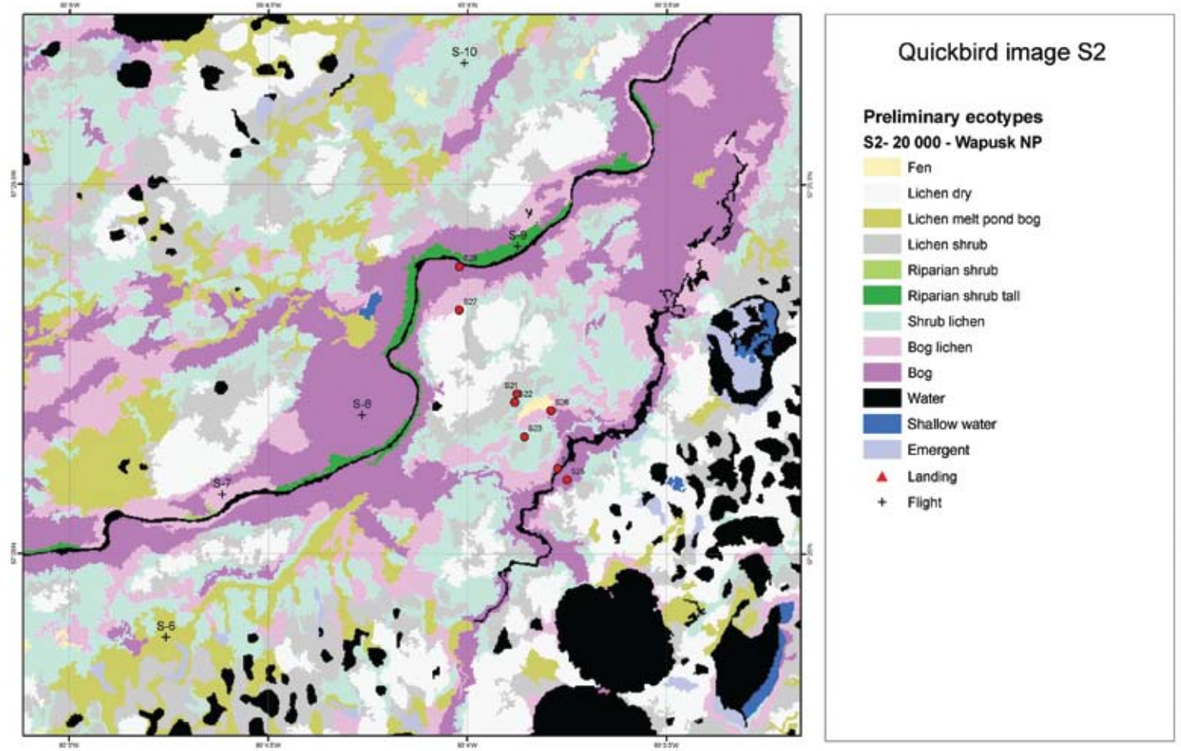
- Year 1 of a 3 year project

## PARTNERS:

- International Polar Year
- Parks Canada – Wapusk National Park
- Parks Canada – Western and Northern Service Centre

## RESULTS:

- Quickbird imagery provides a very detailed delineation of park terrestrial ecosystems and is responsive to subtle changes in terrestrial ecosystem composition and structure.
- EcognitionTM software worked very well in the segmentation and classification of the Quickbird satellite imagery. Within the flat landscape of Wapusk National Park, EcognitionTM has proven to be a promising tool for distinguishing palsas and wetlands.
- Field work confirmed the composition and distribution of ecological units developed by Brook (2001).
- Main ecological systems (groups of ecosystems under the same overriding ecological processes) in the park include riparian, wetland, beach ridge and ground ice ecosystems.
- Feedback from this exercise will be used to provide an assessment of the methods used for developing future ecosystem maps for the whole park.




Recording locations for Quick Bird landcover training. – Photo: Paul Dixon

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Aerial view of Wapusk National Park. – Photo: Paul Dixon

## RATIONALE:

Freshwater ecosystem monitoring has been identified as an important ecological integrity (EI) monitoring objective in northern national parks. The Northern Bioregion Working Group (NBWG) of Parks Canada is supporting a pilot study to assess current monitoring protocols, logistical constraints and program requirements. Two northern national parks were identified to host freshwater monitoring pilot projects: Nahanni National Park Reserve of Canada and Wapusk National Park of Canada (WNP).

# WAPUSK NATIONAL PARK AQUATIC MONITORING PILOT PROJECT

## OBJECTIVES:

- Work in partnership with the NBWG and other partners to establish a feasible freshwater aquatic ecosystem monitoring program.
- Identify and test freshwater and benthic monitoring protocols for applicability to northern parks.
- Begin accumulating freshwater aquatic ecosystem data for future reference.
- Assess the overall feasibility of aquatic monitoring in the region.

