Annual Report of Research and Monitoring in the Greater Kejimkujik Ecosystem 2007

Parks Canada Parcs Canada

Canada

Mersey Tobeatic Research Institute

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Cover photos from top left:
- Sweet pepperbush habitat in Kempt
- Sunset on Blanding's turtle habitat in Kejimkujik
- Winter forest near Mill Falls in Kejimkujik
- Waves on Piping plover habitat near Shelburne, Nova Scotia
- Autumn splendor reflecting on a lake with citizen scientists

Printed on 100% post-consumer paper

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FRESHWATER

WETLAND

HUMAN DIMENSIONS

INTRODUCTION

This is the third Annual Report of Research and Monitoring in the Greater Kejimkujik Ecosystem. As with previous editions, this one was inspired by a very similar series piloted by the Parks Canada Western Arctic Field Unit. This report serves as a compilation of the research and monitoring projects that were conducted in the Kejimkujik area. The summaries are all written by the researchers who are listed as contacts for each project but the report as a whole is a collaborative effort between Kejimkujik National Park and National Historic Site of Canada (Kejimkujik) and the Mersey Tobeatic Research Institute (MTRI). A committee comprised of Amanda Lavers and Jennifer McKinnon (MTRI), Sally O'Grady, Darien Ure, and Chris McCarthy (Parks Canada) collected, edited, and prepared the publication. Many thanks to all the researchers who took the time to submit the research and monitoring project summaries this year.

The research projects provide a better understanding of the ecology of the area and how it is affected by natural and human-related disturbances. Research projects in this report are organized in five chapters corresponding to Kejimkujik's Indicator Ecosystems: Coastal, Forest, Wetland, and Freshwater, with an additional chapter highlighting research about the Human Dimensions of sustainable resource use. Projects are categorized as either monitoring or research projects.

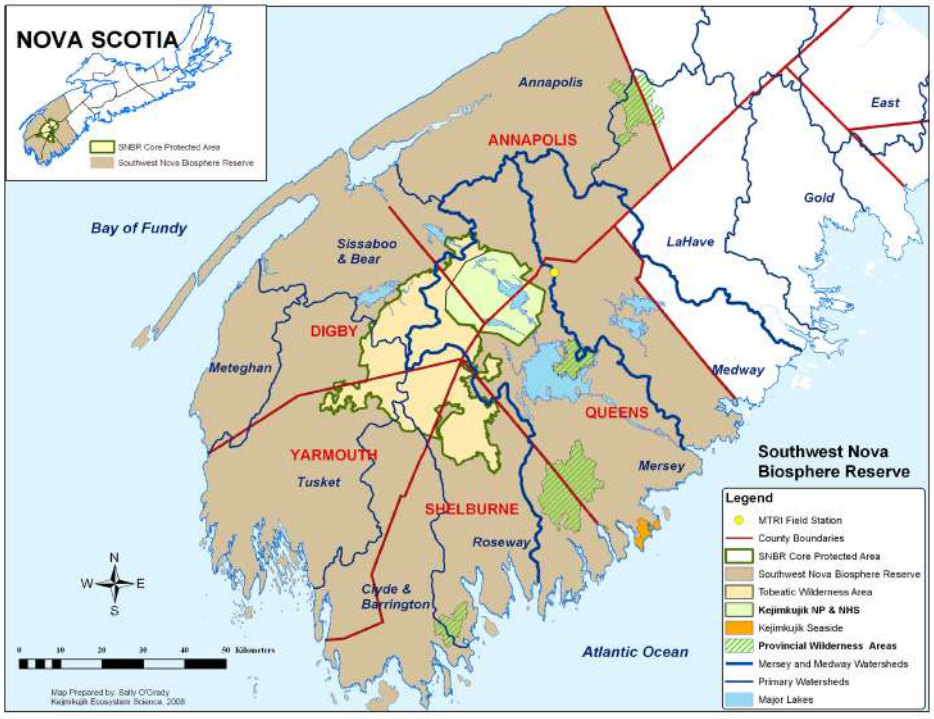
This report was produced in summer 2008 and is a compilation of the research and monitoring projects that were conducted in the Kejimkujik area in 2007 by Parks Canada, MTRI, and their partners. The purpose of the report is to make information about these projects available to the public, government agencies, researchers and other stakeholders.

The research and monitoring projects detailed in this report are essential tools for attaining sustainable management of our natural resources and maintaining ecological integrity of our protected areas. The monitoring projects are conducted to keep track of how the ecological systems around us are changing over time and examine the effectiveness of management actions. The research projects provide a better understanding of the ecology of the area and how it is affected by natural and human-related disturbances. On sum, they indicate an impressive amount of work that is being undertaken in Kejimkujik and the surrounding area.

Kejimkujik represents the Atlantic Upland Natural Region in Parks Canada's network of protected areas. Kejimkujik consists of 381 km^2 inland and a 22 km^2 adjunct on the coast and, in combination with the Tobeatic, is the core area of the Southwest Nova Biosphere Reserve. Since its establishment, Kejimkujik has been an important centre of science for southwest Nova Scotia. In collaboration with partners, research and monitoring in the park and surrounding landscape has informed decision-makers on a number of management issues at local, regional and national scales. Kejimkujik was declared the first Ecological Monitoring and Assessment Network site in Canada (1993) and was the first in Canada to install a Smithsonian Institution Monitoring and Assessment of Biodiversity plot (1994). Kejimkujik also serves as one of five core Canadian Acid Precipitation Monitoring Network sites that monitor long-range transport of air pollutants and is a long-term climate monitoring station for Environment Canada. In 1995, Kejimkujik was designated a national historic site (the only national park in Canada with this dual designation) highlighting the cultural significance of the area and the importance of aboriginal peoples to understanding and presenting commemorative integrity. Kejimkujik is identified by the Parks Canada Agency as a species at risk priority site where stewardship and recovery of species at risk are paramount. More information about Kejimkujik can be found at www.pc.gc.ca/pn-np/ns/kejimkujik or at the Friends of Keji Cooperative Association website (www.friendsofkeji.ns.ca).

The Mersey Tobeatic Research Institute (MTRI) is a non-profit co-operative with a mission to advance collaborative research, monitoring, and management that promotes sustainable use of resources and biodiversity conservation in the Southwest Nova Biosphere Reserve. MTRI maintains a field station that provides office workspace, accommodation for researchers, space for public presentations and a site for learning. MTRI provides expertise in the community and coordinates research and monitoring projects to address the goal of sustainable resource management. MTRI also provides an important link from research to the public through an active outreach and education program. More information about the co-operative is available at www.merseytobeatic.

The Southwest Nova Biosphere Reserve (SNBR) comprises a large portion of terrestrial and coastal southwestern Nova Scotia (see map below). The United Nations Educational, Scientific and Cultural Organization (UNESCO) internationally recognizes a biosphere reserve as an area in the world that is deemed to demonstrate a "balanced relationship between humans and the biosphere." Biosphere reserves around the world fulfill the following three functions: conservation, sustainable development, and capacity building. Collaborative efforts among people in the designated area promote the sustainability of local economies and communities, as well as the conservation of the ecosystems. A biosphere reserve is also a mechanism used for regional planning and multi-sector collaboration. It offers an opportunity for the community to envision sustainability for the region and to work towards achieving it. In 1999, a group of volunteers from Queens and Annapolis counties in Nova Scotia developed a proposal for the establishment of a UNESCO Biosphere Reserve incorporating Kejimkujik and the Tobeatic as the core protected area. This group of volunteers later became incorporated as the Southwest Nova Biosphere Reserve Association (SNBRA). In September 2001, the nomination document received approval and the region of southwest Nova Scotia was designated a biosphere reserve by UNESCO.



S. O'Grady, Parks Canada

Clockwise from top left: Piping plover habitat in southwest Nova Scotia; volunteers monitoring plovers in their habitat; a Piping plover nest; sunrise on a southwest Nova Scotia beach; waves on a beach near Shelburne.

COASTAL

Rationale

The Piping plover is a small shorebird that has been listed as an Endangered species by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) since 1985. Presently, the piping plover nests on the white sandy beaches of southwest Nova Scotia, including St. Catherine's River Beach at the Kejimkujik Seaside. In recent years, the number of nesting pairs of Piping plover in the province has decreased significantly, due to: habitat disturbance, loss and fragmentation, predation and development of over-wintering grounds. The Piping plover is often referred to as a *management dependent species*, as sustained management actions are needed to maintain and increase population levels. Park staff have monitored plover adults and chicks within the park since 1985 to assess Piping plover population levels at the Kejimkujik Seaside (and southwest Nova) and to implement a suite of management strategies focused on protecting and sustaining plover numbers.

D. Smith, Parks Canada

Video camera focused on Piping plover sitting on its nest at the Kejimkujik Seaside

Monitoring

PIPING PLOVER MONITORING PROGRAM

OBJECTIVES

- To monitor the status of Piping plover populations, breeding pairs and chick fledgling success.
- To protect Piping plover nests via exclosure use.
- To examine predation and abandonment of nests through experimental deployment of a digital video recorder.

METHODS

- Park staff monitored St. Catherine's River Beach frequently during Piping plover nesting season. This was done at a distance with binoculars and spotting scopes. Other birds and animals, including predators, were also noted.
- Nest, chick, and habitat observations were recorded. Nests were located by observing territorial birds and individuals exhibiting nesting behaviours.
- After two eggs were laid (of four in a full clutch) protective wire predator exclosures were installed to protect the eggs and nesting adults from most predators. All nests were coded and georeferenced.
- A digital video recorder was deployed on nests with 4 eggs, to monitor potential predation and study abandonment rationale.

B. Caverhill, Parks Canada

Kendra Sauerteig and Rick Brunt Monitoring Piping plover at the Kejimkujik Seaside

RESULTS

- As many as ten Piping plover nest attempts were documented, (although other adult birds were seen).
- Three of these nests had exclosures placed around them to protect the nests.
- A digital video recorder was deployed on one nest and successfully monitored the clutch for a week. No predation was recorded, however a crow was seen walking the beach near the nest.
- Unfortunately, all ten nests were abandoned.

YEARS OF DATA

- Ongoing project since 1985

PARTNERS

- Parks Canada
- Piping Plover Recovery Team (Eastern Canada)
- Bird Studies Canada
- Environment Canada
- Province of Nova Scotia

D. Smith, Parks Canada

Volunteers and park staff installing video camera at Kouchibouguac National Park

S. Abbott, Bird Studies Canada

Emily Swim and Logan Atkinson installing a Piping plover nest enclosure

D. Smith, Parks Canada

Ashley Robar and Travis Landry taking measurements of Piping plover habitat at the Kejimkujik Seaside

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Rationale

The addition of the Seaside to Kejimkujik ensured the protection of an important natural area of coastal ecosystems with their unique and diverse plants and animals. The dune and estuarine components of the Seaside present a challenging area for the development of an ecological integrity monitoring program because of their natural propensity to change over time. Dune ecosystems change with wind effects, and infrequent, high intensity storms can radically alter dune and estuarine habitats. This study uses historical aerial photography going back to 1927 to assess how the dune and estuary ecosystems at Little Port Joli basin and St. Catherine's River Beach have changed over the last 80 years. The results of the study will provide baseline data for establishing monitoring thresholds and assessing future ecological change in the dune and estuarine ecosystems at the Seaside.

D. McLennan, Parks Canada

Salt marsh ecosystem in Kejimkujik Seaside

Monitoring

COASTAL ECOSYSTEM CHANGE

OBJECTIVES

- To describe plant community composition and structure, and to interpret ecological processes in estuarine and dune ecosystems.
- To describe how estuarine and dune ecosystems have changed over the last 80 years in these dynamic areas.
- To measure the rate of encroachment of estuarine ecosystems into adjacent riparian forest ecosystems.
- To establish monitoring thresholds for assessing future changes in estuarine and dune ecosystems.
- To assess new digital stereo ecosystem mapping (Purview software) and aerial inventory methods (LIDAR with high resolution aerial photography).

METHODS

- Estuarine and dune ecosystems were delineated on 1:10,000 colour photos taken in 2000 using a light stereoscope.
- Field work was conducted to describe the plant species composition and vegetation structure that occur in each of these ecosystems; ecological processes such as degree of marine flooding, and sand dune effects were interpreted in the field at the same time.
- A plant community and ecosystem classification will be developed from the field observations.
- All air photos for Little Port Joli and St. Catherine's River Beach were scanned and geo-referenced to a common base; this included high resolution air photos (2008) and traditional air photos (2000, 1992, 1986, 1976, 1973, 1972, 1965, 1955, 1945, and 1927).
- Stereo models that permit the use of PurviewTM software will be developed from the scanned air photo imagery.
- Maps of estuarine and dune ecosystems will be developed using PurviewTM software.

RESULTS

- Historical changes in the aerial extent of the different ecosystem types will be estimated through comparisons of the historical ecosystem maps generated.
- The historical encroachment of estuarine ecosystems into riparian forest will be assessed and reported.
- Major changes to the dune and streams will also be assessed and reported.
- Using this data and observations, a set of thresholds for EI monitoring measures for the Coastal EI Indicator will be developed.

YEARS OF DATA

- This is a retrospective study with historical air photos dating as far back as 1927

PARTNERS

- Parks Canada
- Applied Geomatics Research Group, Nova Scotia Community College

D. McLennan, Parks Canada

Little Port Joli dune ecosystem, Kejimkujik Seaside

D. Ure, Parks Canada

Donald McLennan ground-truthing coastal ecosystems

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Rationale

Several hundred years of development in the Annapolis Valley area have resulted in the destruction or alteration of most of the original salt marshes along the Annapolis Basin. Salt marshes are rich and diverse ecosystems that contribute to the overall health of a river system; they produce large amounts of vegetation that fuel complex food chains, provide important protection against erosion and storm surge and improve water quality by filtering out toxins and excess nutrients.

D. Sullivan, CARP

French Basin site, with brackish impoundment created by dyke

Research

FRENCH BASIN SALT MARSH RESTORATION

OBJECTIVES

- To investigate the feasibility of restoring the selected fallow dykeland in Annapolis Royal to its former salt marsh habitat.
- To provide clear instructions on what would be required to complete a restoration of the French Basin Marsh including approximate costs, required permits, and suggested monitoring activities both prior to and after restoration.

METHODS

The feasibility of restoring the salt marsh was carried out by the:

- Preparation of a digital elevation model and flood modelling of the site;
- Undertaking an engineering assessment of the site;
- Evaluation of land tenure and municipal zoning;
- Consultation with landowners, stakeholders, and the local community; and
- Completion of a biological assessment (hydrology, soils & sediments, vegetation, nekton, birds).

D. Sullivan, CARP

One of the salinity monitoring wells installed at the site

RESULTS

- The French Basin Salt Marsh Feasibility Study examined all aspects of a restoration project ranging from physical and biological to social and economic components. The study indicates that the restoration of the French Basin Marsh is indeed feasible, and completes the first steps required for its restoration.
- Both the digital elevation model and further elevation measurements during the engineering study indicate that opening the dyke at the French Basin Marsh would not cause any adverse effects, such as flooding, to adjacent properties.

RESULTS
Continued

- Baseline ecological monitoring provided a better understanding of the current conditions in the marsh and tidal creek, and to a limited extent, conditions of the potential floodwaters to the marsh. The data collected will provide a baseline against which further monitoring both pre- and post- construction may be compared, should the restoration of the marsh proceed.
- Community consultations suggested strong support for the restoration of the marsh from a range of stakeholders, including the Town of Annapolis Royal, the Municipality of the County of Annapolis, local business owners and residents. The feasibility study found that the estimated cost of restoration was relatively high, given the area of new salt marsh that would be created.

YEARS OF DATA

- Single year project (2007)

PARTNERS

- Clean Annapolis Rover Project
- Gulf of Maine Council on the Marine Environment
- National Oceanic and Atmospheric Administration
- Applied Geomatics Research Group, Nova Scotia Community College
- CB Wetlands and Environmental Specialists Inc.
- Fisheries and Oceans Canada

D. Sullivan, CARP

Heather Stewart conducts a vegetation survey at the French Basin site

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Rationale

The Kejimkujik Seaside has two major Zone 1 (Special Preservation) areas that encompass estuarine lagoons at St. Catherine's River Beach and Little Port Joli Beach. These lagoons are major components of the Boreal Estuarine Ecoregion which covers about 20% of Kejimkujik Seaside, and provides an immense variety of habitats for coastal and marine species in the transition from freshwater to saltwater. The lagoons are protected by barrier beaches (long sand spits with dune complexes) that maintain the integrity of these estuaries. These beaches offer an excellent opportunity to monitor the interaction of a beach/dune/marsh complex advancing landwards as the coastline submerges and sea level rises. Sea level rise is expected to exceed 70 cms this century. By tracking this change, park managers will obtain advance warning of accelerated sand shifts and the ability of the dunes to react to rising sea levels.

C. McCarthy Parks Canada

Sand encroachment into forest at St. Catherine's River Beach

Monitoring

BARRIER BEACH DUNE DYNAMICS MONITORING

OBJECTIVES

- To monitor change in the established rate of dune movement, based on an analysis of historic aerial photography dating back to 1927.
- To compare different technologies (permanent posts, Wild Survey Level, RTK/PPK GPS, LiDAR, Total Station) to determine the most efficient and cost effective protocol for long-term monitoring of dune dynamics.
- To establish a correlation between this measure and surrounding nearest point DFO-Canadian Hydrographic Service Water Level Tide Gauge Stations to establish the timing and spatial extent of sea level rise and storm surge events on these sensitive barrier beach systems.
- To conduct long term monitoring of major shifts in dune movement and to assess the effects on other coastal ecosystem components.

C. McCarthy, Parks Canada

Little Port Joli Beach dunes

METHODS

- Surveys will be conducted at a standardized interval annually, based on tidal cycle, GPS configuration timing and prior storm event timing. Measurements are made along permanent transects at a maximum of 5 m intervals, with more frequent fixes for elevation change or major vegetation community change. The GPS data is corrected from a fixed base station located over a known survey benchmark. Field measurements will be interpreted in terms of three elements: 1) profile shape, 2) crest movement, and 3) vegetation community extents change.

RESULTS

- Nine series of air photos have been obtained to track major habitat movement back to 1927. Analysis is still in progress.
- To date, investigation using permanent posts, LiDAR, Wild Survey Level and RTK GPS methods have been completed. Methods are being compared based on cost and accuracy related to repeat interval.

RESULTS
Continued

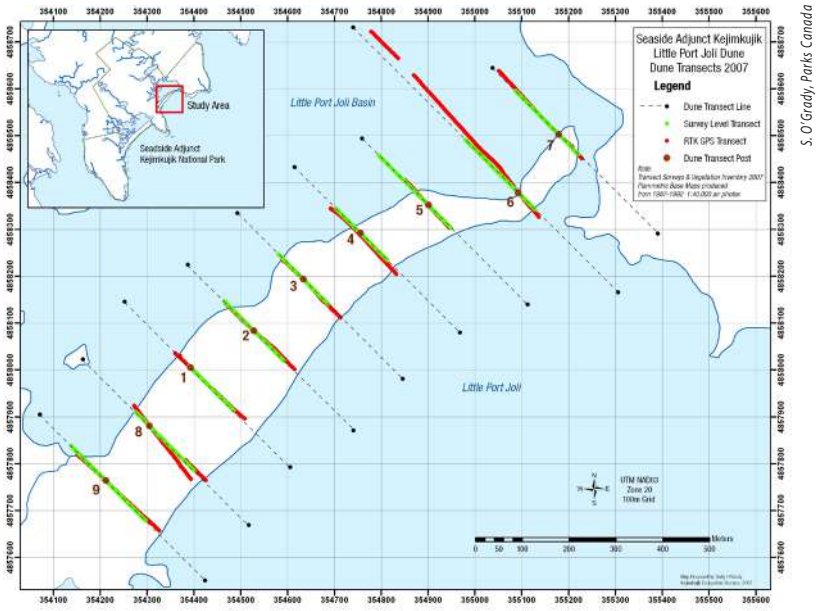
- Observations show the beach continues to move inland but it is unclear at this time how the sand budget is changing.
- Permanent posts installed in 1995 show up to a 17 m crest movement inland (between x and y).
- The GPS technology provided an acceptable level of accuracy and was useful for delineating vegetation community banding along the dune.This was the first year of vegetation community mapping along transects.

YEARS OF DATA

- Ongoing Project since 1995

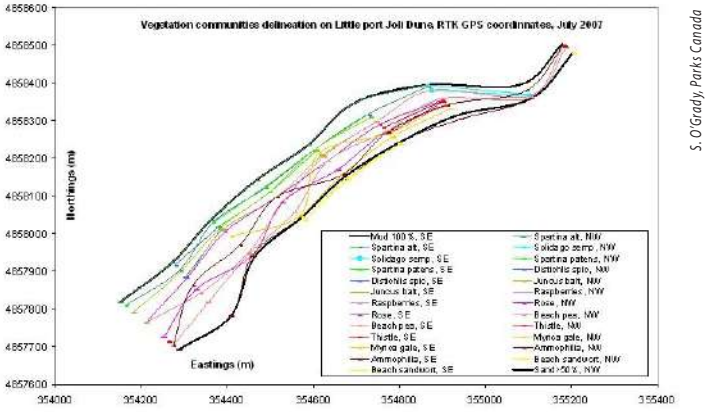
PARTNERS

- Parks Canada
- Applied Geomatics Research Group, Nova Scotia Community College



S. O'Grady, Parks Canada

Little Port Joli Beach permanent transects



S. O'Grady, Parks Canada

Little Port Joli Beach dune vegetation banding

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Rationale

Parks Canada is in the process of developing comprehensive ecological integrity monitoring programs for every major ecosystem type in each national park. The overall objective of this project is to develop a framework for assessing and monitoring the ecological integrity of coastal ecosystems in the Kejimkujik Seaside. This 22 km2 reserve protects several unique and representative coastal ecosystems in Queens County, including extensive coastal headlands, forest, tidal flats, salt marshes, and sweeping sand and cobble beaches. Until now, park monitoring has been restricted to the Piping Plover and visitor use (visitor numbers). Given the many threats facing coastal ecosystems in Nova Scotia--increasing coastal development and habitat fragmentation, sea-level rise, nutrient enrichment, persistent marine litter and ATV recreation--it is imperative that a comprehensive ecological monitoring program be in place. Hence, the purpose of this research project is to fill-in the gaps in the existing monitoring program for the Kejimkujik Seaside by identifying, developing and implementing additional ecological integrity measures.

S. Beaton

Aimee Pelletier conducting soft-shell clam surveys in Little Port Joli Basin, Kejimkujik Seaside

Monitoring

COASTAL ECOSYSTEM MONITORING

OBJECTIVES

- To select a core suite of measures for long-term monitoring of coastal ecosystem integrity at the Kejimkujik Seaside.
- To select a subset of measures for which formal monitoring protocols will be developed.
- To pilot test the effectiveness and utility this subset of measures in the Kejimkujik Seaside.
- To collect baseline data for these measures.

METHODS

- The core suite of measures was selected through expert consultation, a focus workshop, and extensive literature review.
- A subset of these core measures were selected for protocol development during the summer of 2007 through pilot testing and identification of monitoring priorities in the Kejimkujik Seaside.
- Baseline data collection and protocol refinement will continue through the summer of 2008.

K. Benoit

Aimee Pelletier (left) and Anna-Sarah Eyrich (right) filtering water quality samples from Little Port Joli Basin, Kejimkujik Seaside

RESULTS

- Six measures were selected for protocol development and baseline data collection, including: 1) estuarine water quality; 2) Eelgrass distribution and condition; 3) Soft-shell clam population condition; 4) salt marsh vegetation; 5) barrier beach-dune dynamics (see pages 18-19); and 6) coastal ecosystem change (see pages 14-15). Baseline data for several of these measures were collected in the summer of 2007 and will continue through the summer of 2008.

YEARS OF DATA

- Year 1 of a 2 year project with subsequent long-term monitoring

PARTNERS

- Dalhousie University
- Natural Sciences and Engineering Research Council
- Parks Canada

BIODIVERSITY	PROCESS	STRESSOR
Salt Marsh Vegetation	Estuarine Water Quality	Invasive Species
Eelgrass Distribution and Condition	Coastal Community Change	Climate
Soft-shell Clam Population Condition	Barrier Dune Change	

A. Pelletier

Coastal measures of ecological integrity (EI) being developed for Kejimkujik Seaside

A. Pelletier

Little Port Joli Lagoon, Kejimkujik Seaside

A. Pelletier

Brian Starzomski counting shorebirds in Little Port Joli Lagoon, Kejimkujik Seaside

A-S. Eyrich

Aimee Pelletier conducting eelgrass bed surveys in Basin Lake, Little Port Joli Lagoon, Kejimkujik Seaside

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Clockwise from top left: Hemlock canopy in Kejimkujik; pine after rain; fir in the winter; hemlock forest; Chicken-of-the-woods fungus.

FOREST

Rationale

Christmas Bird Counts have been carried out annually for over a century. They have been conducted at several locations in Nova Scotia over the last 50 years. Currently, within Nova Scotia, approximately 35 Christmas Bird Counts are conducted every year. The counts occur on one day between mid-December and early January (hence the name Christmas Bird Count) within the same set area. The bird counts document early winter birds and can be compared from year-to-year and area-to-area. The Nova Scotia Bird Society maintains a master record of all counts within the province and annually reports the counts with notes on the unique results of that year.

J. McKinnon

Mourning dove

Monitoring

CALEDONIA CHRISTMAS BIRD COUNT

OBJECTIVES

- To document early winter birds during an ongoing annual survey.
- To record sufficient data so that the results may be compared from year-to-year and count-to-count.
- To utilize interested volunteer members of the public to complete the annual count.
- To publicize the results to inform and interest the local public in the bird communities of the Caledonia area.

METHODS

- Annually, a one day Christmas Bird Count has been held between specific dates determined by the Audubon Society between mid-December and early January.
- The count was held on one specific day from midnight to midnight.
- The count has always been held in the same area - a circle of 12 kilometers diameter centered where a brook flows northward out of Donnellan Lake in West Caledonia.
- The coordinator organized volunteers to cover different areas so the maximum number of habitats can be searched and the most species located while preventing repeated counting of the same birds in the same areas.
- The bird species and their numbers were recorded.
- The time spent in the woods and at bird feeders, distances traveled, methods of travel and numbers of people involved were recorded to compare the effort by observers.

J. McKinnon

Downy woodpecker on suet feeder

RESULTS

- This is Nova Scotia's only entirely inland Christmas Bird Count. This year was colder (between - 8°C and - 13°C) and with 25 cm of snow on the ground, it was more than in recent years.
- The December 16, 2007 count noted 37 bird species and 1,925 total birds.

RESULTS
Continued

- Forty- four observers participated.
- Three species (Barred owl, Mourning dove, and Black-capped chickadee) set abundance records.
- One hermit thrush was notable as this species has usually migrated well before this date.
- Only 12 species have been reported consistently for every year of the Caledonia count but over 65 species have been noted on one or more counts.
- Full details and results from previous years at: www.merseytobeatic.ca

YEARS OF DATA

- Ongoing project since 1991

PARTNERS

- Nova Scotia Bird Society
- South Shore Naturalists Club
- Annapolis Field Naturalists Society
- Parks Canada
- Mersey Tobeatic Research Institute

J. McKinnon

Blue jay

J. McKinnon

Common redpolls

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Rationale

Nocturnal owls are surveyed across Canada as indicators of forest ecosystem health. As top predators in the food chain, they are vulnerable to habitat disturbance. Barred owls have specialized habitat requirements that link them to large hardwood trees for cavity nesting. Additionally, they are sensitive to forest cover and composition changes associated with forest management activities. Owls are not easy to monitor due to their secretive, nocturnal activities. They roost for much of the day and attempts to conduct visual surveys are challenging. Bird Studies Canada coordinates surveys in all three Maritime provinces. Locally, two official routes have been conducted annually since 2002 while a third, unofficial route, was established in 2005. These surveys document relative owl counts and note changes over time within landscapes being changed by forest harvesting and human developments.

J. McKinnon

Barred owl in Kejimkujik

Monitoring

NOCTURNAL OWL SURVEY

OBJECTIVES

- To carry out an annual survey of nocturnal owl populations on established routes.
- To compare local populations within Nova Scotia, within the Maritimes and within Canada.

METHODS

- At night, volunteer surveyors drove their designated route and stopped every 1.8 kilometers. At each stop they broadcasted recordings of owl calls prepared by Bird Studies Canada and recorded the number and species of owls heard or seen.
- Route 40 was surveyed by Peter and Lorraine Hope. This route began on highway Route 8, eight km north of Mersey River Bridge in Maitland Bridge and continued north to South Milford.
- Route 41 was surveyed by Chris McCarthy. This route began at the Kejimkujik entrance and ended near the Gold Mines trailhead.
- One unofficial route, using the same protocol, began at the entrance of the Devonshire/ Rossignol Road (surveyed by Peter Hope, Colleen Anderson, and Celia LeGall) and continued towards the Mersey River.

RESULTS

- In 2007, Barred and Saw-whet owls were reported. In other years, Great horned owls have also been detected.
- Route 40 along Route 8 detected eight Barred owls and one Saw-whet on April 23/07.
- Route 41 within the park detected nine Barred owls on May 14/07.
- The Devonshire / Rossignol survey detected three Saw-whet and two Barred owls on May 7/07.

YEARS OF DATA

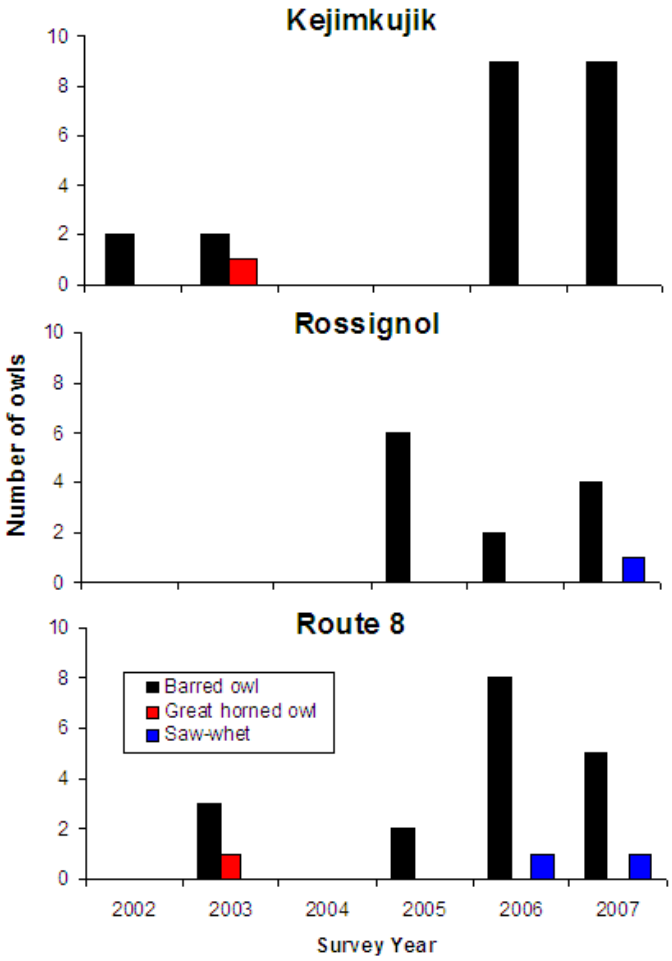
- Ongoing project since 2002

PARTNERS

- Parks Canada
- Bird Studies Canada
- Mersey Tobeatic Research Institute

J. McKinnon

Barred owl



Number of owls detected on three survey routes. The Route 8 and Kejimkujik soutes have been surveyed since 2002 and the Rossignol route has been surveyed since 2005. Barred owls are indicated in black, Saw-whet owls in blue and Great horned owls in red

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Rationale

Once common throughout Nova Scotia, the American marten is now limited to two known populations in the province: Cape Breton Island and the western portion of mainland Nova Scotia. The mainland marten population, with a hotspot centred near Weymouth, is classified as 'data deficient' by NSDNR. This population is believed to be at least partially the result of a reintroduction program that released 116 marten from New Brunswick into 11 sites at Kejimkujik between 1987 and 1994. In 1979, the last reported marten trapped on mainland Nova Scotia was from this area, which suggests a remnant population may have existed prior to the Kejimkujik releases. To determine the presence or absence of rare or endangered mammals in remote areas, hair snag stations can be used to collect DNA samples, which can be used to determine the health and size of a population.

J. Moss

Collared marten in a tree

Monitoring

SOUTHWESTERN NOVA SCOTIA MARTEN DISTRIBUTION

OBJECTIVES

- To determine the distribution, size and health of the southwestern Nova Scotia (SWNS) marten population.
- To develop an understanding of the multi-scale habitat associations of the SWNS marten population.
- To determine the efficacy of various hair snag techniques using captive animals being held at the provincial wildlife park at Shubenacadie as well as in the field.
- To collect hair samples for future analysis to determine health and size of the SWNS marten population.

METHODS

- Marten habitat models were developed for the five SWNS counties using current forest inventory data and geographic information systems (GIS).
- Four to eight hair snags (a baited wooden trap equipped with glue patches for hair sampling) were placed within 5 km^2 grids predicted to contain marten habitat (based on the GIS habitat model), in areas that form natural funnels or crossings.
- Snags were checked every four days for twelve days or until tracks, scat or hair was found in or around the snag.
- Hair was collected to verify species identification.
- Habitat information was collected at each hair snag site to populate the GIS habitat model.

P. Austin-Smith, NSDNR

Marten hair snag in a tree

RESULTS

- The Trappers Association of Nova Scotia were successful in acquiring funds from the Nova Scotia Habitat Conservation Fund in 2007 to help conduct American marten presence/absence surveys in SWNS. With these funds, 2 trappers were hired to place 4-8 hair snags in 5km^2 blocks containing suitable marten habitat based on NSDNR's current habitat model. In total, the trappers were able to gain information on 33 blocks, with some help from NSDNR staff, either through hair snag/track surveys during the winter months, or through

RESULTS
Continued

discussions with other outdoorsmen (hunters or trappers). Of the 33 blocks surveyed, marten were confirmed in 16 blocks based on tracks, hair or reliable reports.

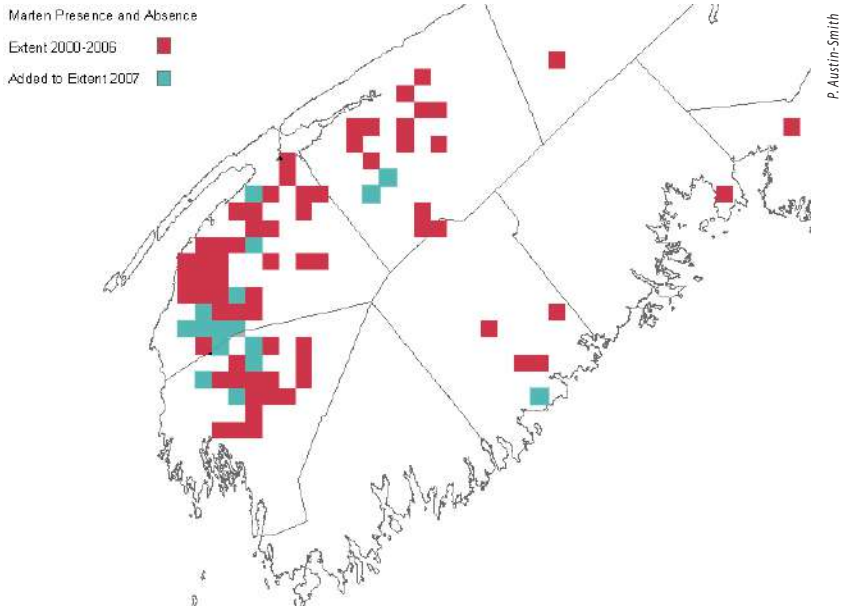
- Hair samples collected from the snags have yet to be analyzed to determine if they are marten or not. The first step will be to look at gross features of the hair and compare them to other similar species that might be present on the landscape at that time of year. Once this is complete we should be able to gain information on the health and size of the SWNS marten population through DNA analysis, which will aid in determining the status of this rare carnivore.
- The trappers suggest that deer hunters are very likely to see marten around bait piles, if marten are present, and may present another opportunity to gain reliable records for this species.
- An Acadia University honours student was hired by NSDNR through the Career Starts Cooperative Student Program. Emma Vost monitored the efficiency of various hair snag designs using captive animals held at the Shubenacadie Wildlife Park, as well as in the field to determine: (i) the best technique; (ii) the number of times the unit needs to be entered before suitable hair samples are collected for determining presence/absence; and (iii) the length of time the unit(s) need to be in the field. The hair snag that she found to be most effective was the one that used three intact wooden boards that were 15 cm wide. The rodent glue boards were also determined to be the most effective snagging medium, and could be conveniently

YEARS OF DATA

- Year 1 of a 3 year project

PARTNERS

- Nova Scotia Department of Natural Resources
- Trappers Association of Nova Scotia
- Nova Scotia Habitat Conservation Fund



Marten presence and absence in southwest Nova Scotia

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Rationale

The Budget Model of the Canadian Forest Sector incorporates forest inventory, growth and yield, natural disturbance and forest management data to estimate major ecosystem carbon stocks and carbon stock changes, and is used to determine carbon stocks and carbon stock changes in Nova Scotia forests for provincial, national, and international reporting commitments. There are few data describing total forest carbon dynamics in Acadian forests, and in particular tolerant hardwood forests regrown following harvesting. There is a need for such data for model calibration and validation. Collection of total forest carbon stock data in a tolerant hardwood forest chronosequence, unique to Nova Scotia and Atlantic Canada, will enable important validation of model estimates for carbon stocks in these forests. These data will increase confidence in the reporting of tolerant hardwood forest carbon stock changes for stand and provincial-level estimates.

K. Nickerson MTRI

Researchers in old-growth hardwood forests in Kejimkujik

Research

COMPARING HARDWOOD FOREST CARBON STOCKS

OBJECTIVES

- To measure old growth and recently harvested hardwood forest carbon (C) stocks in Nova Scotia.
- To compare field measurements to modelled forest carbon stocks provided by the carbon budget model of the Canadian Forest Sector (CBM-CFSS)

METHODS

- For each site, four plots were randomly assigned.
- Each plot consisted of a circular 400 m2 area in which all trees over 10 cm were identified by species, and measured for DBH and height.
- Each plot contained a subplot of 50 m2 in which all trees were identified by species and measured for DBH and height.
- Two transect lines were placed perpendicularly with their centers intersecting directly over the plot center, and all course woody debris that intersected these lines was measured.
- Using the same transect lines mentioned above, the thickness of the top layers of the soil were identified every two meters.
- Within a 1 m2 subplot all fine woody debris and a soil sample were collected for further analysis.

K. Nickerson, MTRI

Jamie Patriquin collecting twig samples

RESULTS

- Dead wood on all sites was dominated by woody debris amounting to 62–88% of total dead wood biomass.
- No snags >30 cm diameter at breast height were encountered, and most snags were collapsing rather than falling intact.
- Snag biomass amounted to just 23% of total dead-wood biomass in old forests. Woody debris was dominated by small pieces (<20 cm diameter) at all sites.

RESULTS
Continued

- Although sites harvested 1–2 years before measurement contained twice as much woody debris as old forests, sites harvested 8 years before measurement contained comparable amounts of woody debris to old forests, indicative of rapid hardwood decay rates.
- Other carbon pools (soil and organic layer) and comparisons of field measure and CBM-CFS3 modeled forest C stocks are not yet available.

YEARS OF DATA

- Year 2 of a 6 year project

PARTNERS

- Canadian Forest Service
- Human Resources and Skills Development Canada
- Mersey Tobeatic Research Institute
- Nova Scotia Department of Natural Resources
- University of Prince Edward Island

K. Nickerson, MTRI

Alain Belliveau and Jamie Patriquin collect samples from the field

K. Nickerson, MTRI

Measuring the volume of a soil sample

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Rationale

The Eastern pipistrelle is one of North America's smallest bats. The species is at the northern-most extent of their geographic range here in eastern Canada, with the only known breeding population residing in southwest Nova Scotia. Relatively little is known about the ecology of the population here, and being presumably geographically disjunct in Nova Scotia makes this species a target of conservation concern. Some unqiue morphological and behavourial traits observed in this population suggests that Eastern pipistrelles here in Nova Scotia (and possibly the whole of Atlantic Canada) may represent a subspecies previously unknown to science, and efforts are now underway to better document and understand their phenotypic distinctiveness and their population genetics. If Eastern pipistrelles in Nova Scotia are taxonomically distinct, then burgeoning conservation strategies and management plans for this species must be revised accordingly.

J. Poissant

Female Eastern pipistrelle from Kejimkujik with transmitter

Research

EASTERN PIPISTRELLE BAT TAXONOMIC STATUS

OBJECTIVES

- To characterize the morphology of Eastern pipistrelles here in Nova Scotia by examining vouchered specimens in biological collections housed in various museums.
- To determine whether Eastern pipistrelles from Nova Scotia are morphologically distinct when compared with those from other regions in North America, and revise the taxonomic designation of the former if they demonstrate to be unique.
- To determine the conservation genetic status of the population of Eastern pipistrelles here in Nova Scotia.

METHODS

- Thirty four morphological characters from the skin and skull of vouchered specimens of Eastern pipistrelles in museum collections will be studied and measured.
- All known vouchered specimens of Eastern pipistrelles originating from Nova Scotia have been examined and measured at various museums (i.e., Canadian Museum of Nature, Nova Scotia Museum, and New Brunswick Museum).
- Specimens of Eastern pipistrelles collected from other regions of North America (e.g., northeastern and southern United States) have been or will be examined at other museums (i.e., Royal Ontario Museum, Smithsonian Institution National Museum of Natural History, Museum of Comparative Zoology, American Museum of Natural History, and Cornell University Museum of Vertebtrates). Collation of this data will be completed this autumn.
- DNA extracted from tissue samples taken from live Eastern pipistrelles captured and released in Kejimkujik will be studied to determine the conservation genetic status of the population relative to others in North America.

H. Huynh

Makeshift lab bench for processing and sampling bats captured and released in Kejimkujik

RESULTS

- Preliminary comparative analysis of the examinations and measurements of housed museum specimens suggest that Eastern pipistrelles from Nova Scotia (and New Brunswick) are morphologically distinct from other populations in North America, characterized by differences in skull and teeth size, and tragus length relative to the ear.
- More data are in the process of being collated for the purposes of increasing sample size to validate statistical comparisons.
- DNA has been extracted from some tissue samples collected from Eastern pipistrelles captured and released in Kejimkujik.
- Testing of microsatellite primers to determine the population genetic structure of Eastern pipistrelles in Nova Scotia has been successful. Analysis is currently underway.
- Testing of other molecular markers (i.e., mitochondrial and nuclear genes) to help answer questions of taxonomic uniqueness is pending.

YEARS OF DATA

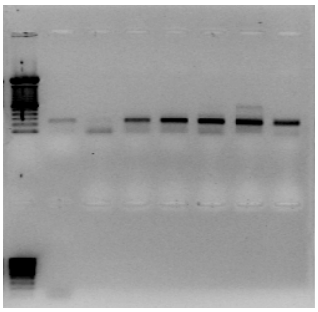
- Year 2 of a 2 year project

PARTNERS

- Acadia University
- Saint Mary's University
- Parks Canada
- Mersey Tobeatic Research Institute

H. Huynh

Howard Huynh examining bats skins and skulls at the Canadian Museum of Nature



H. Huynh

Agarose gel with PCR products from amplified DNA of Eastern pipistrelle samples targeting microsatellite loci

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Rationale

The Eastern pipistrelle bat population in Nova Scotia appears to be disjunct from other populations of this species in North America. The lack of gene flow, concentration in southwest Nova Scotia and apparent low population make study of this species important. Preliminary work over the last several years has identified several hot spots of activity. Through trapping and subsequent PIT tagging and radio-tracking we hope to better understand how this species roosts and behaves socially. By determining the roosting areas of maternity colonies and social interactions of individuals within these colonies we can suggest appropriate means of sustaining the population of this species over the long term.

J. Poissant

Individual from colony captured at roost tree, placed in capture bag with some usnea padding

Research

EASTERN PIPISTRELLE BAT ECOLOGY

OBJECTIVES

- To locate roost sites used by maternity colonies in Kejimkujik.
- To characterize roost sites at both the tree and stand scales.
- To characterize the social structure, particularly females, in Nova Scotia.

METHODS

- Twelve m mist nets are used at various sites within Kejimkijuk to trap bats for 3 hours after sunset.
- Bats of the target species are injected with a PIT tag and receive a 0.3 g radio transmitter. Morphological characteristics such as forearm length, mass, age and sex are recorded.
- Bats are tracked daily to their roost trees until the transmitter falls off or the battery dies (up to 21 days). Trees identified as roost sites are visited later and a 0.1 hectare circle plot surrounding the site is used to characterize the roost site at the tree level and stand level.
- If possible, an antenna was deployed relative to the bats in the tree to record which individuals are present.
- Random 0.1 hectare plots were completed to compare roost site selection to other areas at the stand level.

J. Poissant

A roosting maternity colony of eastern pipistrelles. They are within the typical 'usnea umbrella' that appears to shield them from the sun and rain

RESULTS

- A total of 15 Eastern pipistrelles were captured and received PIT tags. Eight of these bats were fitted with radio transmitters, resulting in the identification of 41 unique roost trees within four separate roosting areas.
- All individuals were found to roost in *Usnea trichodea*, a lichen. This is a novel roosting adaptation for this species.
- Bats were found to roost in 95.2 % Black spruce and 4.8 % Red maple. These trees had an average DBH of 23.1 cm and a height of 16.4 m.
- For reasons unknown, capture success dropped significantly in late June. Activity appeared to decrease at the main capture

RESULTS
Continued

site (Eel Weir Bridge, Kejimkujik) and remained low for the remainder of the summer.

- Collection of social data is expected to occur during the second field season, summer 2008.