## METHODS:

- In 2007, the third year of the pilot study, sampling was completed at the Mary Lake and Broad River sites on June 11-12, July 29-30, and Sept 28.
- The sites were sampled for water quality using an in-situ probe, and additional site measures were water depth, turbidity and flow parameters. Water samples were collected for lab analysis. Benthic invertebrates were collected at both locations, processed according to the lab protocol and sent to the lab for identification.
- Broad River
  - Stream velocity and depth was measured using a Swoffer 2100 flow metre.
  - Benthic invertebrates were sampled and preserved using the Canadian Aquatic Biomonitoring Network (CABIN) protocol.
- Broad River and Mary Lake
  - Water quality was assessed on site using the protocols set up by Northern Ecological Monitoring and Assessment Network (EMAN-North 2005).
  - Water quality samples were collected and were processed according to lab instructions (transport time and temperature).
- Mary Lake
  - Benthic sampling was carried out using the Ontario Benthos Biomonitoring Network (OBBN) protocol and samples preserved according to the OBBN protocol.

## YEARS OF DATA COLLECTION:

Year 3 of a 3 year project.

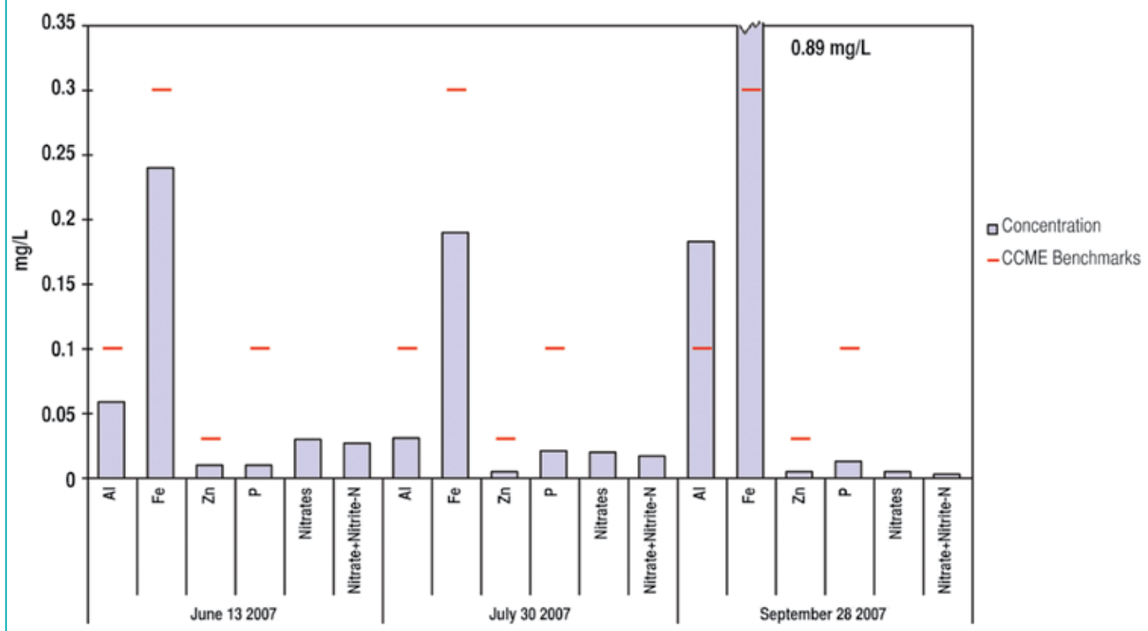
Assessment for continued permanent sampling will be continued once the pilot is completed and recommendations will be forwarded to the NBWG committee.

## PARTNERS:

- Parks Canada – Northern Bioregion Working Group

## RESULTS:

- Water quality results for the lab testing were compared to the Canadian Water quality guidelines for the protection of Aquatic Life for both locations and selected chemicals fell below the limits except for iron. The September sample for Broad River had an exceptionally high concentration of Iron (0.89 mg/l ). The CCME limit is set at 0.30mg/l. The September concentration of Iron for 2006 was slightly higher than the limit at 0.32mg/l. This high value in 2007 may be the result of error but it should be retested to determine whether value is indicative of high Iron in the Broad River.
- At the time of writing this summary the benthic results have been sorted but not identified for the current year.
- Broad River site will need to be mitigated by checking tide table prior to visitation to determine tidal influence at low tide.
- Mary Lake values were well below the CCME benchmarks for all parameters.




Comparison of Broad River water chemistry for three sampling periods.

Rodney Redhead taking an in-situ water measurement at Mary Lake using the YSI 556 multimeter.
Photo: Mike Taylor

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