YEARS OF DATA

- Year 1 of a 2 year project

PARTNERS

- Saint Mary's University
- National Sciences & Engineering Research Council of Canada
- Parks Canada
- Nova Scotia Habitat Conservation Fund
- Mersey Tobeatic Research Institute
- Abitibi-Bowater Incorporated

J. Poissant

The area where the Mersey River meets George's Lake. Based on previous captures and echolocation data this has been identified as one of the areas of highest eastern pipistrelle activity in south west Nova Scotia.

J. Poissant

Main capture site at the Eel Weir Bridge in Kejimkujik. The masts are 10m above the river and support up to four 12m mist nets suspended using ropes and pulleys.

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Rationale

The White-tailed deer is a major herbivore at Kejimkujik and an important element of the forest trophic structure. Changes in deer population density can have a significant impact on forest ecosystem structure and dynamics. Mammals such as Black bear, Eastern coyote and Bobcat prey upon White-tailed deer. Changes in deer population density influence the populations of these top-predators. White-tailed deer is a coveted game speciesthat is highly susceptible to poaching. Changes in deer population density can provide information about hunting pressure outside the park and the effectiveness of management and enforcement within the park. An annual roadside count of deer has been conducted at Kejimkujik since 1976 to provide information on the status and trends in White-tailed deer populations at the park.

J. Steeves

Deer along shoreline

Monitoring

WHITETAIL DEER MONITORING

OBJECTIVES

- To monitor and report on the status and trends in White-tailed deer populations at Kejimkujik. Specifically, to assess and detect changes in: (i) the mean number of deer counted per day; (ii) the mean number of adult males counted per day; and (iii) the ratio of the number of fawns to the number of adult females counted per day.
- To ensure that the White-tailed deer population density is at a sustainable level for the forest to grow and develop without any major shift from its known succession steps.
- To ensure that the White-tailed deer population remains relatively stable over time helping to maintain relatively stable populations of top predators.

METHODS

D. Pouliot, Parks Canada

Forest

- The White-tailed deer population survey has been conducted annually since 1976.
- Deer are counted along the main roads within Kejimkujik on a daily basis at 8a.m. for 31 days in October.
- At the end of the month, the average number of deer counted per day is calculated. The mean number of adult males counted per day and the ratio of the number of fawns to the number of females counted per day is also calculated.
- The average number of deer per day for a given year is compared to the averages of the previous years.
- Quantitative thresholds are used to determine if the size of the deer population is within a range that does not negatively affects the normal growth of the forest in the park. These thresholds are currently based on the data collected since 1976 and represent a natural variation of 31% in the average number of deer counted per day (Figure 1).

RESULTS

- Between 1976 and 1986, the White-tailed deer population in the park was at a high-density level with an average of 17 deer counted per day. Since 1987, the deer population remains

RESULTS
Continued

stable at a low-density level with an average of 3 deer counted per day (Figure 2). Several reasons are being explored for this decrease in density, including the end of logging in the park, harder winters, and an increase in coyote predation.

- The data from 2006 and 2007 suggest that the deer population is currently increasing. A 10-year cycle of higher population density seems to exist in the historical data (1989, 1999) and the next 2 years (2008 and 2009) will be important to assess the persistence of this trend.
- The historical roadside deer data in Kejimkujik (1976-2007) were compared to density estimates from pellet counts obtained by the Nova Scotia Department of Natural Resources for the hunting zones adjacent to the park (Zones 1 and 2). An interesting correlation was found between both sets of data, providing confidence that the roadside deer survey gives valuable and reliable information about the deer population at Kejimkujik.

YEARS OF DATA

- Ongoing monitoring project since 1976

PARTNERS

- Parks Canada
- Nova Scotia Department of Natural Resources

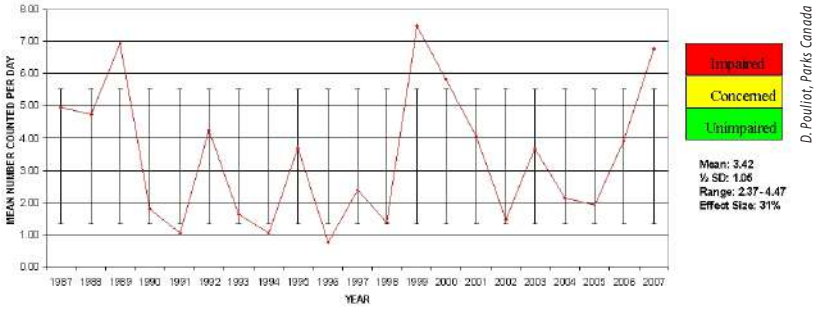

Figure 1: Thresholds used to assess and report on the status of White-tailed deer at Kejimkujik

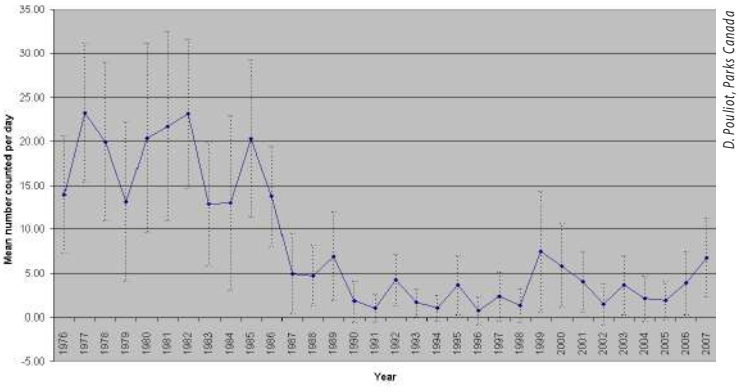

Figure 2: Mean number of deer counted per day during the October roadside deer count survey from 1976 to 2007 in Kejimkujik

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Rationale

Air pollution can affect both the environment and human health. Monitoring levels of air pollution provides information on whether corrective or protective measures need to be implemented in regards to air pollution in a particular area. The costs and logistical challenges of instrument-based air quality monitoring make it unpractical for use in remote areas or for large scale monitoring. Instead, the health and composition of lichen communities can be used as an indicator of air pollution levels in an area.

D. Clapp

British soldier lichen

Monitoring

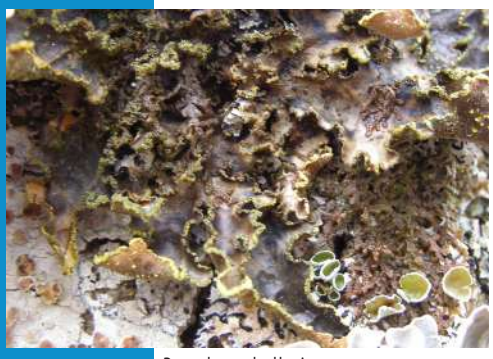
AIR QUALITY MONITORING WITH LICHENS

OBJECTIVES

- Analyze existing lichen data to estimate air quality in Nova Scotia.
- Determine how many lichen air quality monitoring stations are needed in Nova Scotia to make statistically valid conclusions.
- Choose areas where new lichen air quality monitoring station should be installed.

METHODS

- Data from fifty-eight lichen monitoring plots were analysed including 11 plots that are part of study of urban air quality, 7 plots that are air monitoring stations of the Nova Scotia Department of Environment and Labour, 6 long term forest ecosystem monitoring sites at Kejimkujik, 3 plots near a mine in Yarmouth County, and 31 plots in protected areas.
- A sampling quadrat divided into 5 10 x 10 cm sections was hung vertically on each primary cardinal direction of the tree. Most plots considered in this analysis quadrats were surveyed for a restricted suite of lichens that are pollution tolerant based on the work of Cameron *et al*. (2007).
- The best index of lichen diversity was chosen to reflect levels of air pollution in a plot. This index did not include pollution-tolerant lichens.
- The influences of air pollution, location, distance to the coast, and climate on lichen community composition were calculated.



D. Clapp

Pseudocyphellaria crocata

RESULTS

- Comparison of lichen indices and instrument measured pollution levels suggest calibration between the 2 may be possible in Nova Scotia.
- A power analysis suggested at least 19 plots in each region to compare 2 regions within the province with statistical confidence. An initial estimate of the number of airsheds in the

RESULTS
Continued

province was set at 4 (requiring 76 plots). Based on this estimate a trend of at least 10% in the index for the entire province can be detected in as few as 3 consecutive years of sampling. To detect a trend of at least 10% in the index of any given monitoring plot it must be monitored every year for 13 years, every other year for 19 years, every 3 or 4 years for 22 years.

- A scheme for choosing monitoring plots for future monitoring was presented and potential sites for locating new monitoring plots were chosen.

YEARS OF DATA

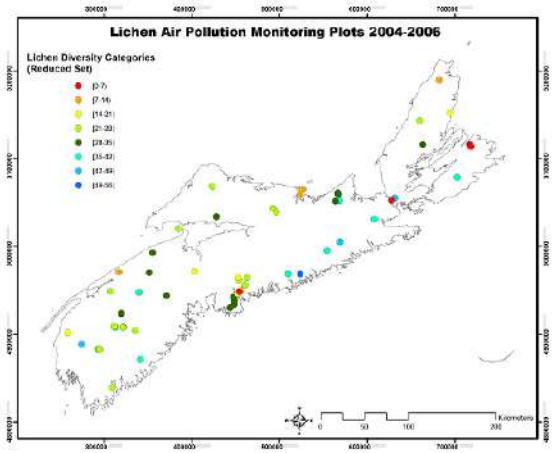
- 2004 - 2007

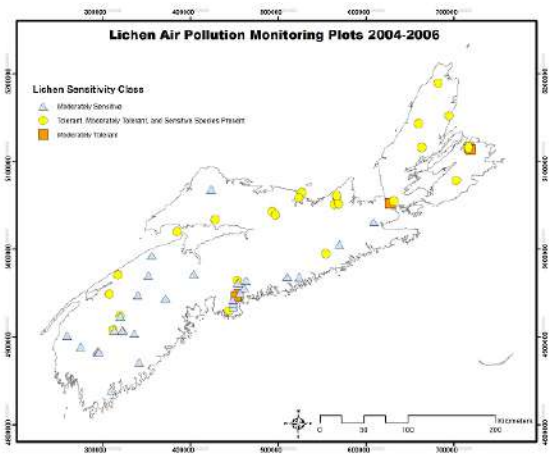
PARTNERS

- Mersey Tobeatic Research Institute
- Ecological Monitoring and Assessment Network
- Parks Canada
- Nova Scotia Department of Environment

D. Clapp

Lung lichen





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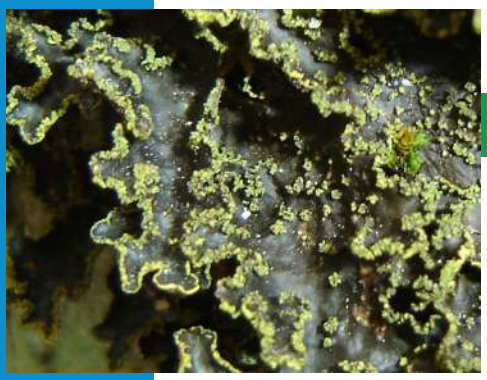
Rationale

Lichens are well-established bioindicators that have been used globally to monitor air pollution for many years. They are particularly sensitive to environmental changes due to the lack of a cuticle, uptake of nutrients from the atmosphere and slow rate of growth and development. As a result, lichens can provide an early warning for air pollution and acid rain impacts on forest ecosystems. Lichen species vary in their sensitivity to pollutants. Therefore, an understanding of the prevailing air quality in an area can be obtained by monitoring the assemblage and abundance of different species. Monitoring lichens can also provide a measure of biodiversity and overall forest health because of demonstrated associations of lichen species with forest structure, seral stage, fragmentation and disturbance history. Lichens are monitored as one component of the integrated forest plots at Kejimkujik designed to assess and monitor the state of forest ecosystems and their changes over time.



T. McMullin

Pseudocyphellaria perpetua, a pollution intolerant lichen species

Monitoring

LICHEN MONITORING

OBJECTIVES

- To assess and report on the status and trends in lichen communities at Kejimkujik as a measure of biodiversity and stress in forest ecosystems.
- To determine if the Index of Air Purity (IAP) is within the range of natural variation in mixed forest ecosystems at Kejimkujik and if it has increased or decreased over the past 5 years.
- To determine if the overall species richness of 50 field-identifiable lichen species is within the range of natural variation in mixed forest ecosystems at Kejimkujik and if it has increased or decreased over the past 5 years.

METHODS

- Lichen species were sampled at six previously established integrated forest plots in Red maple-Red oak-White birch-White pine stands at Kejimkujik. Also being measured in these integrated forest plots were trees, shrubs, ground vegetation, salamanders, forest birds, arthropods, decomposition and coarse woody debris.
- Presence and abundance of 50 field identifiable lichen species were assessed in permanent sampling quadrats ('ladders') on twelve Red maple trees at each forest plot. The Index of Air Purity was developed based on the frequency of occurrence of pollution-intolerant lichen species in each forest plot (i.e., cyanolichen species, Cladonia species, Leptogium species, Lobaria pulmonaria, Lobaria quercizans, Lobaria scrobiculata, Pseudocyphellaria crocata/perpetua)(Cameron et al. 2007).
- A species list was also developed for lichen species located on the lower boles (trunks) and adjacent fallen branches of Red maple, Red oak and White pine trees (co-dominant trees) as a measure of lichen species richness at each plot.

T. McMullin

Lobaria scrobiculata, a pollution intolerant lichen species

RESULTS

- A protocol was developed to guide long-term monitoring of lichens in forest ecosystems at Kejimkujik (McMullin and Ure 2008). The protocol outlines monitoring objectives, sampling

RESULTS
Continued

design, field methodology, data analysis and reporting procedures, and personnel and training requirements.

- An Index of Air Purity was calculated for each of the six forest plots at Kejimkujik (Figure 1). Preliminary thresholds for the Index of Air Purity were established based on the occurrence frequency of pollution-intolerant lichen species across a gradient of air quality. Data from Cameron et al. (2007) were used to calculate the Index of Air Purity for six urban plots within 10 km of Halifax city centre and for seven intermediate plots between 10 km and 50 km from the city centre. The results for the intermediate plots serve as an interim 'concerned' threshold (mean IAP = 0.578 +/- 0.12SE); the results from the urban plots serve as an interim 'impaired' threshold (mean IAP = 0.133 +/- 0.09SE). Based on these thresholds, five plots at the park showed a good Index of Air Purity and one plot was in a concerned condition.
- Lichen species richness was also examined. Fifty field identifiable lichen species were included in the species richness assessment. Throughout the six plots examined, the range of species richness was between 18 and 22 with an average of 19 and a standard deviation of 2.

YEARS OF DATA

- Ongoing project since 2006

PARTNERS

- Parks Canada
- Dalhousie University
- Nova Scotia Department of Environment

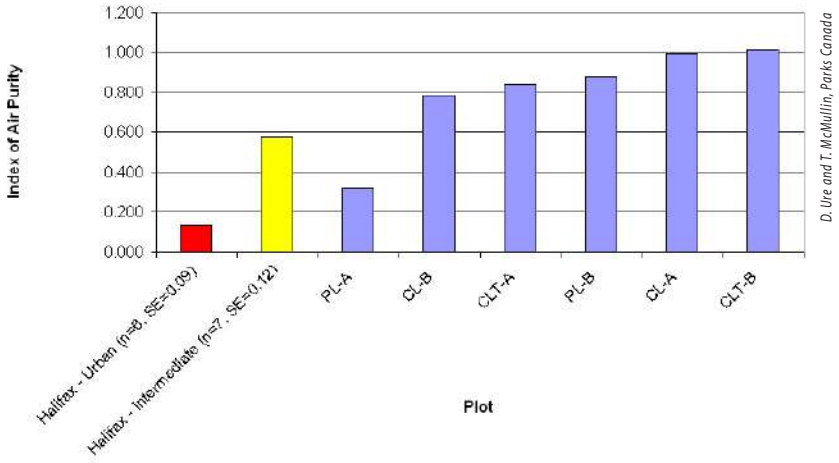


Figure 1. Index of air purity results for six Kejimkujik monitoring plots compared with urban and intermediate plots in the Halifax region

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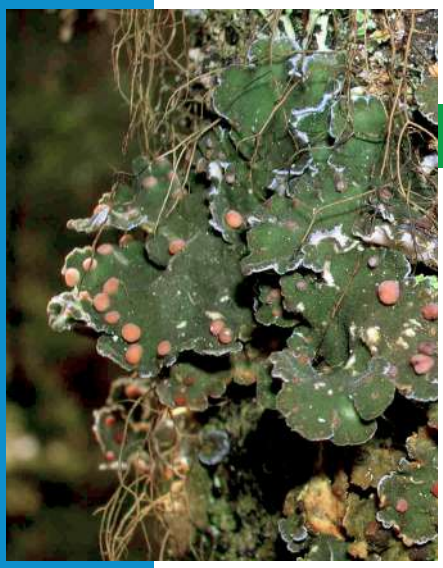
Rationale

Boreal felt lichen and other rare lichens of the coastal forest community are threatened by forestry practices and air pollution. The threat posed by forestry is largely due to lack of ability to detect the lichens presence and lack of knowledge of their likely occurrence. Little is known about which sources of air pollution pose the greatest threats and at what levels. Some progress from the forestry threat has been made in the last two years with the use of the GIS habitat algorithm to identify likely habitat. Eleven new boreal felt lichen locations were found and protected using the GIS algorithm in 2005 and 2006. Search time and effort is very high but could be reduced if the predictive ability of the algorithm was improved. This project was aimed at finding new rare lichen sites ; getting a better understanding of health of population, habitat and level of threat; increasing awareness of at risk lichens in NS and protecting existing boreal felt lichen sites.



R. Cameron, NSDOE

Boreal felt lichen

R. Cameron, NSDOE

Tom Neily in a forest with boreal felt lichen

Monitoring

BOREAL FELT LICHEN MONITORING

OBJECTIVES

- To improve the predictive ability of a GIS habitat algorithm to increase likelihood of finding boreal felt lichen.
- To increase knowledge of habitat characteristics and severity of threats at boreal felt lichen sites over time.
- To raise the profile of Nova Scotia's rare lichens.
- To protect newly found boreal felt lichen and at risk lichen sites through verbal landowner stewardship agreements.

METHODS

- Seventy new predicted sites were searched in 2007 for presence of boreal felt lichen and other at risk lichens.
- GIS data on each searched site were collected and included forest cover, surficial geology, bedrock geology, climate, topography, soil drainage, soil texture, distance from wetland, distance from coast and wetland density.
- All currently known sites of boreal felt lichen were permanently marked for long-term monitoring.
- Data were collected on habitat parameters including trees species, tree heights, tree diameters, tree ages, crown cover, slope, aspect, soil drainage, ground cover and other parameters.
- When Boreal felt lichen sites were found the landowners were provided with information about lichens.
- Day-long workshops were held to train people to identify lichens and look for boreal felt lichen.

RESULTS

- Identification cards were designed for boreal felt lichen and information was included in the Species at Risk Identification Guide published in 2007.
- Fifty-eight sites of predicted habitat were inventoried for boreal felt lichen. Boreal felt lichen was found at four of the inventoried sites. 51 of the sites had at least one at risk, red or yellow listed species. One site had COSEWIC species of special

RESULTS
Continued

C. Kasperkovitz

Boreal felt lichen postcard

concern, ghost antler lichen.

- At the start of the project predictability of the GIS habitat algorithm for boreal felt lichen was 6%. That is, 6% of sites predicted to have boreal felt lichen habitat actually had the lichen. Statistical analyses can be applied to the algorithm to increase predictive ability.
- Fifteen landowner contacts have been made, including small private woodlot owners, large industrial landowners and Crown land managers. All currently known boreal felt lichen locations are protected under a verbal stewardship agreement (3 small private, 3 large industrial, 8 Crown land) and two locations are within an existing protected area. Three agreements were made during this project.
- All sites with boreal felt lichen are dominated by Balsam fir. Other tree species found in order of dominance are Black spruce, Red maple, White pine and Yellow birch. Many of the standing trees are dead, with up to 50% of the trees in several sites. Wind-throw is variable but can be significant in some sites.
- Four workshops were held to train 60 people to identify lichens and look for boreal felt lichen.
- Posters, handouts, and postcards were produced.

YEARS OF DATA

- Ongoing project since 2006

PARTNERS

- Mersey Tobeatic Research Institute
- Nova Scotia Department of Environment
- World Wildlife Fund Endangered Species Recovery Fund
- Environment Canada's Habitat Stewardship Program
- Neenah Paper Incorporated
- NewPage Corporation


R. Cameron, NSDOE

Boreal felt lichen habitat


R. Cameron, NSDOE

Boreal felt lichen on a tree

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Rationale

Flying squirrels may be sensitive to fragmentation and good indicators of landscape connectivity because they need mature trees to climb for gliding and to sleep in during the day. To understand the connectivity requirements of flying squirrels in Nova Scotia, local life history data as required to determine how long they live, how many young they have and how they disperse. With this project, live-trapping, passive integrated transponder (PIT) tags and nest boxes were used to collect life history data for flying squirrels. PIT tags are small glass microchips that are inserted under an animal's skin and that provide the time, date and unique code for the animal when they pass through a circular antenna.

A. Lavers, MTRI

Flying squirrel in tree after release

Monitoring

MONITORING FLYING SQUIRREL SURVIVORSHIP

OBJECTIVES

- To determine survivorship of flying squirrels.
- To determine fecundity (ability to produce young) of flying squirrels.

METHODS

- Study grids were installed at six sites in the Mersey and Medway watersheds with wooden brackets placed on the south side of trees at chest height.
- Live traps were placed on the brackets and baited with peanut butter.
- Captured flying squirrels were implanted with PIT tags and released where they were caught.
- PIT tag receiving stations were placed within the grid to monitor survivorship.
- Volunteers from Lunenburg, Queens and Shelburne counties constructed squirrel boxes, which were installed in study grids for future fecundity work.

A. Lavers, MTRI

Flying squirrel cavity box

RESULTS

- In January and February of 2008, 21 flying squirrels (5 Southern and16 Northern) were live-trapped at Donnellan Lake, Hemlock Hill, and Grassy Lake.
- Nine flying squirrels visited recording stations, three of these were recently PIT-tagged, five were originally tagged the previous year, and one had been tagged two years before
- Incidentally, two captures were made of the rare American marten
- On two occasions, two different Southern flying squirrels were recorded at the same PIT tag receiving station within 5 minutes. On one occasion, two different Northern flying squirrels were recorded at the same PIT tag receiving station within 5 minutes.
- On one occasion, three different Southern flying squirrels were detected at the same PIT tag receiving station within 30 minutes.

YEARS OF DATA

- Ongoing since 2005

PARTNERS

- Mersey Tobeatic Research Institute
- World Wildlife Fund Endangered Species Recovery Fund
- Environment Canada's Habitat Stewardship Program

A. Lavers, MTRI

A. Lavers, MTRI

Andree-Anne Marcoux and Jessica Johnson taking measurements and then releasing flying squirrel

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Rationale

Red oak is an integral component of the Acadian Forest, proving food and shelter for a wide array of wildlife. However, forestry practices conducted in the greater Kejimkujik ecosystem since European settlement in the mid-1700s have fundamentally altered the structure of Acadian Forests in this area. Data from two Smithsonian Institution Monitoring and Assessment of Biodiversity (SI/MAD) Forest Plots within Kejimkujik indicate a proportionately significant decline in Red oak stands. The aim of this project is to assess the distribution, age structure and health of Red oaks in the greater Kejimkujik ecosystem and to quantify levels of Red oak regeneration. Understanding recruitment and population dynamics of Red oak will help develop treatments for the maintenance of this species.

X. Salcedo

Red oak seedling in fall foilage

Research

DISTRIBUTION AND RECRUITMENT OF RED OAKS

OBJECTIVES

- To map and describe the distribution of Red oak in Kejimkujik and areas surrounding the park.
- To establish monitoring plots that will be used for future study and provide a long-term understanding of Red oak population dynamics.

METHODS

- Two helicopter surveys were conducted over Kejimkujik and areas surrounding the park in November. Red oak is one of only a few native hardwood species that retain their leaves late into the fall, which makes this an ideal time for stand identification.
- Stand coordinates were recorded using GPS devices. Researchers also made ocular estimates of the proportion of Red oak occupying each stand.
- Data concerning stand location and their Red oak proportion was entered into GIS (mapping) software to create a Red oak stand map. Individual stands were color coded according to Red oak proportion on a green-to-red scale.

A. Lavers, MTRI

Kyle Rowter preparing for aerial survey of red oak stands

Helicopter, at McGowan Lake, used to conduct aerial surveys of red oak stands

RESULTS

- Seventy-two red oak stands were surveyed, mapped, and classified by the proportion of oak estimated in the overstory
- Most red oak stands had a moderate proportion of oak (30% of the canopy estimated from aerial surveys); only 7 sites had greater than 50% oak in the canopy

YEARS OF DATA

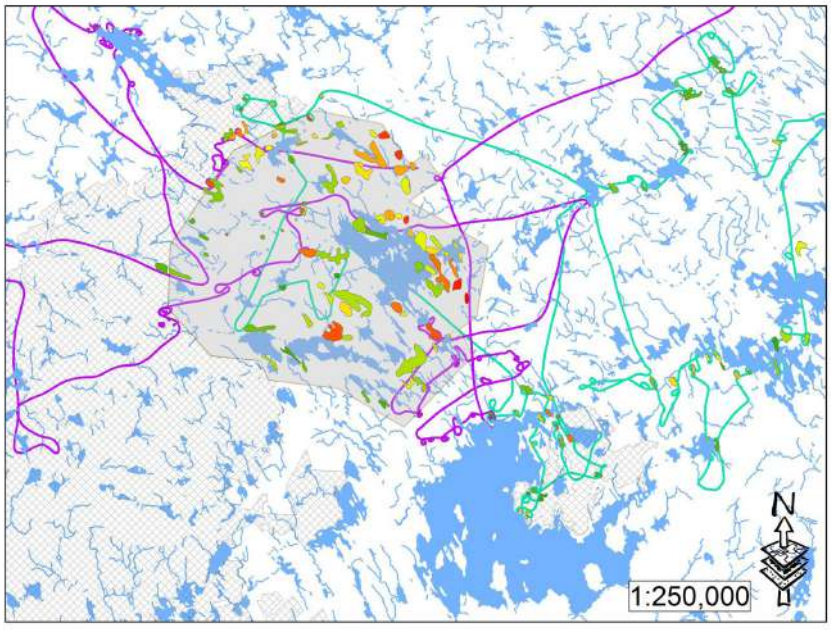
- Year 2 of an ongoing project

PARTNERS

- Mersey Tobeatic Research Institute
- Parks Canada
- Nova Scotia Department of Natural Resources

A. Lavers, MTRI

Aerial view of autumn mixedwood forests in Queens County



A. Belliveau, MTRI

Map showing red oak stands in green (5-40% red oak), yellow (40-60% red oak), orange (60-80%) and red (80-100%) as surveyed by Trant (2006) and this study by helicopter (purple line is flight path November 19, 2007 and green line is flight path November 30, 2007

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Rationale

An understanding of the disturbances that shaped the current forest composition in national parks is crucial for vegetation management. One of the most important natural disturbances in the interior areas of the Maritime region is fire. According to previous studies of the recent fire frequencies in Kejimkujik, the fire return interval in various ecosystems within the park was less than 20 years during the last 100 years (the fire return interval varied from 15 years for white pine to 19 years for Eastern hemlock). If indeed such fire frequencies represented natural processes in the past, fire management in the park should aim to conduct prescribed burning as often as every 15-19 years in order to preserve the existing forest ecosystems. However, extrapolation of these results to any longer time period (e.g.,to the time of the establishment of the oldest tree stands in the park) is disputable, as fire frequency can significantly change through time, and the direction of the change is not immediately obvious. This two-year project aims to reconstruct pre-European fire frequency of Kejimkujik using soil charcoal and semi-coke.

A. Belliveau, MTRI

Charcoal in fire scar

J. Sheppard, Parks Canada

Elena Ponomarenko showing soil features

Research

NATURAL FOREST FIRE DISTURBANCE HISTORY

OBJECTIVES

- To reconstruct historical fire history in the park.
- To determine past changes in fire frequencies.
- To determine the tree species composition associated with various levels of fire occurrence in the past, particularly for the period preceding the intensive European colonization and for the time of the establishment of the oldest tree stands in the park.

METHODS

- In 2006-2007, over 40 sites were examined in the park.
- Soil sections were examined, photographed, and described using an Ecosystem Archaeology approach.
- Charcoal, semi-coke and charred forest duff were sampled from pyrogenic layers and morphons for further botanical identification and radiocarbon dating.
- Radiocarbon dating of charcoal determined the age of fires and their frequency.
- Botanical identification of charcoal has been applied to reconstruct the tree species composition of fire-affected stands and successional changes in the forest cover of the park.

RESULTS

- Fires affected the park area from at least 10,000 years ago: we recorded 18 fire events that took place between 10,000 and 250 years ago.
- Twelve of these fires, 6ka and younger, affected simultaneously several sites, often several kilometers apart. These fires occurred shortly after hurricanes. Each of these combined fire-hurricane events affected tens of square kilometers, causing significant deforestation of the area.
- The number of fires recorded per site varied from three to five for the period from 3,000 to 250 years ago. Fire frequency changed through time, reaching its maximum in the last

RESULTS
Continued

millennium. Between AD1100 and AD1720, the average fire return interval in the area was approximately 250 years. However, fire return interval in the first millennium AD and in the first millennium BC could be as low as 600 years. The 600 year-long breaks in fires took place between AD 400 and AD 1100 and from AD 200 to 400BC.

- During the last millennium, four large-scale fires simultaneously affected 30 to 75% of the study sites. The fires occurred approximately 1,000, 800, 500, and 250 years ago. The area affected by a given fire was especially large during the fire events of AD 1207-1288, AD 1430-1476, and AD 1700-1764.
- The tree species recorded in pre-historic charcoal assemblages did not differ significantly from the species composition of the modern forests in the park, including: Eastern hemlock, White pine, Red pine, Spruce, Balsam fir, Red oak, maple, American beech and birch. Under-storey species included Canada yew, Hazelnut and Witch hazel.
- Some of the stands that were not affected by fires for ~600 years, still contained a proportion of light-demanding species (Red oak, White pine), possibly as a result of wind actions not associated with fires. In contrary, some of the sites that experienced fires every 200 years, contained no light-demanding species, possibly as a result of some forest pest infestations targeting pine and oak. Finally, the proportion of oak versus pine in charcoal assemblages varied through time, with either oak or pine being more abundant in certain time periods. It could be associated with recurring forest pest infestations.
- Pre-historic and early historic fires occurred as a result of catastrophic fuel accumulation during hurricanes/windstorms. Ignition of this fuel within a decade after the windstorm caused high-intensity, large-scale fires. However, not each hurricane landfall entailed a fire, which indicates that the windstorms could have impacted local forests more frequently than the fires.
- The frequency of past hurricane landfalls differed among various sites within the park, with some sites being much more windstorm-prone than the others.

A. Belliveau, MTRI

Old forest

YEARS OF DATA

- Year 2 of an ongoing project

PARTNERS

- Canadian Museum of Civilization
- Parks Canada

J. Sheppard, Parks Canada

Uprooted tree showing modern-day example of effect on soil

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Rationale

Approximately 20,000 km of roads criss-cross the five counties of southwestern Nova Scotia. Many of them are forest roads. This means that in much of the region critical habitat for species requiring large, undisturbed, roadless areas is scarce and fragmented. Despite recognition by landscape ecologists that roads penetrating forest ecosystems present a serious threat to habitats of many wildlife species and wilderness values, consequences of road building within the context of sustainable forest management are not well understood. Ecological impacts of roads can be hard to quantify. However, a growing body of research makes a compelling link between roads and ecological degradation. Understanding impacts of existing forestry roads and developing creative mitigation solutions provides opportunity for landowners, forest managers and protected areas planners to improve the status quo. Responsible road development and management of existing road networks is an integral part of sustainable forest management and complementary to an ecosystem-based approach to landscape level planning that is needed in Nova Scotia.

C. Robinson

Roads fragment interior forest habitat

Research

ECOLOGICAL EFFECTS OF FOREST ROADS

OBJECTIVES

- To propose a comprehensive framework for systematically assessing a broad range of potential road impacts on forests that considers indirect and cumulative effects, as well as mitigation options. Apply the framework to a case study in southwestern Nova Scotia.
- To critically assess and provide NS Department of Natural Resources (DNR) partners with constructive feedback on their version of a road index tool designed to help integrate the influence of roads into an ecological landscape analysis process.
- To broaden knowledge of forest stakeholders on the importance of considering ecologically sensitive areas and areas important for connectivity in the planning and maintenance of forest roads.

METHODS

- Components of the assessment framework were built from qualitative reasoning drawn from a thorough examination of road ecology literature, a review of GIS-based tools used to measure landscape-level road influence, and field observations of various indicators of effects on terrestrial and aquatic ecosystems.
- To test the applicability of the approach, a case study was conducted on the Indian Fields Road, near the Tobeatic in southwestern Nova Scotia. Crown land-use managers and wilderness recreation groups were contacted for insight into the management challenges (maintenance, costs) and public use of the road.
- A road index analysis was completed for southwest Nova Scotia.

L. Valotaire

Bridges on old access roads eventually revert back to nature

RESULTS

- The assessment framework includes two parts: (1) a series of impact hypothesis diagrams wherein ecological impacts are organized relevant to three phases of road existence:

RESULTS
Continued

A. Lavers, MTRI

Clare Robinson uses a bicycle to navigate through an old road to collect data

construction, presence and use; and (2) a five-step approach whereby ecological impact and road importance can be systematically evaluated and a decision matrix used to determine appropriate mitigation strategies.

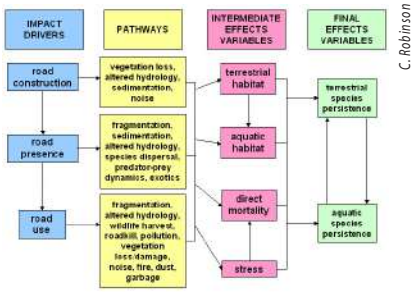
- The case study demonstrated the utility of the framework in (1) identifying and interpreting relevant indicators of impact related to the presence and use of an existing road, and (2) highlighting important linkages between impact drivers and effect variables that can be targeted for the most appropriate mitigation strategy. In this example, ecological impact of the Indian Fields road was assessed as high and road importance for resource and recreational use was considered to be low. Recommended mitigation includes a combination of active and passive options for road decommissioning.
- The design of DNR's road indexing tool is generally consistent with coarse analytical approaches used elsewhere to measure landscape-level road influence where the analysis is considered a preliminary assessment of road influence. Quantitative sensitivity analyses to test further some of the specific assumptions inherent in the tool's design were recommended to search for improvements in the approach. Wherever possible, field assessments are recommended to ground-truth digital data and facilitate a better understanding of local and landscape-scale road influence.
- In general, regular maintenance and limiting public access on forest roads necessary for management operations would mitigate some ecological impact. Decommissioning of redundant and unnecessary roads would help reduce road impact and maintenance costs and improve habitat for interior forest species sensitive to human interaction.

YEARS OF DATA

- Year 2 of a 2 year project

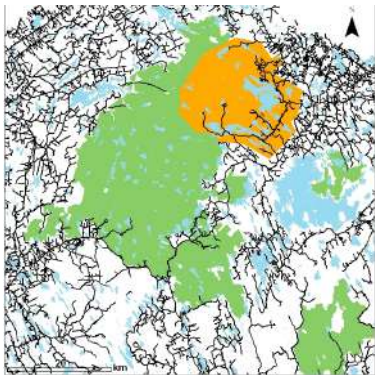
PARTNERS

- Dalhousie University
- Mersey Tobeatic Research Institute
- Natural Sciences and Engineering Research Council
- Nova Forest Alliance
- Nova Scotia Department of Natural Resources
- Nova Scotia Department of Environment



C. Robinson

Impact hypothesis diagram summarizing how road construction, presence and use affect terrestrial and aquatic species persistence



C. Robinson

Dense road networks (black) penetrate and isolate protected areas in southwestern Nova Scotia (Kejimkujik = orange, Provincial Wilderness Areas = green)

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Rationale

The provincial Forest Ecosystem Classification (FEC) can be thought of as a catalogue of forest and woodland ecosystems in Nova Scotia. The FEC provides information about the site, soil moisture, soil nutrients and tree and understory plant species. Classifying forest ecosystems based on vegetation, soil and site characteristics allows forestry professionals, woodlot owners and researchers to recognize similar forest ecosystem units on the ground and to develop a common understanding of these units. This allows for the development and use of best management practices which address hazards and operational limitations associated with different ecosystems, leading to more predictable and sustainable forest management. Forest ecosystem classifications also provide a means through which ecosystem-based management principles can be applied operationally at the stand level, and a framework from which to communicate the success or failure of different management treatments. Most forest resource values can be evaluated within the classification.

P. Neily, DNR

Red pine woodland near Hibernia, Queens County

Research

FOREST ECOSYSTEM CLASSIFICATION

OBJECTIVES

- To develop a comprehensive forest ecosystem classification system for Nova Scotia.
- To identify and describe recurring vegetation communities and soil types associated with Nova Scotia forests.
- To provide an ecological framework from which to communicate and promote ecosystem-based management at the stand level.
- To provide an ecological framework from which best management practices can be developed and applied to promote sustainable forest management in the province.

METHODS

- A stratified sampling approach was taken to divide the province's forest landscapes into 47 different sampling units (based on earlier biophysical and ecological land classification).
- Covertype maps, soil series map, and surficial geology maps were also used to narrow down potential sampling areas.
- At each sample location, detailed vegetation, soil, and site data were collected from representative plots. Data included an inventory of above ground plants (bryophytes, lichens, herbs, shrubs, and trees) and a full soil profile description. Where applicable, sequential plots were also established along major slopes.
- Similar plant communities and soils were grouped into recurring vegetation types and soil types based on statistical analysis and expert opinion.
- Ecotypes were also delineated which represent general productivity units as reflected by changes in soil moisture and nutrient regimes.

P. Neily, DNR

Skunk cabbage at Wilson's Lake, Yarmouth County

RESULTS

P. Neily, DNR

Red spruce and white pine stand near Wilkins, Queens County

- This project was initiated as a pilot from 2000-2003, and as a full scale provincial project from 2004 onward. To date 1165 plots have been measured across the province, with about 310 in western Nova Scotia.
- The Forest Ecosystem Classification of Nova Scotia's Model Forest was published in 2003. This field guide contains information on 28 vegetation types and 16 soil types found in central Nova Scotia (available from the Nova Forest Alliance).
- The Forest Ecosystem Classification for Nova Scotia's Western Ecoregion - Interim Report was published in 2006 and contains fact sheets for 39 vegetation types, descriptions for 16 soil types (plus 3 phases), keys for identifying vegetation types and soil types and information on provincial ecotypes found in western Nova Scotia (available from NSDNR).
- The number of vegetation types and soil types will increase as more data is collected and analyzed. An interim Eastern FEC was produced in 2007. The final Provincial FEC is scheduled for completion in 2010.
- Forest Soil Types of Nova Scotia: Identification, Description, and Interpretation NSDNR Manual FOR 2007-2 is available on line at: http://www.gov.ns.ca/natr/publications/forpubs.htm. This document contains keys to determine soil type and soil texture as well as photographs of the soil types and distinguishing features.
- Field Manual for Forest Ecosystem Classification, NSDNR Manual FOT 2007-1 is available on line at: http://www.gov.ns.ca/natr/publications/forpubs.htm. This report provides the methodology used to establish sample plots for forest ecosystem sampling.

YEARS OF DATA

- Ongoing project since 2006

PARTNERS

- Nova Scotia Department of Natural Resources
- Parks Canada
- Dalhousie University

P. Neily, DNR

Cancer root near Cedar Lake, Annapolis County

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Rationale

Jeremys Bay Campground is the primary camping facility in Kejimkujik. The campground was recently infested with the Pale-winged Gray moth. The infestation raised concern about the sustainability of the campground's forest because much of the campground is dominated by hemlock, which is foraged upon by the Pale-winged Gray. The park wishes the campground to be more self-sustaining with a vegetation type that is resistant and resilient to natural pathogens and camping activity. This project was initiated to evaluate the effectiveness of a restoration strategy with multiple revegetation techniques. The success of the different techniques provides insight into stressors and associated protection measures required to restore degraded areas and accelerate revegetation. The overall restoration strategy facilitates the transition toward a more sustainable vegetation type.

C. Brittain

Planted maple tree in Jeremys Bay Campground in Kejimkujik

J. Sheppard, Parks Canada

A young volunteer helping to water tree seedlings

Monitoring

JEREMYS BAY CAMPGROUND RESTORATION

OBJECTIVES

- Ensure forest sustainability a) increase regeneration and promote a vegetative community that is more sustainable under current visitation patterns, and b) improve tolerance to natural pathogens by increasing species diversity and regeneration.
- Enhance visitor experience by promoting desirable campsite qualities including privacy and sunlight.
- To develop sampling methods to monitor the different life stages of the Pale-winged Gray moth and to relate insect densities to the percent of hemlock leaves that are eaten, in order to allow reliable prediction of tree damage in the future.
- Evaluate the success of artificial vegetation restoration.
- Assess the effects of camping activity and wildlife herbivory on protected and unprotected trees.

METHODS

- In the fall 2006, two quarter hectare shelterwood harvests were completed in the Jim Charles Loop of Jeremys Bay Campground to facilitate the transition to a more diversified forest.
- Red maple, Red oak, White pine, and Red spruce seedlings and saplings were planted in the harvested areas in the spring of 2007. Seedlings were unprotected, protected with stakes to make them visible to campers or protected with wildlife exclosures to inhibit herbivory.
- Survivorship, camper impacts, and wildlife impacts were monitored at the end of summer and winter.
- Two interpretation programs and signage highlighted the restoration project. Volunteers helped to restore degraded areas by watering and planting trees.

RESULTS

- The shelterwood harvest successfully increased natural regeneration. White pine and Red maple seedlings were the most abundant.
- The shelterwood harvest reduced the canopy by 30% resulting in more sunlight. Seedlings require time to grow before they will provide privacy between campsites, but the increase in natural regeneration and supplemental planting suggests privacy will increase in the near future.
- Insect damage was evident on Red maple and Red oak. Insecticide soap was applied manually to each tree to minimize defoliation. Deer also foraged upon hardwood species during the winter and summer. Approximately 60% and 40% of Red maple and Red oak died during the summer respectively. Winter mortality was lower as replanted hardwoods were fenced to provide protection against deer herbivory. Mortality appears to be related to herbivory and transplant shock. Fencing effectively minimized browsing. Only two softwood trees died indicating little required maintenance or protection, however, deciduous species require protection from herbivory.
- There was no visible camping related tree damage. The cooperation of the public is believed to be, at least in part, due to the high profile the project received from interpretation programs and signage. The harvest also created a very obvious visual impact that may also have influenced visitor behavior as they recognized the effort being undertaken.

YEARS OF DATA

- Year 1 with ongoing monitoring

PARTNERS

- Parks Canada
- Saint Mary's University
- National Tree Seed Centre
- K.C. Irving Environmental Science Centre at Acadia University

J. Sheppard, Parks Canada

Christa Brittain and her volunteers planting trees in Jeremys Bay Campground in Kejimkujik

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Rationale

Populations of many species of forest birds, as well as other land birds, have declined in recent decades. Such declines impact biodiversity and the structure and function of forest ecosystems. Birds play important roles in forest ecosystems: for example, flycatchers, wood-warblers, vireos, kinglets, and thrushes consume large quantities of insects and other invertebrates, hawks and owls prey on other vertebrates, and woodpeckers modify trees for other species. Furthermore, the specific habitat requirements of many bird species make them sensitive indicators of terrestrial ecosystem change. This project has been monitoring populations of forest birds in Kejimkujik since 1996. For this year, focus was on examining the data collected and recent advances in population modelling in order to develop a detailed protocol for future long-term monitoring of forest birds as indicators of ecological integrity.

Parks Canada

Yellow-bellied sapsucker feeding on sap and insects of a deciduous trees

Research

FOREST BIRD MONITORING AND PROTOCOL DEVELOPMENT

OBJECTIVES

- To monitor populations of forest bird species in Kejimkujik over the long term.
- To detect trends (changes) in forest bird species abundance over time.
- To select a suite of bird species that reflect specific mature mesic forest elements.
- To develop a detailed protocol for effectively monitoring forest birds in Kejimkujik and other national parks in the Atlantic Bioregion in the future.

METHODS

- The point count is the most-widely used method for estimating the abundance of forest birds. In Kejimkujik, surveyors record all birds detected at permanent sampling points for 10 min twice a season. Abundance is measured by the maximum number of potential pairs detected per season for each species at each point. Most birds are detected by ear and identified by their sounds, e.g. songs of territorial males.
- Trends (changes in abundance over time) were analyzed for data collected at 21 points each year and at another 43 points every year or two. Data from an associated study at another 100 points in hardwood and hemlock forest were analysed to identify species that reflect particular aspects of mature mesic forest.
- Recent literature was reviewed to determine ways to calculate densities (birds per unit area) from Kejimkujik point-count data by accounting for detectability, which varies with species, habitat, surveyor, and distance from the bird.

C. Staicer

Megan Crowley surveying birds in a hemlock stand

RESULTS

- Overall, forest bird populations in Kejimkujik appear to have declined since monitoring began in 1996 (see graph). Possible reasons include changes in surrounding landscape (e.g. decline in mature forest cover due to harvesting), changes

RESULTS
Continued

during migration or on wintering sites (e.g. habitat loss), and changes inside the park (e.g. acidification, insect outbreak). One of the few species that increased was the Least Flycatcher, apparently in response to the outbreak of the native pale-winged gray moth.

- Mature mesic forest was selected for long-term monitoring of ecological integrity in Kejimkujik. Data will be collected for all forest bird species but analyses will focus on 24 bird species with strong associations with mature forest elements (see table). Changes in their abundance should reflect changes in the structure of mature mesic forest in Kejimkujik.
- Work to model bird population densities based on variation in detectability is ongoing.

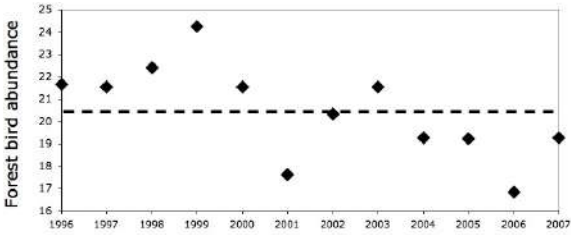
Forest bird species selected for long-term monitoring at mature mesic forest sites in Kejimkujik. Within each forest type, species are listed in order of greater to lesser abundance

C. Staicer

Mature hardwood-dominated forest
Ovenbird
Red-eyed Vireo
Yellow-bellied Sapsucker
Least Flycatcher
Black-throated Blue Warbler
Eastern Wood Pewee
Downy Woodpecker
Veery
Mature hemlock-dominated forest
Blue-headed Vireo
Black-throated Green Warbler
Blackburnian Warbler
Swainson's Thrush
Bay-breasted Warbler
Brown Creeper
Golden-crowned Kinglet
Northern Goshawk
Mature mesic forest of all types, including white-pine dominated
Yellow-rumped warbler
Black-capped Chickadee
Northern Parula
Hermit Thrush
Red-breasted Nuthatch
Broad-winged Hawk
Hairy Woodpecker
Pileated Woodpecker

C. Staicer

Study sites for long-term monitoring in Kejimkujik are located in mature mesic forest



C. Staicer

Forest bird abundance at 21 sites monitored annually in Kejimkujik from 1996-2007; points indicate maximum numbers of potential pairs per site based on 10-min point counts made twice per season and dotted line shows average abundance for all 12 years

Parks Canada

Cindy Staicer surveying birds in a hardwood stand

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YEARS OF DATA

- Ongoing project since 1996

PARTNERS

- Parks Canada

Rationale

The practice of leaving forested buffers along watercourses (i.e. riparian buffers) may provide habitat for birds that require mature forest. Buffers have a potentially important role to play in biodiversity conservation in NS: they will be widespread and increasingly represent a larger fraction of older, connected forests on the landscape. Nova Scotia regulations require harvesters to leave >20m buffers around watercourses but allow some harvesting within buffers. In other forested regions, buffers this narrow provide inadequate habitat for many species. Negative effects have been documented for several bird species of Nova Scotia's Acadian forest region. This study was the first to examine bird use of riparian and upland forest, and the influence of the width of forested buffers in Nova Scotia. The focus was on 27 bird species of conservation concern, including priority bird species and others known to be negatively affected by forest harvesting and buffer width.

C. Staicer

Magnolia Warblers prefer open or young coniferous forest and were abundant in riparian buffers

C. Staicer

Gareth Akerman, the MSc student who worked on this project, indicating blowdown in a riparian buffer; Gareth died in a tragic plane crash in March 2008

Research

RIPARIAN BUFFERS AND FOREST BIRDS

OBJECTIVES

- To investigate the conservation value of riparian habitat and riparian buffers to breeding birds in the Acadian forest of Nova Scotia.
- To examine if riparian buffer width influences the abundance of species of conservation concern and to identify optimal buffer widths for these species.

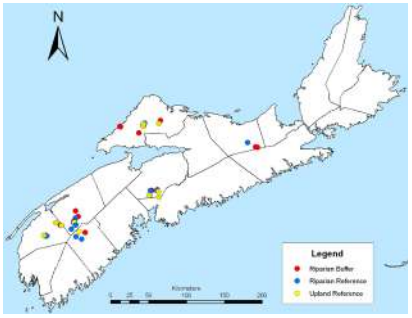
METHODS

- Existing sites across mainland NS were surveyed. Fifteen transects 200-300 m in length were established in each of three 'treatments' matched for forest type: forested Riparian Buffers (RR), Riparian References (RR) and Upland References (UR). From May-July, the 45 transects were surveyed once in 2005, and 3 times in 2006, at least 2-3 weeks apart. Vegetation species and structural features and site features were measured July-August 2005-2006.
- Use of sites was quantified by species presence (see table). Their abundance was quantified by using ionly data collected 30-m from transects. Treatments were statistically compared. Treatments were well-matched for vegetation and site features. The only significant differences were that buffers had lower canopy cover and lower basal area of conifers, due in part to harvesting in the buffer and/or blowdown. Analyses using detection probabilities to obtain more accurate densities (birds per unit area) are in progress.

RESULTS

- Buffers had significantly fewer target individuals and species than reference forest and were dominated by non-target, open/edge species, with more ground-foragers, ground-nesters, and short-distance migrants. Combined densities of forest interior species were significantly lower in riparian buffers.
- Buffers >40 m wide, twice the regulation width, had a larger diversity and abundance of target species. Target species

RESULTS
Continued



C. Staicer

45 transects located across mainland Nova Scotia; each Riparian Buffer was matched with a Riparian Reference and an Upland Reference transect

absent from narrower buffers included Red-breasted Nuthatch, Brown Creeper, Bay-breasted Warbler, Blackburnian Warbler, and Ovenbird. Others found in fewer buffers than reference sites included Black-throated Blue Warbler and Swainson's Thrush. Golden-crowned Kinglet and Blue-headed Vireo occurred in most of the buffers, but their density increased with buffer width.

- Both upland and riparian forest appear important to forest bird species of conservation concern. Upland and riparian references had similar combined densities and richness of target species. Yellow-bellied Flycatcher, Northern Parula, and Bay-breasted Warbler seemed to prefer riparian forest while Eastern Wood Pewee and Ovenbird seemed to prefer upland forest.
- Buffer sites near large protected areas (Kejimkujik) appeared to have more individuals and species than buffers in more fragmented landscapes. The amount of mature forest and connectivity of the surrounding landscape may explain variation in the data set.

YEARS OF DATA

- Year 3 of a 3 year project

PARTNERS

- Dalhousie University
- Parks Canada
- Bowater Mersey Paper
- J.D. Irving Ltd.
- Stora Enso
- Nova Forest Alliance
- Habitat Conservation Fund
- Natural Sciences and Engineering Research Council
- Mersey Tobeatic Research Institute
- Environment Canada

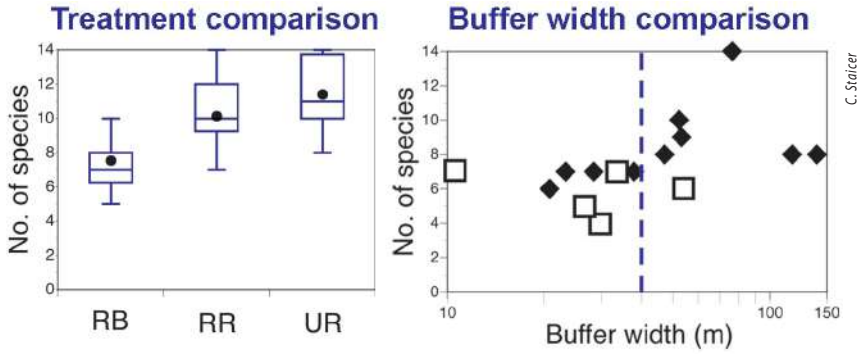
Target species and their presence among the 15 sites per treatment

C. Staicer

Species	Basis*	No. of sites		
		RB	RR	UR
Yellow-bellied Sapsucker	A	3	1	4
Black-backed Woodpecker	A, E	1	1	1
Pileated Woodpecker	A, D, E	1	0	1
Olive-sided Flycatcher	A	6	2	5
Eastern Wood-Pewee	A, D	0	0	3
Yellow-bellied Flycatcher	A	0	3	0
Least Flycatcher	A, B, D	5	4	5
Gray Jay	A	1	4	2
Boreal Chickadee	A, B	2	4	3
Red-breasted Nuthatch	C, D, E	4	8	10
Brown Creeper	A, D	2	6	8
Golden-crowned Kinglet	C, D	12	14	14
Veery	A, B	1	0	0
Swainson's Thrush	C, D	5	11	11
Hermit Thrush	C	12	10	15
Blue-headed Vireo	B, D	12	14	15
Northern Parula	A, B, D	6	10	6
Black-throated Blue Warbler	A, B	0	3	3
Black-thr. Green Warbler	A, B, D	8	13	10
Blackburnian Warbler	A, B, D	5	11	12
Bay-breasted Warbler	A, B	5	10	6
Ovenbird	C	3	9	13
Canada Warbler	A	1	0	2
Northern Waterthrush	C	1	0	0
Rusty Blackbird	A, D	1	0	0
Purple Finch	A, B	4	4	5
Red Crossbill	A	1	0	2

** Basis for inclusion of species associated with mature forest habitats*

A - Partners-in-Flight, Atlantic Maritimes
B - Partners-in-Flight, Area 28, Eastern Spuce-Hardwood Forest
C - Sensitive to fragmentation and/or buffer width in published studies
D - More abundant in mature forest in 1993 Bowater study
E - Stora Enso indicator species



C. Staicer

Left: Buffers had fewer species of conservation concern than reference sites (RB: Riparian Buffer, RR: Riparian Reference, UR: Upland reference; box plots show medians and interquartile ranges in blue and means in black **Right:** Buffers <40 m wide (dotted line) and/or with harvesting or blowdown (open symbols) had fewer species of conservation concern

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Clockwise from top left: Common loon (A. Lavers, MTRI); Mersey River stillwaters; canoeing on Kejimkujik Lake; Grafton Brook; Mill Falls.

FRESHWATER

Rationale

Water chemistry is a widely used measure of aquatic ecosystem health. Freshwater processes and biodiversity are strongly influenced by water chemistry. Many of the stressors to freshwater processes, such as acidification, eutrophication, land use change, and climate change, are reflected in changes to water chemistry. The Canadian Council of Ministers for the Environment (CCME) has developed a Water Quality Index (WQI), as a tool to summarize complex water chemistry data into a single index to simplify and standardize the assessment and reporting of water chemistry data. The WQI is an exceedance-based index that examines several key water chemistry parameters and calculates scope (the number of parameters not meeting an established target), frequency (the number of times established targets are not met), and amplitude (the amount by which established targets are not met) (CCME 2001). This monitoring project uses the CCME's WQI to assess and detect changes in water chemistry in lakes and streams at Kejimkujik.

D. Ure
Parks Canada

Kejimkujik Lake

Monitoring

WATER QUALITY MONITORING

OBJECTIVES

- To identify and assess a core suite of water quality parameters that are critical to aquatic ecosystem health at Kejimkujik and that may be impaired by key stressors in the region.
- To identify site-specific targets for each parameter to enable analysis of and reporting on the WQI for Kejimkujik.
- To provide information on the status and trends of water quality in lakes and streams in Kejimkujik. Specifically, to determine if the WQI is within the range of natural variation at Kejimkujik and to detect a 20% change in the WQI for lakes and streams over a five-year period.

METHODS

- A protocol for long-term monitoring of lakes and streams at Kejimkujik was developed. The protocol integrates existing water chemistry monitoring initiatives at Kejimkujik (i.e., Environment Canada's Acid Rain Lake Monitoring Program; Canadian Aquatic Biomonitoring Network (CABIN) stream sampling for benthic invertebrates and water quality) and provides guidance for data analysis and reporting using the WQI.
- The methodology for water sampling and lab analysis is based on Environment Canada's best practice guidelines. Water samples are collected annually from 18 lakes at Kejimkujik in May, June, August and October. Water samples are collected from 25 streams at Kejimkujik every second year. Additionally, one intensive stream sites (Mersey River) is sampled weekly by Environment Canada as part of the Acid Rain Monitoring Program.
- Water samples are sent to Environment Canada's analytical lab in Moncton for processing and analysis. A suite of nine core parameters was identified for the WQI based on the significant stressors in the region (Lacoul and Freedman 2006). Site-specific targets were identified for these parameters to enable analysis of and reporting on the WQI for Kejimkujik.

D. Ure, Parks Canada

Daniel Pouliot sampling water quality in Back Lake, Kejimkujik

RESULTS

- Figure 1 outlines the core suite of parameters for the WQI. Three parameters are identified in relation to each of three potential stressors in the region. Data for these nine parameters are combined to develop an overall WQI for reporting purposes.
- Site-specific targets were identified for each parameter based on literature review, expert consultation, analysis of natural variability in historic data from Kejimkujik, and use of CCME's water quality guidelines where they exist and are locally relevant.
- These site-specific targets were applied to historical lake data at Kejimkujik to calculate a WQI for each year from 1982 to 2006. A total of 18 lakes were analyzed, ten of which were brown lakes and eight of which were clear water lakes. Historical data were not available for all nine parameters so a subset of six parameters was used for the analysis (i.e., pH, dissolved organic carbon, nitrogen, nitrate, aluminum, calcium).
- The WQI has a defined range from 0 to 100. Between 1982 and 2006, the mean WQI for 18 lakes at Kejimkujik was 50 (+/- 5.5 SD). Thresholds for good (green), moderate (yellow) and poor (red) water quality were established based on equal division of the WQI range. In this context, the WQI for lakes at Kejimkujik has been within the moderate range with a slightly decreasing trend over the past 24 years (Figure 2).

YEARS OF DATA

- Ongoing project since 1982

PARTNERS

- Parks Canada
- Environment Canada
- Dalhousie University

Water Quality Index Parameters		
Eutrophication	**Acidification**	**Land use change**
Total phosphorous Total nitrogen Dissolved oxygen	pH Calcium Aluminum	Turbidity/Suspended solids Nitrate Dissolved organic carbon

Figure 1. Core parameters for WQI (adapted from Lacoul and Freedman 2006)

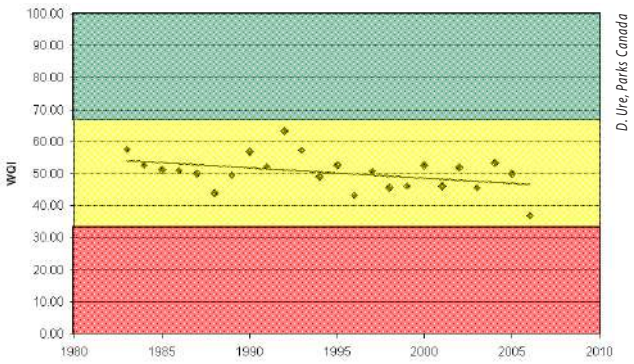

Figure 2. Water Quality Index for 18 lakes at Kejimkujik (1982-2006)

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Rationale

The Common loon is a highly visible water bird inhabiting many of the lakes within the Southwest Nova Biosphere. It is an icon of wilderness and the public are captivated by its beauty and haunting call. Concerns have been raised about the health of loons after a study by the Canadian Wildlife Service found very high blood mercury concentrations in Kejimkujik loons. These levels have been associated with impaired reproduction and altered breeding behavior in some areas. LoonWatch began on 16 lakes within Kejimkujik in 1996. In 2006, the program was expanded to the greater landscape through the MTRI where volunteers are trained to observe and record loon activity and breeding success on their assigned lake throughout the summer using a national protocol developed by Bird Studies Canada. These two program components will provide a picture of how well loon populations are doing in the region.

A. Lavers, MTRI

LoonWatch on Hilchemakaar Lake

Monitoring

THE KEJIMKUJIK-MERSEY LOONWATCH PROGRAM

OBJECTIVES

- To observe Common loon abundance and breeding success on 16 lakes within Kejimkujik and 25 lakes outside the park, primarily in the Mersey and Medway watersheds.
- To determine status and trends in loon abundance, lake use and reproductive potential of resident birds.
- To monitor water quality on 15 lakes being observed by Loon Watchers outside Kejimkujik.

METHODS

Inside Kejimkujik:

- LoonWatch uses trained volunteers in a coordinated effort to simultaneously survey study lakes within a three hour observation period, in June and during the third week of August.
- Loon monitoring combines data gathered from intensive LoonWatch days involving many volunteers, plus public observations and repeated surveys by Kejimkujik staff.
- CWS will also be doing more intensive work to better understand population dynamics and relative mercury levels in loons in the region.

Outside Kejimkujik:

- Lakeside dwellers and cottagers with an interest in loons were recruited and provided with information about loons and the monitoring protocol.
- Trained volunteers were used to survey their lakes in June for loon pairs, in July for newly hatched chicks, and in August for surviving young.
- MTRI staff visited many of these lakes, canoed to the deepest part and measured water quality at one meter intervals, recording temperature, conductivity, dissolved oxygen and pH.
- Volunteer data was collected and compiled, then shared with Bird Studies Canada.

A. Lavers, MTRI

Loon eggs

RESULTS

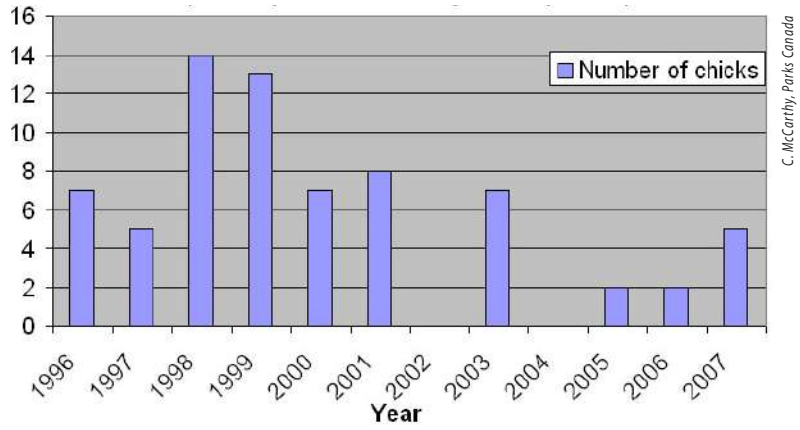
- In 2007, many nests were flooded following establishment. While the number of adults remained fairly high, the number of loon chicks continues to be low.
- Four loon chicks were recorded by LoonWatchers in Kejimkujik at Channel Lake, Cobrielle Lake, and Grafton Lake. Outside Kejimkuji, nine loon chicks were recorded at Cameron Lake, Harmony Lake, Fisher Lake, First Christopher Lake, and Charlotte Lake.
- The surface pH of 10 lakes outside Kejimkujik ranged from 4.7 to 6.6.
- More than 80 volunteers participated in the Kejimkujik-Mersey LoonWatch Program observing loon activity and breeding success.

YEARS OF DATA

- 2006 was the first year for the Mersey LoonWatch Program.
- 1996-2007 for the Kejimkujik program.
- Monitoring will continue on an annual basis.

PARTNERS

- Parks Canada
- Mersey Tobeatic Research Institute
- Nova Scotia Go For Green Fund
- The Shell Environmental Fund
- Pool of 50+ dedicated volunteers



C. McCarthy, Parks Canada

Loon Watch chick count over an 11 year period for Kejimkujik

A. Lavers, MTRI

LoonWatch on Lower Silver lake

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Rationale

The Common loon is widely used as an indicator of the health of lake ecosystems. The number of chicks that each territorial loon pair is able to raise is monitored on 35 study lakes within Kejimkujik and the surrounding region; this is our measure of the loon's reproductive success or productivity. Loon productivity is adversely affected by such factors as acid rain, structural and recreational development of lake shorelines, disturbance by boaters, water-level fluctuations, predators, and mercury pollution. The Canadian Wildlife Service monitored loon productivity in Kejimkujik from 1988 until 1997. Loon productivity was found to be limited by mercury levels in the loons and the fish that they eat. Some lakes in Kejimkujik had high mercury levels in fish and loons and low loon productivity, and vice versa. The Canadian Wildlife Service resumed monitoring of fish mercury levels in 2006 and Common loon productivity in 2007.

A. Lavers, MTRI

Loon on Cobrielle Lake

Monitoring

MONITORING COMMON LOON PRODUCTIVITY

OBJECTIVES

- To monitor the number of territorial Common loon pairs on the study lakes.
- To monitor the number of loon chicks produced by these territorial pairs.
- To provide data on loon productivity for each study lake, which can then be related to environmental factors, human disturbance and mercury pollution.

METHODS

- Common loons and Common mergansers were surveyed at least three times from early June until September 2007 by trained researchers on 25 lakes within Kejimkujik and 10 lakes in the surrounding area.
- Surveys included adult loons and chicks, and common mergansers.
- Surveys were conducted by canoe (except Poplar and Ben Lakes which were only surveyed from shore).
- When loons were located, the time, date, weather and a GPS location of where the loon was first seen were recorded.
- Survey results were summarized in a database, and productivity was calculated for each territorial loon pair.

J. Peck, MTRI

Loon nest with eggs on Turtle Lake

RESULTS

- Fourteen Common loon chicks were counted on 9 of the 25 lakes within Kejimkujik.
- Four loon chicks were counted on the 10 lakes surveyed outside of Kejimkujik.
- On the 35 lakes surveyed, 45 territorial pairs of Common loons were counted.
- A total of 13 large loon chicks were counted at the end of the summer on the 35 lakes.
- Overall, Common loon productivity was 0.29 chicks produced

RESULTS
Continued

per territorial pair.

- One artificial loon nesting platform was installed at Donnellan Lake in late summer 2007.

YEARS OF DATA

- Year 1 of a 5 year project

PARTNERS

- Parks Canada
- Canadian Wildlife Service, Environment Canada
- Mersey Tobeatic Research Institute
- TD Friends of the Environment
- Mountain Equipment Co-op

MTRI

Jakah Imlay and Kyle Rowter launching a floating loon nesting platform

A. Lovers, MTRI

Marielle Turner observing loons from a distance

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Rationale

Improperly installed culverts can have a negative impact on fish passage in rivers and streams. Poor culvert design can prevent fish from accessing critical upstream habitats and can also degrade habitat quality upstream, downstream, as well as near the barrier. The importance of properly placed culverts to habitat connectivity has become increasingly important as shown by recent studies in several jurisdictions.

K. Hicks, CARP

Verticle drops onto rocks represent an insurmountable barrier to fish passage

Monitoring

ANNAPOLIS WATERSHED FISH MIGRATION BARRIERS

OBJECTIVES

- To assess the extent of barriers to fish migration in a number of sub-watersheds of the Annapolis River watershed.
- To compile a list of the priority barriers that require remediation and provide possible options for these remediations.

METHODS

- A total of 268 culverts in the Annapolis watershed were visited and 60 assessments were performed from June to October 2007. The culvert assessments primarily utilized the protocol developed by the British Columbia Ministry of Environment.
- Given the large area of the Annapolis River watershed and the number of barriers involved, initial efforts were focused in sub-watersheds with critical fish habitats. The selection of sub-watersheds was based on three important criteria: pH buffering capacity, water temperature, and productivity of fish habitat.
- Culvert information was collected in five broad categories: general site information, culvert characteristics, stream characteristics, barrier evaluation and site photos. Factors assessed in the barrier evaluation included the outfall drop, the pool depth at outfall, the water flow through the culvert as well as the presence or absence of debris in the culvert.
- A scoring matrix was applied to the complete list of barriers to prioritize those in greater need of remediation. The selection criteria were based on four variables: the presence or absence of fish, the habitat value, the barrier type and the length of upstream habitat to be restored. Culverts with higher scores were considered top priority for remediation.

RESULTS

- A total of 268 culverts were visited and 60 assessments were performed from June to October. Of the 60 culverts assessed, a total of 33 culverts, or 55%, were found to pose a barrier to fish passage. Of the identified barriers, 22 culverts were full barriers, while 11 were only partial barriers. Of the 60 culverts

RESULTS
Continued

assessed, 23 (38%) culverts were perched.

- A list of ten culverts recommended for remediation was prepared. These culverts were chosen because of their high score on the matrix. The majority of those culverts are creating barriers due to being perched and their outflow dropping onto rocks. The work involved in remediating these barriers is potentially costly and time consuming, and therefore longer term in nature. A second prioritized list was compiled for projects whose remediation may be quicker and less expensive, while still providing access to upstream habitat.
- It is envisioned that surveys of additional barriers will continue in 2008 and beyond, with a rolling list of priority barriers for remediation maintained.
- Several options for retrofitting existing culverts were explored, including: tailwater control weirs, baffles, roughened channels and fishways. Retrofit options were recommended for the prioritized list of identified barriers. Finally, options for post-restoration monitoring were recommended, including parameters to monitor, field methods and useful reference documents.

K. Hicks, CARP

One of the barrier types encountered in the study: beaver dams in culverts

YEARS OF DATA

- Year 1 of an ongoing project

PARTNERS

- Clean Annapolis River Project
- Nova Scotia Department of Transportation and Infrastructure Renewal
- Shell Environment Fund
- Sage Foundation
- Human Resources and Skills Development Canada
- Centre of Geographical Sciences
- East Coast Aquatics
- Nova Scotia Community College

K. Hicks, CARP

High current velocities and shallow water depths can prevent fish from moving upstream through culverts

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Clockwise from top left: Tobeatic Wilderness Area; Water pennywort in Kejimkujik; hatchling Blanding's turtle; esker overlooking Blanding's turtle habitat in the Tobeatic Wilderness Area; checking live turtle traps in Kejimkujik.

WETLANDS

Rationale

The Rare Plant Monitoring program is part of the Nova Scotia Nature Trust's (NSNT) Plants on the Edge project, an initiative to protect critical habitat for unique coastal plain plants found along lakeshores and bogs in southwest Nova Scotia. Monitoring helps to determine how these rare plant populations behave over time. Are they migrating over the shoreline? Are they staying in one established location? Are the numbers of plants increasing or decreasing? This information improves our ability to understand population changes and to protect these exceptional plants and their habitat. The Atlantic Coastal Plain Flora is one of the most endangered plant groups in Canada. Of the 64 species, 11 are extremely rare and listed nationally by the Committee on the Status of Endangered Wildlife in Canada, occurring within Canada only in Nova Scotia. Five species are considered to be globally at risk of extinction and 25 are listed as 'at risk' or 'sensitive' by the Nova Scotia provincial government.

P. Green, NSNT

Virginia Meadow Beauty

Monitoring

RARE PLANT MONITORING

OBJECTIVES

- To involve local landowners, recreational land users and other interested individuals in the conservation and recovery of atlantic coastal plain flora in southwest Nova Scotia.
- To collect information on the geographic distribution of atlantic coastal plain flora on private lands in southwest Nova Scotia.
- To track changes and assess threats to atlantic coastal plain flora populations and habitat in southwest Nova Scotia.

METHODS

- Outreach and education initiatives were conducted with landowners in Lunenburg, Queens, Shelburne, Yarmouth, Digby and Annapolis counties about the importance of protecting coastal plain plants and habitat on their property.
- Volunteer Rare Plant Monitors were trained to identify atlantic coastal plain flora species, observe changes and threats to habitat and record information using Nature Trust data sheets.
- Monitors visited selected coastal plain sites on private lands a couple of times each year to count plant populations, photograph the sites and record observations of habitat.
- Monitoring data collected by the Nature Trust were submitted to the Atlantic Coastal Plain Flora Recovery Team, who use the data to plan the conservation and recovery of atlantic coastal plain flora.

RESULTS

- A National Recovery and Conservation Plan for Atlantic Coastal Plain Flora was finalized in 2005 with input from the Nature Trust's monitoring program.
- Nature Trust volunteers assisted with the monitoring of 29 sites, on seven lakeshores or bogs in 2007, contributing significantly to long-term data records of habitat characteristics and

RESULTS
Continued

species occurrences.

- Ten new volunteer monitors have been engaged in the program since 2006.

YEARS OF DATA

- Ongoing project since 1999

PARTNERS

- Nova Scotia Nature Trust
- Atlantic Coastal Plain Flora Recovery Team
- Nova Scotia Department of Environment and Labour
- Nova Scotia Department of Natural Resources
- Habitat Stewardship Program for Species at Risk
- Endangered Species Recovery Fund
- Aveda Corporation
- Beautiful Gaia Project
- Parks Canada

P. Green, NSNT

Plymouth Gentian

P. Green, NSNT

Goldencrest

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www.nsnt.ca

Rationale

Water-pennywort is a small, clonal macrophyte that grows along freshwater lakeshores in southern North America and South America. Its distribution in Canada is limited to two regions in Nova Scotia: Wilson's Lake and Kejimkujik. The species was designated as 'Endangered' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1985 due to its limited range and threats to its habitat. Water-pennywort is currently listed as 'threatened' by COSEWIC and a recovery plan was developed in 2003. As a federal agency, it is the responsibility of Parks Canada to protect species at risk. Water-pennywort populations are monitored at Kejimkujik to detect changes in species distribution and abundance and to better understand the influence of environmental variables and human impacts on the species to inform management and ensure protection.

S. Chisholm Parks Canada

Water-pennywort with inflorescence

Monitoring

WATER-PENNYWORT MONITORING

OBJECTIVES

- To monitor Water-pennywort population abundance and stand density.
- To monitor spatial distribution of Water-pennywort at Kejimkujik (i.e., stand surface area and locations).
- To survey potential habitat at Kejimkujik for the establishment of new stands of Water pennywort.
- To assess water levels at Water-pennywort stands.
- To assess stem height and percent damage within Water-pennywort stands.

METHODS

- Water-pennywort surveys have been conducted annually on Kejimkujik and George Lakes within Kejimkujik. Surveys were conducted at known populations in both shoreline and aquatic habitats.
- Extensive surveys have also been conducted every 3 years to search for new stands.
- Population abundance, density, stem height, water depth and percent damage of individual Water-pennywort stands are assessed by systematic transect surveys in early August each year. Stand surface area is also measured. Survey results are compared to historic data in order to determine population size fluctuations.
- In the past, stand surface area was approximated manually with a measuring tape. In addition to manual measurements, delineation of stand perimeter has been performed using a GPS since 2005. This provides a more accurate estimate of stand area while enabling changes in stand movement and shape to be observed over time.

D. Ure, Parks Canada

Assessing Water-pennywort density in a 0.5m^2 quadrat

RESULTS

- Stand area appears to fluctuate drastically from year to year (Table 1), but this appears to have little effect on ramet counts. Although the Meadow Beach population increased in area it decreased in ramet density (Table 2). The Petroglyph site was the only site that increased in ramet density and stand size, while Meadow Beach also increased in size it decreased in ramet density. When both stand density and stand area decreased the relationships was not proportional. These results indicate that inconsistent factors are affecting these populations.
- Mean water level at the sites was low in comparison to 2005. It does not appear that water level is influencing ramet density; for example a similar drop in water had a much greater effect on Merrymakedge than Meadow.
- The Mill Bay population was present where it has not been in the past.
- The George Lake population normally located by the petroglyphs was not found, but this usually has low counts and is difficult to locate.
- Inflorescences were observed at Mill Bay, George Lake, and Indian Point (4 within plots).

D. Ure, Parks Canada

Water-pennywort

YEARS OF DATA

- Ongoing project since 1999; initial population estimates for Water-pennywort were conducted in 1983

PARTNERS

- Parks Canada
- Atlantic Coastal Plain Flora Recovery Team

Table 1. Estimated area (m^2) per stand in Kejimkujik

Stand Name	2001	2002	2004	2005	2007
Merrymakedge Beach	138	2,791	106	1,920	1,677
Meadow Beach	175	1,260	140/48	222	466
Jim Charles Point Beach	172	858	42	401	131
Jeremy's Bay (Indian Point)	-*	2,300	158	4,854	3,161
George Lake	-*	210	45	178	145
Mersey River/Mill Bay	2	4	1	0	120 (Mill Bay)
Petroglyphs	-*	-*	122	276	851

*Populations not reached in a specific year.

C. Brittain, Parks Canada

Table 2. Estimated number of individual ramets per stand in Kejimkujik

Stand Name	1999/2000	2001	2002	2004	2005	2007
Merrymakedge Beach	25,000	<22,000	2,314,127	18,060	284,175	73,700
Meadow Beach	27,000 (3 sections)	>22,000	587,267	18,000 and 4,272	9,121	6,400
Jim Charles Point Beach	22,000	>20,000	324,452	10,400	26,040	6,300
Jeremy's Bay (Indian Point)	7,500	8,000 (2 sections)	358,812	7,600 (2 sections)	219,733	38,000
George Lake	10,000	Unknown	120,930	1,440	9,249	2,700
Mersey River/Mill Bay	240/ new	480	54	32	No stand	3,100
Petroglyphs	15,000 in 1999	-*	-*	11,000	16,858	17,500

* Populations not reached in a specific year

C. Brittain, Parks Canada

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Rationale

Blanding's turtles in Nova Scotia exist in three small populations on the Mersey and Medway watersheds and have been listed as Endangered under both the federal Species at Risk Act and the Nova Scotia Endangered Species Act. One of the concerns for this long lived (80+ years), slow maturing (20+ years) species is the lack of young adults in the population. This is of particular concern in the population at Kejimkujik where only 5 young known females have been recorded during the last decade. Rates of predation of unprotected nests are variable but can reach 100%. Raccoons are the primary nest predators and their populations may be unusually high in human inhabited areas (e.g., campgrounds and communities). An annual volunteer-based nest protection program was established in Kejimkujik and later expanded to populations outside the park to engage the public in helping to protect and care for turtle nests.

J. McKinnon

Enclosures protecting a Blanding's turtle nest in Brookfield Mines

Monitoring

BLANDING'S TURTLE NEST MONITORING

OBJECTIVES

- To protect Blanding's turtle nests from predation to improve recruitment into the populations.
- To provide an opportunity for volunteers to engage in Species at Risk recovery.
- To collect long-term data on female survivorship, clutch size, hatching success, and site fidelity.
- To reduce threats to females and their hatchlings by enhancing nest site habitat and turtle awareness near roads.

METHODS

Nest Protection (June)

- Known nesting sites were monitored on a nightly basis during nesting season.
- Individual turtles were radio tracked to locate new nesting sites.
- At 7:30pm, volunteers and researchers walked each site watching for turtles. Observers watched females go through the nesting process and recorded data related to behaviour and movements, weather, timing of activities, and clutch size.
- Once a nest was completed and the female had left the site, volunteers covered the nest with a wire mesh cage and secured it with large rocks to protect the nest from predation.

Nest Monitoring (September – October)

- Nests were monitored periodically until the first nest emerged and then were monitored daily by volunteers and researchers who marked, measured, weighed and released hatchlings at the nest site.

J. McKinnon

Volunteers wait for female Blanding's turtles to come to shore and nest in June

RESULTS

Nest Protection

- In 2007, 70 volunteers and researchers in Kejimkujik located 23 Blanding's turtle nests.
- Ten nests were protected at McGowan Lake and one nest was predated.
- Nine nests were located in Pleasant River. Over ten families (25+ individuals) helped protect ten nests on or near their properties.

Nest Monitoring

- A total of 182 hatchlings emerged in Kejimkujik and 25 of these were tracked. Volunteers also helped excavate eggs from nests that were overdue.
- At McGowan Lake, 11 of the 51 hatchlings that emerged were tracked from the ten protected nests.
- 59 hatchlings emerged in Pleasant River where volunteers monitored the nine protected nests over a six week.

Reducing Threats via Road Signs

- Road signs and speed bumps were installed in Kejimkujik in June to reduce or prevent mortality of adult turtles nesting in June and emerging hatchling turtles in September and October. These signs drew attention to the turtles and the bumps reduced driving speeds.

YEARS OF DATA

- Ongoing project since 1989 in Kejimkujik
- Ongoing project since 2000 at McGowan Lake
- Ongoing project since 2002 at Plesant River

PARTNERS

- Parks Canada
- Blanding's Turtle Recovery Team
- Acadia Universiy
- Friends of Keji Cooporating Association
- Mersey Tobeatic Research Institute
- Habitat Stewardship Program for Species at Risk

J. McKinnon

Heber Meadows, Kejimkujik where multiple Blanding's turtle nests are located

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Rationale

The Nova Scotia population of Blanding's turtle is listed as Endangered under the Species at Risk Act due in part to its restricted range, uneven age structure and low recruitment of juveniles and young adults. Currently, very little is known about the earlier life stages of this species, and particularly about the ecology and behaviour of hatchling Blanding's turtles. Use of radio telemetry allows researchers to track hatchlings following emergence from their nests and collect information on hatchling behaviour, activities and habitat use. Detailed description of hatchling habitats can also reveal patterns in habitat use and preference. A better understanding of the behaviour and ecology of hatchling Blanding's turtles will help in identifying potential threats and risks to hatchlings and in defining and protecting critical habitats, thus leading to more effective conservation of this species.

J. McKinnon

Blanding's turtle hatchling with radio transmitter in Kejimkujik

Research

RADIO-TRACKING HATCHLING BLANDING'S TURTLES

OBJECTIVES

- To study the behaviour and movement patterns of hatchling Blanding's turtles following emergence from the nest.
- To determine habitat use and preferences of hatchlings during fall and winter.
- To identify potential threats and risks to hatchlings in their habitats.
- To aid in the identification and protection of critical habitats for this species.

METHODS

J. McKinnon

Ken Cosh tracks a hatchling Blanding's turtle in Kejimkujik

- Following emergence from the nest, small radio-transmitters (0.3 – 0.6 g) were attached to the shell of hatchling Blanding's turtles from the two of the three distinct populations in Nova Scotia.
- Hatchlings were tracked manually every 1 – 3 days throughout the fall using a hand-held antenna and receiver.
- UTM coordinates of hatchling locations were recorded, along with weather conditions, hatchling activity and position, and information about the microhabitat.
- Microhabitat characterization was based primarily on a standardized set of photographs. At both the hatchling's position and a random point (within 7.5m of the hatchling's position) photos were taken down showing ground cover, up showing canopy cover, and in the four cardinal directions. Additional habitat information such as water depth, aquatic

RESULTS

- Hatchling emergence began on 12 September 2007 and continued until mid October 2007. Thirty-six hatchlings were equipped with radio transmitters: 25 radios in Kejimkujik and 11 in McGowan Lake.
- Nine hatchlings were predated in Kejimkujik and one was hit by a car; in McGowan Lake, the locations of two hatchlings were lost because of failed transmitters.

RESULTS
Continued

- Preliminary observations suggest that hatchlings move towards protected wetlands near the nest. Hatchlings from inland nests moved towards small ponds, ditches, bogs and/or swamps near the nest, while hatchlings from beach nests tend to avoid the open water and moved inland towards the forest and the wet meadows beyond.
- Upon arrival at protected wetland sites, hatchlings spent all of their time in and around the sites, often remaining within a very small area. Hatchlings remained relatively active throughout the remainder of the study period and were often observed basking and/or active on warmer days.

YEARS OF DATA

- Year 2 of an ongoing project

PARTNERS

- Dalhousie University
- Blanding's Turtle Recovery Team
- Parks Canada
- Habitat Stewardship Program for Species at Risk
- Endangered Species Recovery Fund
- National Science and Engineering Research Council
- Environment Canada's Science Horizons Youth Internship Program
- Friends of Keji Cooperating Association
- Mersey Tobeatic Research Institute

J. McKinnon

Abbey Camaclang checks a nest for newly-emerged Blanding's turtle hatchlings in McGowan Lake

J. McKinnon

A newly-emerged hatchling is measured and weighed in Kejimkujik

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Rationale

The objectives of this study were to assess the size, sex-ratio, and age distribution of the Barren Meadow population. The home range movements of individuals, by sex and by age, were estimated to determine the use of the habitat, according to the different life-history stages (overwintering, nesting, mating, estivation). The knowledge obtained from this study will contribute to the developement of a conservation plan that is necessary for the long-term survival of Blanding's turtle and the sustainable use of resources in the region.

J. Lefebvre

Blanding's turtle digging her nest in Barren Meadow

Research

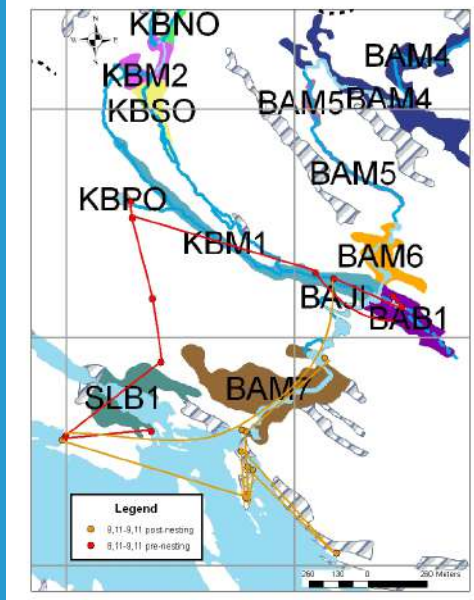
BARREN MEADOW BLANDING'S TURTLE POPULATION

OBJECTIVES

- To assess population size, sex-ratio, age distribution, behavior patterns, home ranges, and movements (in all life history stages) of the Barren meadow population of Blanding's turtle.

METHODS

- Blanding's turtles were trapped using hoop traps baited with sardines or herring along Barren Meadow and Keddy brooks.
- Radio-tracking of males females and juveniles was conducted to determine size and differences among the sexes and individuals.
- Trapping and tracking results were analysed and mapped with geomatic software (ArcGIS).
- Individuals were observed for unexpected or rarely seen behavior (ie, aggression, mating).



J. Lefebvre

A Blanding's turtle's (Angela) overland travel route

J. Lefebvre

Two radio-tagged Blanding's turtles mating in Barren Meadow

RESULTS

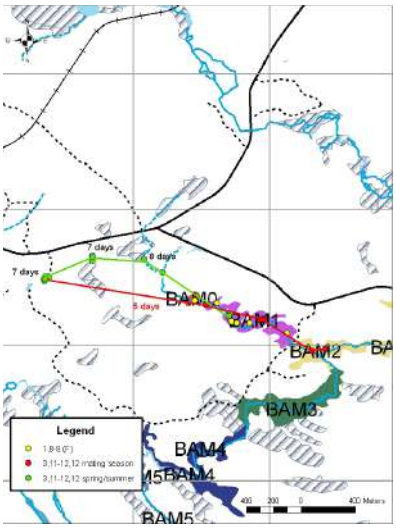
- This project resulted in 76 captures (41 individuals),17 new captures, from a total of 245 trapnights, and 248.0 hours in 88 days of radio tracking.
- The Blanding's turtle population at Barren meadow is estimated to be 87.8 ± 13.9 individuals (from 34 to 65 known turtles in the last 2 years).
- The sex ratio was not significantly different than 1:1 (i.e., 31.7%, (20/63) under 10 years old, 69.8% (44/63) were under 30 years old).
- Males and females make major terrestrial movements for important events such as nesting or mating (see figures).

YEARS OF DATA

- Ongoing project since 2006

PARTNERS

- Acadia University
- Nova Scotia Department of Natural Resources
- Endangered Species Recovery Fund
- Habitat Stewardship Program
- Priority Investment Fund for Species at Risk Recovery



J. Lefebvre

A Blanding's turtle's (Gordon) overland travels

J. Lefebvre

Blanding's turtle habitat in the bog area of Barren Meadow, as seen from the air

M. Crowley, Parks Canada

Researcher Jose Lefebvre collects data from Barren Meadow

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Rationale

Blanding's turtles in Nova Scotia are listed as Endangered by both the Federal Species at Risk Act and the Nova Scotia Endangered Species Act. They are currently only known to occur in three distinct populations in the southwestern region of the province. To recover this species, there is a need to both monitor known populations and search unknown areas for additional populations. Blanding's turtles are long-lived (80+ years) and slow to mature (20+ years) so long-term data are necessary to determine changes in abundance, trends in age-related survival, changes in habitat use and the effect of our recovery actions. Searching unknown areas will allow us to determine the extent of the species' range in Nova Scotia and to locate additional populations to target recovery actions.

J. McNeil Parks Canada

Blanding's turtle from the McGowan Lake population

Research

ASSESSING BLANDING'S TURTLE POPULATIONS

OBJECTIVES

- To trap and visually survey areas in and around the three known Nova Scotia populations to monitor individual turtles, assess abundance and determine age-related survival and movement patterns.
- To radio-track turtles throughout the season to locate important seasonal habitats (*e.g.,* nesting, overwintering).
- To trap and visually survey areas beyond the three known populations, especially where Blanding's turtle sightings have been reported, to determine the extent of the range in Nova Scotia.

METHODS

- Live trapping was conducted using hoop traps baited with sardines. Traps were set for 2–5 days and were checked daily by trained staff and volunteers.
- Visual surveys were conducted by slowly searching the area by canoe or on foot.
- All new turtles captured were given a unique notch code so that they can be individually identified on subsequent captures. Turtles were handled by trained personnel in accordance with the standard procedures developed by the Blanding's Turtle Recovery Team.
- Select turtles were outfitted with radio transmitters to allow researchers to track their seasonal movements.
- Data on turtles and their habitats were entered into the long-term Blanding's turtle database, which has records on some individuals as far back as 1969.

J. McNeil, Parks Canada

Researcher Abbey Camaclang weighs a hatchling Blanding's turtle from the McGowan Lake population

RESULTS

- Volunteers Harold and Diane Clapp found Blanding's turtles in the Tobeatic. Four turtles were captured by trapping (242 trap nights) and visual surveys (>100 hrs effort). This exciting find may represent a fourth population in the province.
- Trapping, visual surveys and nest monitoring surveys in and

RESULTS
Continued

around the three known populations (~850 trap nights, >1500 hrs surveys) yielded 20 new individuals and >150 previously marked individuals.

- Turtles captured ranged in age from 2-year-old juveniles to adults over 60 years old, providing information on age-related survivorship and habitat use.
- Seasonal movements were monitored in all three populations and new nesting and overwintering sites were located.

YEARS OF DATA

- Ongoing project since 1996

PARTNERS

- Acadia University
- Blanding's Turtle Recovery Team
- Parks Canada
- Government of Canada Habitat Stewardship Program
- Endangered Species Recovery Fund
- Mersey Tobeatic Research Institute
- Nova Scotia Department of Natural Resources
- Nova Scotia Department of the Environment
- Friends of Keji Cooperating Association

J. McNeil, Parks Canada

Troy Freck tracks radio-tagged Blanding's turtles

J. McNeil, Parks Canada

Hatchling Blanding's turtle (Squirtly) is a Headstart who was released August 2007

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Rationale

Although it is known that the Blanding's turtles here in Nova Scotia repeatedly use the same nesting sites, summering grounds, and overwintering sites, there is often little data on the precise movements to and from these areas. As these travel routes are often crossing roads, passing through industrialized and residential areas, as well as land designated for logging operations, it is vitally important that these travel routes are well defined. If important corridors of the travel routes are not indicated to be critical habitat, and eventually altered, the Blanding's turtles could potentially lose their ability to travel from one component of its critical habitat to another. It is the precise timing of the travels that is so unpredictable, and because these turtles can move long distances unexpectedly fast, the identification of travel routes has proven challenging. The technology and methods that are currently being used to follow these animals are costly and labour intensive and potentially disruptive of turtle movement. Developing new technology, which is not costly and light enough to deploy on Blanding's turtles, could potentially aid in determining the fine scale travel routes, home ranges, and habitats used by them.

P. Kydd

Adult Blanding's turtle with textaline mesh pocket.

Research

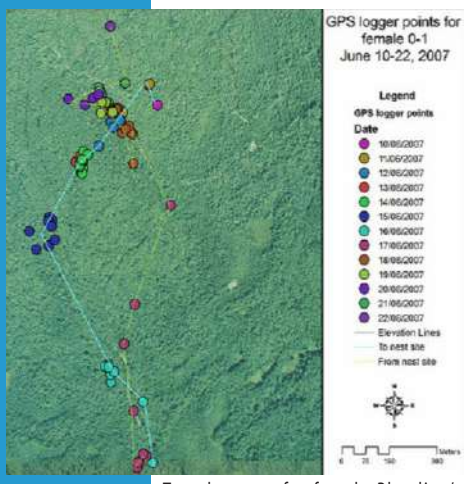
TRACKING BLANDING'S TURTLES USING GPS

OBJECTIVES

- Accurate identification of travel routes has proven challenging.
- Developing new technology could potentially aid in determining the travel routes, home ranges, and habitats used by Blanding's turtles.
- Evaluate the effectiveness of GPS technology in documenting turtle movement patterns.
- Compare the GPS technology to conventional radio telemetry.
- Map travel routes and use data to identify critical habitats.
- Identify previously unknown nesting and overwintering sites, and summering areas.

METHODS

- GPS unit and custom software were designed by Norm Green, Friends of Keji Cooperating Association.
- Points are logged on a flash memory card contained in the unit and downloaded once the unit is retrieved.
- The data collection interval, maximum attempt time to obtain a location, and number of points to sample before storing are easily customized.
- Units are currently encased in 12 gauge vinyl for waterproofing.
- A small transmitter is imbedded in the unit to facilitate relocation of the turtle.
- Two Tadiran TLH-5903 3.6 V AA batteries are used to minimize weight and maximize battery life.
- Units are placed in a textaline mesh pocket which is glued to the shell. This enables the subsequent deployment of GPS units on the same turtle, to avoid the unnecessary stress of re-glued.
- Initial weight of the complete unit with epoxy was approximtely 90g, and approximtely 100g with the addition of the textaline mesh pocket.



J. McNeil, Parks Canada

Travel route of a female Blanding's turtle to and from her nesting sites. Path shows that surprisingly, she spent a couple of days on top of a hill in the woods.

RESULTS

- GPS units successfully recorded up to 110 points and batteries lasted up to 13 days.
- GPS data were downloaded and compared against known locations; most points accurately reflected the actual location of the turtle.
- Based on their distance from other points, a few points appeared to be inaccurate. Initial analysis of these points also revealed abnormal altitudes, which combined with their isolation indicates that these points were inaccurate.
- Some problems were encountered with waterproofing; four of the eight initial loggers leaked, prompting the use of the more durable 12 gauge vinyl. Although these units were ruined, the data logged before the leak remained intact.
- Problems were also encountered with attachment of the GPS units. Turtles appeared to be stressed for about one minute as the epoxy reached its maximum temperature while setting. On two separate occasions, removal of GPS loggers that were directly attached to the carapace of the turtles resulted in the detachment of small patches of keratin. The textaline mesh pocket eliminates these problems.
- The nesting routes and/or travel routes of 18 turtles, in and around Kejimkujik, were documented through the deployment of over 30 GPS loggers.
- Several previously unknown travel routes were documented and one suspected nest site was identified.

P. Kydd

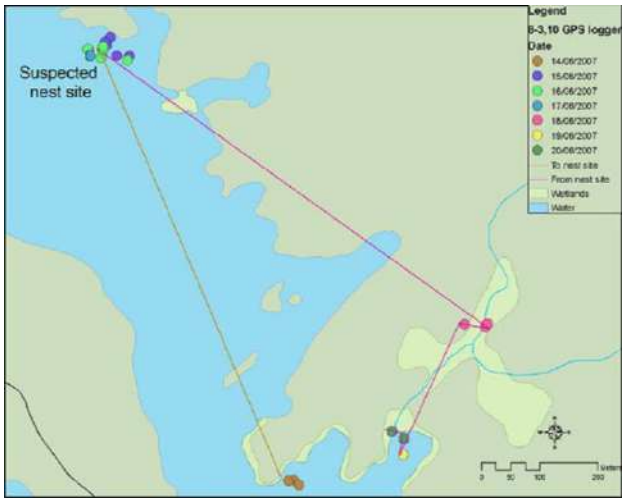
GPS logger units, with radio transmitter, packaged in 12 gauge vinyl.

YEARS OF DATA

- Year 1 of a 2 year project.

PARTNERS

- Acadia University
- Friends of Keji Cooperating Association
- Endangered Species Recovery Fund
- Government of Canada Habitat Stewardship Fund
- Parks Canada



J. McNeil, Parks Canada

Travel route of a female whose nesting site was previously unknown.

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Rationale

The Eastern ribbonsnake (Atlantic Population) is listed as threatened under the Species At Risk Act. This population occurs only in one inland region of southwestern Nova Scotia. Limited research has been conducted on the ribbonsnake in Canada. Conservation of this species requires adequate knowledge of its ecology, growth, and development. Growth rates can be related to timing of sexual maturity and predation rates. Analyzing growth rates for Eastern ribbonsnake at Grafton Brook is an important first step in determining the viability of this population.

J. Todd

Eastern ribbonsnake at Grafton Lake

J. Phillips

Josie Todd conducting fieldwork at Grafton Lake

Research

RIBBONSNAKE GROWTH AT GRAFTON BROOK

OBJECTIVES

- To collect and analyze morphometric data on the Eastern ribbonsnake at Grafton Brook.

METHODS

- Data were compiled on total length, snout-vent length, tail length, and weight for Eastern ribbonsnakes that were known to have been caught during more than one season at Grafton Brook, Kejimkujik, between 2004 and 2006.
- Data were analyzed for trends related to size class and season if possible.

RESULTS

- High variance and unequal sample sizes discouraged the use of traditional statistics on these data, but they were explored for trends.
- Most growth occurred between the summer and fall and very little occurred between the fall and winter.
- Weight gain seemed to be more evenly distributed between spring and fall.
- Although individuals would be expected to lose weight between the fall and winter due to seasonal anorexia, this was not the case on average.
- When the growth rates of individuals estimated to be "immature" based on snout-vent length were compared with those estimated to be "mature", annual growth (in terms of snout-vent length) showed a tendency to be much higher (9.3cm ± 1.2 SD vs. 3.0 ± 3.3 SD).
- Annual weight changes for the two maturity classes were similar.

YEARS OF DATA

- Ongoing project since 2003

PARTNERS

- Dalhousie University
- Parks Canada
- Natural Sciences and Engineering Research Council of Canada
- Eastern Ribbonsnake Recovery Team

J. Todd

Eastern ribbonsnake in the hand

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Rationale

Research on the Eastern ribbonsnake in 2007 began in March and ended in October. The majority of effort was concentrated at Molega Lake and Grafton Lake in an attempt to increase our understanding of the movement and habitat use patterns of this species. Testing of PIT tags was continued from previous years as a more permanent method of marking. Additionally, the attachment of radio-transmitters to the external surface of snakes was piloted. Fluorescent powder-tracking was also used to examine micro-habitat use and offered interesting observations. Landscape-level habitat-use patterns were apparent along the causeway at Molega Lake. Snake mortality was also observed. Eastern ribbonsnake observations near Middleton expanded the known range for this species. Outreach and stewardship efforts are ongoing.

B. Cavenhill
Parks Canada

Eastern ribbonsnake at Grafton Lake

Research

EASTERN RIBBONSNAKE DISTRIBUTION

OBJECTIVES

- To survey wetlands and determine the extent of Eastern ribbonsnake distribution in Nova Scotia.
- To locate previously unknown high-density sites of ribbonsnakes for future research and stewardship efforts.
- To increase public awareness of this species by the distribution of pamphlets and to solicit sightings from the public.

METHODS

- Several high priority sites for surveying were identified based on sighting reports (both historic and recent) or their location at the periphery of the known range. Blanding's turtle researchers also recorded Eastern ribbonsnake sightings.
- Visual surveys, by foot or canoe, were conducted with a minimum of two observers. Effort exerted during each survey was recorded. Attempts were made to capture all snakes observed; transmitters were attached using adhesives (e.g., Superglue) or steri-strips. Transmitters with adhesives were removed from the snake within 24 h of attachment, often removing several ventral scales.
- Weather conditions, behaviour of the snake and the microhabitat variables within a 2.5 m radius were recorded for each observation. Additional information was recorded on the physical characteristics and morphology of all captured snakes.
- The effectiveness of fluorescent powder-tracking was tested on 24 ribbonsnakes using two methods of application: fluorescent powder and a thick paste comprised of powder and mineral oil.

RESULTS

- Eastern ribbonsnakes at Grafton and Molega Lake were found in dry areas through early spring and along the shoreline through late spring, summer, and early fall. Many snakes were observed in the water during the summer.

RESULTS
Continued

- Eastern ribbonsnakes were frequently found at Molega on 2 esker-like formations. These narrow areas contain many rocks and dense shrubs; they are surrounded on both sides by water. Arboreal habitat use was documented on 4 powder-tracking paths with snakes climbing in shrubs as high as 71 cm above ground.
- Ribbonsnakes were observed at the a suspected hibernacula site at Grafton Lake in early spring and late fall. Additionally, a ribbonsnake was observed in Grafton woods on October 28th. The earliest Molega Lake sighting was in the woods approximately 400 m from next the closest observation. Another late fall sighting occurred near the Woods Rd at McGowan. These three sightings seem to suggest that ribbonsnakes can hibernate considerable distances from the summer feeding grounds.
- Distribution: three observationson East Lake, near Middleton, by Chris Wagner (these are now our most northern sightings); several observations along southern shores of Molega Lake and neighbouring lakes by Bruce McInnis; one observation each on Long Lake and Beavertail Lake, both observed by Sean Blaney.
- Mortality: snake found suspended in steeplebush with a wound on the right side and blood in the mouth. Appeared to have been attacked by a bird (mid-April); found decomposing carcass with gnaw marks on ventral surface and opaque eyes (late August); snake observed being run over by a vehicle and died shortly afterward.
- Stewardship: Bruce McInnis has been observing ribbonsnakes on his and a neighbours property for approximately 20 years. Conducted several visual surveys this summer and is keen to do more; Molega cottagers attended two Molega cottage owner meetings (Keddy Cove and the Greater Molega area) and talked about ribbonsnakes. Several people were interested at each meeting.

J. McKinnon

Eastern ribbonsnake with radio antennae visible on right side of the photograph

YEARS OF DATA

- Ongoing project since 2004

PARTNERS

- Acadia University
- Eastern Ribbonsnake Recovery Team
- Dalhousie University
- Parks Canada
- Mersey Tobeatic Research Institute

Table 1: Visual survey effort at the five known ribbonsnake high density sites and the total number of observations, including general observations, in 2007

High density site	Time	# of observations
Barren Meadow	36 h 30 m	29
Cobrielle Brook	18 h 26 m	16
Grafton Lake	315 h 22 m	161
McGowan Lake	2 h 52 m	3
Molega Lake	244 h 48 m	178

T. Imlay

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Rationale

Wetlands provide critical habitat for aquatic and semi-aquatic species, as well as for many terrestrial species at key points in their life cycle. In Nova Scotia, a large proportion of species at risk occur in inland wetlands. These populations represent a rich biodiversity heritage whose natural history has been shaped by past environmental changes and will be vulnerable to future changes in climate and human activity. Understanding the impacts of past environmental changes on the distribution and abundance of these species is essential to predict vulnerability to future environmental change. Nova Scotia has a long history of intensive forestry, especially in its southern regions. Forestry-related activities often required the flooding of wetlands, the effects of which may have been profound for resident wildlife populations. This project is an initial effort to examine these effects by documenting post-European contact changes in species at risk populations of southwestern Nova Scotia. Specifically, the history of water impoundments ("dams") throughout this region for the past 200 years will be obtained.

K. McKendry

Intact dam on Medway River near Harmony

Research

EFFECTS OF DAMS ON WETLAND SPECIES

OBJECTIVES

- To locate all dams and dam remnants in the Mersey and Medway watersheds.
- To determine the effects of dams (historic and present) on the distribution of select wetland-dependent species as risk in southwestern Nova Scotia.

METHODS

- Historic literature, maps and local informants were used to estimate approximate locations of dams (past and present).
- Dam coordinates were recorded using GPS (digital photos also taken).
- A map was constructed using GIS software overlaying the water bodies of the Mersey and Medway watersheds, dam locations, and distribution data for select species at risk.
- Geostatistical analyses were performed to examine the effects of dams on species at risk population distributions.

K. McKendry

Dam removed from Bowater's Rossignol District

RESULTS

- The Mersey and Medway watersheds contain 39 and 34 dams and dam remnants respectively, for a total of 73 dams in the study area. Most dams were located thanks to the directions given by local informants.
- Most of the Blanding's turtle, Eastern ribbonsnake, and Atlantic Coastal Plain Flora observations were located in the upper portions of the watersheds, which is coincident with relatively fewer dams and dam remnants than in the lower reaches of the watersheds.
- Dam locations, Blanding's turtle observations, and Eastern ribbonsnake observations were significantly clustered on the landscape and these clusters overlapped. Although the species at risk were clustered on the landscape, much of the clustering may be explained by a sampling bias towards observations recorded in Kejimkujik.

K. McKendry

Metal spike used to secure historic timber

RESULTS
Continued

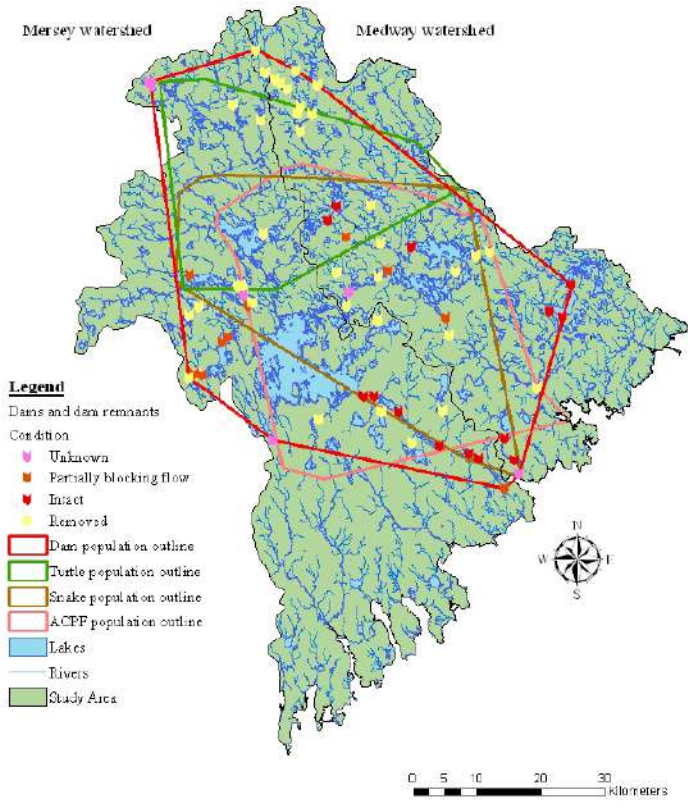
- The mechanisms by which dams affect wetland-dependent species are beginning to be understood, but the influence of the number of dams, condition of dams, and proximity to dams on these mechanisms remains unclear. Future researchers are encouraged to explore the role of dam height and age, and ice scour in explaining wetland-dependent species at risk presence, and to incorporate absence data. Increased sampling for Blanding's turtle and Eastern ribbonsnake outside Kejimkujik National Park and Historic Site's boundaries would strengthen these data sets.
- It is hoped that these data on human alterations of the environment will inform future research on Nova Scotia's wetland-dependent species-at-risk.

YEARS OF DATA

- Year 1 of a 2 year project

PARTNERS

- School for Resource and Environmental Studies, Dalhousie University
- Acadia University
- Atlantic Centre for Global Change and Ecosystems Research
- Mersey Tobeatic Research Institute
- Parks Canada
- Bowater Mersey Paper Company
- Nova Scotia Department of the Environment



K. McKendry

Population extents of dam, Blanding's turtle, Eastern ribbonsnake, and Atlantic Coastal Plain Flora (ACPF) observations in the Mersey and Medway watersheds

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Rationale

Soils that are frequently wet or moist and that become anaerobic for a while or year-round pose significant challenges to land managers. These areas are often associated with important ecological flows (e.g., water, nutrients, pollutants, dissolved organic carbon, water colour, sediment, denitrification, methane production, methylization of mercury), as well as unique flora and fauna (e.g., wetland perimeters, stream side riparian zones, vernal pools). At the same time, these areas are highly susceptible to damage from management actions that do not recognize their inherent hazards (leading to change in soil drainage and flow channel alterations, rutting, loss of habitat). Land managers and land-use planners now have access to a new tool to systematically locate potentially wet areas and habitats across the landscape with sufficient resolution for operational planning. This tool is a digital, high-resolution flow-channel, wet-areas and cartographic depth-to-water map wet areas map (or WAM for short), which will locate areas that are potentially wet and/or subject to frequent water inundation and flows with fairly good field conformance.

J. Sheppard

Surface water running over forest floor in autumn

Research

WET AREA AND FLOW CHANNEL MAPPING

OBJECTIVES

- To verify the digital map (10 m resolution) showing potential water retention areas and flow channels associated with perched water tables and surface water bodies across Nova Scotia.
- To refine and update the potential wet areas map based on extensive ground verification work.
- To interpret the high-resolution wet-area features in terms soil, site, wetland and habitat classification from physical, chemical and biological perspectives (e.g., assessment of terrain trafficability, soil resistance to tree blow-down, relation between stream colour and wet area percent per watershed, distribution of bryophytes and other wetland obligate species).

METHODS

- An ArcView-based mapping methodology was used.
- Flow accumulation was charted based on digital elevation model (DEM) data and automatically corrected to coincide with hydrographically already identified water bodies and wetlands.
- Programming was developed to automatically delineate watershed boundaries for any given point along any mapped channel.
- The cartographic depth-to-water classification was automatically derived and displayed based on local DEM data and locations of water bodies within the topographic grid.
- The process can be further refined by considering the likely area needed to produce surface water flow within accumulation zones, as dictated by local depressions and soil substrate permeability. This includes the registration of roads and associated linear flow channel features such as ditches.

P. Arp

Stream-water quality and fluxes as affected by basin-specific soil conditions pertaining to percentage of wet-area coverage per basin in Liverpool

A. Belliveau

Ephemeral wet area in foreground, forest harvesting in background

RESULTS

- A map displaying ephemeral channels and the probable depth-to-surface-water at the high water mark at any location in NS was developed in the fall of 2005, and is now available for all of Nova Scotia at http://www.gov.ns.ca/NATR/FORESTRY/GIS/downloads.htm#WAM
- Forest companies report that the wet areas map, as derived from the provincial DEM for Nova Scotia, is now used as a base layer to locate potential hydrological risks as part of day-to-day operations planning, (i.e., road and access trail layout, cutblock design, site preparation, tree planting).
- A GPS-based map-verification process has been formulated to systematically compare map-derived flow channels, wet area borders and depth-to-water index with on-the-ground features. The process compares GPS locations for road-stream culverts, wet-area borders, and flow channels with the corresponding map locations. This verification work includes using LiDAR-derived DEMs, and other high-resolution DEM products. It was found that photo-interpreted wetland borders tend to confirm with the LiDAR-derived depth-to-water index within 50 cm.
- Work has begun in addressing the issue of high-resolution soil mapping, by checking the soil unit borders with local air photos, satellite images, DEM, the DEM-derived flow-channel, wet-areas and cartographic depth-to-water map, and other existing land classifications especially wetlands. In this process, soil borders and soil drainage become topographically, texturally and geomorphological corrected, and become consistent with already mapped wetland borders.
- The cartographic DTW index is now also used for interpreting stream water quality and fluxes as affected by basin-specific soil conditions pertaining to percentage of wet-area coverage per basin. Water quality aspects addressed in this refer to in-stream dissolved organic carbon and nitrogen, extent of basin-wide denitrification, and amount of Hg transfer from the basin into the streams and lakes below.
- The wet-area map is also used to assess daily soil moisture and trafficability conditions, year-round, from ridge tops to the wet areas below. The map is being used for assessing forest biomass productivity. The process of doing so advances gradually, and requires the revised DTW-indexed soils map with a completed data base for all pertinent soil physical and chemical properties per mapping unit.

YEARS OF DATA

- Year 3 of a 3 year project

PARTNERS

- University of New Brunswick
- Nova Scotia Department of Natural Resources
- Province of New Brunswick
- Province of Alberta
- Environment Canada
- Parks Canada
- Canadian Forest Service
- Nova Forest Alliance
- NSERC
- Sustainable Forest Management Network

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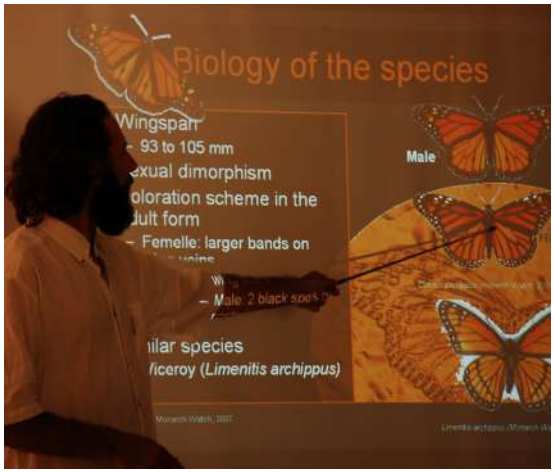
Clockwise from top left: exploring Atlantic Coastal Plains Flora habitat; Species at Risk fashion show held in Kejimkujik; volunteer watching for nesting turtles on a June evening in Kejimkujik; exploring Eastern ribbonsnake habitat; MTRI summer seminar series.

HUMAN DIMENSIONS

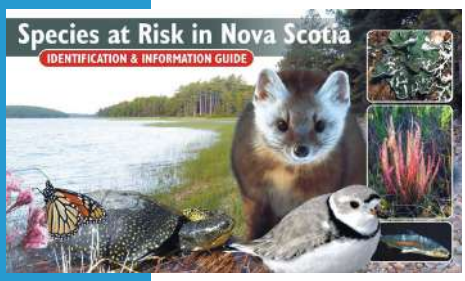


Rationale

The Southwest Nova Biosphere Reserve (SNBR) is home to approximately 75% of the more than 40 Species at Risk (SAR) that live in Nova Scotia. SAR Stewardship Biologists from Kejimkujik have partnered with MTRI and other NGOs, First Nations, schools, community groups, industry, and all levels of government to help recover the SAR that live in this unique region. Their work is to learn interesting and useful information about SAR in the SNBR, share this knowledge with the public, and excite, engage and guide interested individuals, families, and communities in the conservation of these species and the habitat in which they live. This 3-year project (2006, 2007, 2008) is funded by Parks Canada's Priority Investment Fund for Species at Risk Recovery.

B. Caverhill Parks Canada

Jennifer McKinnon refills bait for Blanding's turtle live-traps in the Tobeatic Wilderness Area



J. Todd

The cover for *Species at Risk in Nova Scotia: Identification and Information Guide*

Research

SPECIES AT RISK STEWARDSHIP IN SNBR

OBJECTIVES

- To increase awareness and understanding of SAR in the SNBR, and generate sighting reports.
- To promote environmental stewardship and advocacy and create ambassadors for species at risk.
- To help recover key species at risk, including Blanding's turtle, Eastern ribbonsnake, Piping plover, Southern flying squirrel, Monarch butterfly, Water-pennywort, and endangered Atlantic coastal plain flora.

METHODS

- Engaging outreach strategies and activities continue to be developed and deployed throughout the SNBR, including the creation of the *Species at Risk in Nova Scotia: Identification and Information Guide* which is intended to increase awareness, sighting reports, and stewardship of SAR in Nova Scotia.
- Simple, useful, and fun volunteer opportunities continue to be provided for Kejimkujik visitors and communities in the SNBR, including: Blanding's turtle nest monitoring, trapping, radio tracking, and visual surveys; Eastern ribbonsnake surveys; Piping plover habitat restoration; and Atlantic coastal plain flora monitoring.
- Partnerships continue to be established with individuals and organizations that work with SAR in Nova Scotia to enhance communication and collaboration and ultimately the recovery of SAR.

RESULTS

- Stewards continue to monitor SAR on their properties throughout the SNBR, and participate in volunteer programs - over 250 individuals volunteered a total of more than 10,000 hours in the Greater Kejimkujik Ecosystem in 2007.
- In June, two volunteer stewards discovered the first four individual Blanding's turtles ever recorded in the Tobeatic Wilderness Area.

RESULTS
Continued

- Over 800 high school students participated in presentations during the fall 2006 bike tour around SNBR; over a dozen schools participated in "The SAMPAA challenge: linking art & science in the SNBR."
- In August, four headstarted hatchlings were released at Grafton Lake in Kejimkujik. More than 100 volunteers, community members, local Mi'kmaw and park visitors came out to celebrate their release.
- Over 100 volunteers and stewards attended a volunteer banquet in December to celebrate their achievements.

YEARS OF DATA

- Year 2 of a 3 year project

PARTNERS

- Parks Canada
- Acadia University
- Bear River First Nations
- Mersey Tobeatic Research Institute
- Southwest Nova Biosphere Reserve Association
- Government of Canada Habitat Stewardship Program

J. McKinnon

Harold and Diane Clapp, who discovered the Tobeatic Blanding's turtle population

J. McNeil

The cast of the Species at Risk fashion show, held at Kejimkujik

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Rationale

This research investigates the process of establishing Mi'kmaq education through the creation of learning experiences, which are based in Mi'kmaq knowledge and pedagogy, as they are developed collaboratively between the school educators and Mi'kmaw community members. The work will address the inherent systemic constraints that Aboriginal education initiatives face within the public education setting and the spaces in education that are open to legitimating and promoting Aboriginal knowledge.

D. Potter

Salmon release at Wildcat First Nations

Research

COMMUNITY-BASED MI'KMAQ EDUCATION

OBJECTIVES

- To collaboratively develop community-based and school-based Mi'kmaq education initiatives.
- To identify the challenges and barriers in establishing Mi'kmaq knowledge and pedagogy as central to learning experiences.
- To identify the strategies that educators and community members use in overcoming identified challenges and barriers.
- To legitimate and validate Mi'kmaq knowledge .

METHODS

- The establishment of research to meet the needs and priorities of the First Nations community.
- Indigenous research methodology as defined by culturally-situated understandings and directions in gathering data.
- Interviews with collaborative research participants.
- Reflective journals.

W. Wells

Salmon eggs going into the tank at Wildcat First Nation

RESULTS

- The collaborative development of a multitude of community-based and school-based education initiatives.
- The establishment of the environment as a site of learning where Mi'kmaq knowledge and scientific knowledge can be complimentary ways of learning.
- Ongoing collaboration to further establish learning experiences founded in Mi'kmaq knowledge and pedagogy.
- The importance of respectful human relationships as the basis of collaboration and learning.

YEARS OF DATA

- Ongoing project since 2002

PARTNERS

- Lakehead University
- Wildcat First Nations
- North Queens School

W. Wells

Salmon hatching in the tank at Wildcat First Nation

S. Moore

Todd Labrador telling salmon stories on the Wildcat River

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Rationale

It has long been recognized that protected areas do not exist in isolation from their surrounding regions. Ecological, economic and socio-cultural interactions between protected areas and their surrounding regions occur on a regular basis within the context of a politicized environment, a lack of knowledge and a great deal of complexity. A regional, multi-stakeholder and co-operative approach to protected area management is needed. Regional integration is a complex process by which protected area staff and regional participants engage in formal and informal social interactions in order to reach independent and shared goals related to the protected area. Regional integration is influenced by regional contextual factors such as the biophysical environment, the economy, demographics, history, and culture. Regional integration initiatives can involve: building partnerships, collaborating and cooperating with actors within a protected area's surrounding region; increased public participation in protected area management and planning; or engaging in ecological integration initiatives such as joint monitoring programs.

J. McCleave

View from scenic canoe trip in Kejimkujik

Research

REGIONAL INTEGRATION OF PROTECTED AREAS

OBJECTIVES

- To develop the theory and improve the practice of the regional integration of protected areas.
- To answer the following four primary research questions: 1) what are the critical interactions between national parks and their surrounding regions and what management challenges do they raise, 2) how have the interactions between national parks and their surrounding regions been addressed by protected area managers and other actors, 3) how is the concept of regional integration currently defined and practiced within the context of national parks in Canada, and 4) how can the regional integration of Canada's national parks be improved.

METHODS

- Four case studies were selected: Kejimkujik; Gros Morne National Park, Waterton Lakes National Park; and Mount Revelstoke and Glacier National Parks.
- Qualitative research methods were used.
- Semi-structured interviews were conducted with Parks Canada staff, biosphere reserve board/committee members, provincial and local government representatives, local business owners and other relevant stakeholders.
- 25-35 people were interviewed at each case study site.

RESULTS

- Each case study had a unique regional context as well as formal and informal mechanisms in place for interaction and communication between park staff and regional participants.
- Several characteristics of strong regional integration were identified including park staff being aware of the park's effects on the park region; principles in place for park involvement in regional issues; and regular informal interactions occurring between park staff and regional participants.

RESULTS
Continued

- It was found that Gros Morne National Park has the strongest regional integration of all of the case studies while the regional integration of the three other case studies was strong in some areas and weaker in others.
- Several suggestions are made for improving the regional integration of national parks in Canada including decreasing the turnover of key park staff; effectively communicating the park mandate to regional actors; improving relationships with First Nations; obtaining political and managerial "buy-in" for regional integration; and increasing informal interactions with regional actors.
- For more information and to download the entire thesis, please visit www.juliamccleave.ca

YEARS OF DATA

- Single year project

PARTNERS

- University of Waterloo
- Southwest Nova Biosphere Reserve Association
- Mersey Tobeatic Research Institute
- Parks Canada

J. McCleave

Canoe retreat location in Waterton Valley

J. McCleave

Setting sun on Gros Morne Mountain

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Rationale

Southwest Nova Scotia has been declared a UNESCO biosphere reserve because of its unique and rich natural and cultural history. The biosphere reserve is comprised of 5 counties: Queens, Shelburne, Yarmouth, Annapolis, and Digby. The core protected area for the Southwest Nova Biosphere Reserve is Kejimkujik and the adjacent, Tobeatic. Traditional industries of the region include: forestry, initially for timber and later pulp production; small-scale agriculture; and coastal fisheries. There are many challenges for the Southwest Nova Biosphere Reserve, including: many citizens being unaware they live in a biosphere reserve; people do not understand the meaning of a biosphere reserve; sustainable resource management is not a concept clearly understood by the public. Community-based planning is needed to satisfy the need for local engagement, outreach, and stewardship to ensure that forest industries and ecosystem integrity are maintained into the future.

R. Owens-

Group in old growth forest within the Southwest Nova Biosphere Reserve

Research

FOREST COMMUNITY PLANNING AND ENGAGEMENT

OBJECTIVES

- To prepare for visioning workshops for the future of the SNBR.
- To inform the public discourse on the status of the SNBR in terms of the sustainability of natural resources and the sustainability of the rural economy.
- To compile natural resource and socio-economic information, format this information in a form suitable for community-based workshops, and produce a communications strategy for delivery of this information to the public.
- To build a common understanding of the facts relating to the sustainability of the SNBR.

A. Lavers, MTRI

Wood harvested and ready for transport in Queens County

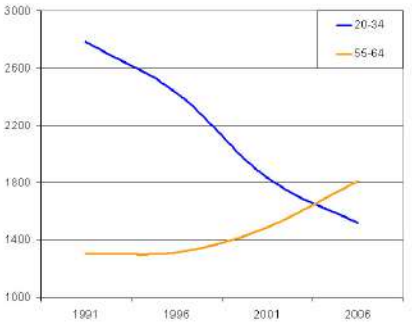
METHODS

- Natural resource and socioeconomic information was compiled by gathering existing data for the SNBR, including information on: forest cover, species at risk maps, landscape management, demographics, and economic activity.
- Formatted information for use in community-based workshops and summarized in key messages, facts, and figures.
- Information was collected from GPI Atlantic, Statistics Canada, Acadia University, Applied Geomatics Research Group, Dalhousie University, Parks Canada, Wildlife Conservation Society, and Nova Scotia Finance Community Counts.

RESULTS

- Nova Scotia's forest ownership is: 69% Private; 3% Federal; 28% Provincial. Canada's forest ownership is: 8% Private; 14% Federal; 78% Provincial.
- With mechanization, there has been a greater potential to harvest larger areas in less time. Over the last 20 years there has been an increase in the proportion of the landscape where there has been forest cover change. Employment per unit of biomass has declined as mechanization and automation in both harvesting and processing has increased.

RESULTS
Continued



K. Rowter, MTRI

Queens County age demographic from 1991 to 2006 (Statistics Canada)

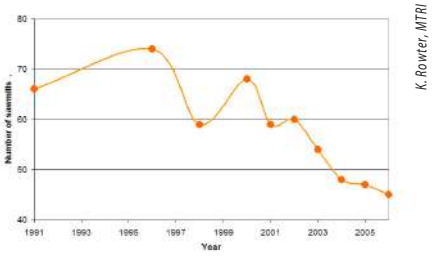
- In all counties in the biosphere reserve, there has been a 50% decline in residents between the ages of 20-34 since 1991.
- There were 93,000 kms of roads in Nova Scotia in the 1990's, the equivalent of 2.3 times around the world. As the footprint of harvesting gets larger, there are less areas with forests more than 80 years old which are considered mature. In the SNBR, there have been efforts by Bowater, NSDNR, and some private land-owners to identify mature and old forests and to set these aside. On private land, there is a growing interest to restore old forest features.
- In eastern North America, the SNBR includes some of the region's largest wilderness areas with the lowest ecological impact. Because of large core protected areas managed forest wilderness are still intact. This suggests there is a great opportunity in SNBR to plan ahead and manage the footprint, particularly as changes arise in the forest industry.
- Threats to the survival of species at risk include: intentional harm from people, road mortality, loss of habitat, lack of knowledge about the species, and collection for the pet trade. There are many opportunities for volunteers to help with species at risk research and stewardship: Piping Plover Guardians, Nova Scotia Nature Trust

YEARS OF DATA

- Ongoing project since 2006

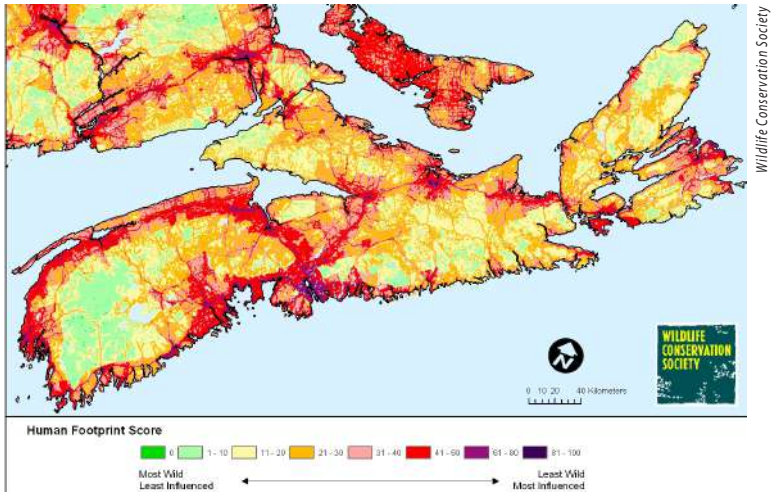
PARTNERS

- Mersey Tobeatic Research Institute
- Southwest Nova Biosphere Reserve Association



K. Rowter, MTRI

Number of sawmills in the Southwest Nova Biosphere Reserve acording to NS Natural Resources Registry of Buyers.



Wildlife Conservation Society

Current human footprint in Nova Scotia and other areas of the Maritimes as calculated by the Wildlfe Conservation Society

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Rationale

Many individuals and organizations are concerned about the threats posed by invasive alien plant species; no single information resource exists for Nova Scotians. Currently, obtaining and using data on the distribution and abundance of invasive alien plant species in our region is difficult. To begin bridging the current gaps in information, Clean Annapolis River Project (CARP), in partnership with the Applied Geomatics Research Group (AGRG), developed a web-mapping database and associated sampling protocols to be used for collecting information on the location of invasive alien plants in Nova Scotia. When provided with the tools and skill sets to identify and map invasive alien plants, citizen scientists can play an important role in the prevention and early detection of new invaders. Data collected by volunteers was added to a database and is displayed on the Plant Patrol NS website (www.plantpatrolns.ca)

M. Godwin, CARP

A Plant Patrol volunteer using GPS technology to map a stand of Common reed in Annapolis Royal

Monitoring

PLANT PATROL

OBJECTIVES

- To engage members of the public in recognizing, reporting, and tracking occurrences of priority terrestrial (including wetland) invasive alien plants.
- To create a database of information related to the locations of invasive alien plants in Nova Scotia.
- To provide web-based information on the biology, threats, and management of regionally important terrestrial invasive alien plants.

METHODS

- A volunteer monitoring protocol and datasheet for terrestrial invasive alien plants was developed.
- Volunteers were supplied with manuals and global positioning system (GPS) units, and were trained to collect data on the biology and location of invasive alien plants.
- Volunteers conducted a trial implementation of the survey methods and datasheet from July to September 2007.
- Data collected by volunteers was entered into a spreadsheet, then developed into a database.
- Volunteer feedback was solicited to revise and edit the protocol and datasheet.
- A website was developed to provide access to data and invasive alien plant information.

RESULTS

- In 2007, 18 volunteers were trained to implement the Plant Patrol NS monitoring protocol using GPS technology to collect data on the biology and locations of invasive alien plants.
- Volunteers collected 355 individual invasive alien plant observations.
- An interactive website (www.plantpatrolns.ca) was developed where visitors can "Report an Alien" (by entering data for invasive alien plant occurrences), view maps of recorded

RESULTS
Continued

invasive plant sightings, look up species information, and download the volunteer monitoring protocol.

- The survey methods and datasheet were reused for 2008 based on feedback from volunteers.

YEARS OF DATA

- Ongoing project since 2007

PARTNERS

- Clean Annapolis River Project
- Applied Geomatics Research Group
- Harriet Irving Botanical Gardens (Acadia University)
- Invasive Alien Species Partnership Program (Government of Canada)
- Shell Environmental Fund

M. Godwin, CARP

Volunteers count Purple loosestrife plants in the Belleisle Marsh, Belleisle, during an intensive roadside survey trial

H. Stewart, NSCC

Oriental bittersweet vine overtopping native vegetation in West Paradise

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www.annapolisriver.ca

Rationale

The Mersey Tobeatic Research Institute was established in 2004 and within a couple of years was able to purchase its field station in the small rural community of Kempt, Queens County. To achieve its goal of promoting sustainable resource use, members of the MTRI co-operative have adopted ambitious education and outreach objectives and always strive to keep the lines of communication open between members and researchers and with the public. MTRI's plan for outreach includes a number of signature events such as monthly seminars about local research projects through the winter and a weekly series of seminars throughout the summer. Each year, MTRI hosts a Woodlot Demonstration in the fall and an Open House around the Christmas holiday. MTRI also works with North Queens schools to bring students to the field station in early summer to meet researchers. All of these education projects, and others, are advertised through local newspapers, by word of mouth, and other means. To evaluate the success of these efforts, phone surveys to local residents have been ongoing.

J. McKinnon MTRI

Alain Belliveau conducting phone surveys which take place from MTRI

Research

SOUTHWEST NOVA SCOTIA PHONE SURVEY

OBJECTIVES

- To determine how successful MTRI's education and outreach activities have been at reaching members of the local community.
- To create a database of baseline information related to the perceptions of the residents of southwest Nova Scotia to activities taking place in and around MTRI.
- To enable local citizens of southwest Nova Scotia to become involved in research and monitoring activites in their area.

METHODS

- A series of questions was developed to assess the participant's awareness of activities in and surrounding MTRI, including topics such as: whether people have heard about MTRI and what are their information sources; asking if people know what MTRI does; creating a profile of willing respondents which describes their outdoor activities, dependance on the forest industry, their visitation of Kejimkujik, their age, and their gender; determine what people know about invasive fish, old forests, and species at risk; determine the values and concerns of respondants about economic and environmental issues.
- Random numbers in the North Queens exchange were called and permission was requested of the household resident to answer the survey.
- Staff of MTRI collected answers and analysed the data gathered from phone conversations with local citizens.

B. Caverhill

Mersey Tobeatic Research Institute

RESULTS

- The community of North Queens includes approximately 800 households, 250 of these were contacted by telephone during the summer of 2007. Seventy-three people agreed to answer a series of questions and of those, 43 had heard of MTRI. Twenty-five people who had heard about MTRI had read about it in newspaper articles, 19 had seen posters in the community, 26 had heard about MTRI's public talks (most by word of mouth but also via posters and newspaper articles).

RESULTS
Continued

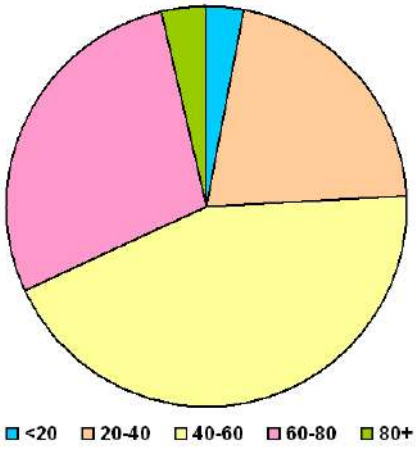
- Two had attended a public talk, and 1 had visited MTRI's website. When asked what MTRI works on, the most common responses (in this order) were: turtles, species at risk, fish, and loons but there was quite a variety of answers.
- Two-thrids said they participated in outdoor activities: 42% canoeing, 34% camping, and 30% birdwatching.
- One-third said someone in their household worked in the forest industry.
- 50% have visited Kejimkujik in the past year.
- 95% think old growth forests are important for habitat, animals, historical reference, ecosystem function, lumber, and beauty.

YEARS OF DATA

- Ongoing project since 2007

PARTNERS

- Mersey Tobeatic Research Institute



Age demographic of participants in the phone survey that took place in the North Queens exchange

A. Lavers, MTRI

MTRI participates in the Queens County Fair Parade annually as a tool for outreach, education, and citizen participation of research and monitoring events in the area

December 13, 2005 SPECTATOR

Mersey Tobeatic Research Institute hosts open house

SUBMITTED

An exciting year filled

The MTRI offers a public seminar series on various research topics. Roughly 20

going to host four public events:

January 30 - a talk about

March 27 - the annual general meeting.

April 26 - a public talk

Spectator

Newspaper articles are an effective means of communicating events and research updates throughout the rural communities of Southwest Nova Scotia

J. McKinnon, MTRI

Andrew Folkes corresponds with many respondents who are happy to talk to MTRI staff about the survey as well as a variety of other topics

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Rationale

Over the past four centuries, little of Nova Scotia's forested areas have escaped human influences. The outcome has been a proliferation of relatively young, even-aged, early successional forests types across an increasingly fragmented landscape. Less than 1% of Nova Scotia's forest cover remains as old forest, which makes it increasingly difficult to maintain ecological connectivity between them. Old forests are a vital component of the forest ecosystem and biodiversity; they are important habitat for wildlife including mosses, lichens, cavity nesting birds and mammals. Most of Nova Scotia's forest land (70%) is privately owned with almost half in small private holdings. Small private landowners must be included in collaborative work to maintain landscape connectivity, conserve biodiversity and restore old forests in western Nova Scotia. The development of private landowner stewardship requires an understanding of landowner knowledge and values about managing old forests and their active participation in research and management activities.

K. Nickerson, MTRI

Private woodlot with old forests

A. Lavers, MTRI

Katie Nickerson talking to a landowner about their values in old forests

Research

LANDOWNER ATTITUDES ABOUT OLD FORESTS

OBJECTIVES

- Conduct a local survey to better understand woodlot owners' values and attitudes towards old forests.
- To foster stewardship of old forests on private land by utilizing research findings to design communication outreach interventions.

METHODS

- A 61-question survey was created to collect woodlot owners' views on management and stewardship practices for old forests. The survey was distributed to 10 landowners in the Mersey and Medway watersheds whose property had been scored for old forest characteristics during MTRI's old forest stewardship project.
- The survey was excerpted from one created by Dalhousie University researches for a master's thesis on old forest stewardship attitudes among woodlot owners in central Nova Scotia (Dube, 2006).
- Surveys were completed by participants at home and then returned to MTRI for analysis. Results were sometimes compared to those of the Dube study.

RESULTS

- Eighty percent of respondents were somewhat to very concerned with the decline of old-growth forests in Nova Scotia.
- All respondents considered old-growth forests to be an important part of our natural heritage and important habitat for wildlife.
- Eighty-nine percent of landowners claimed they were interested in restoring old-growth forest features on their land and half had already attempted to do so.
- Seventy percent of the survey group said they had retained dead standing (snag) trees during the past 10 years.
- All respondents either somewhat or strongly agreed that

RESULTS
Continued

having multiple age classes of trees is a future goal for their property.

- The two most common harvesting practices were the frequent removal of dead or damaged trees (60%) and diameter limit cutting (50%). No respondents claimed to be frequently clearcutting their land.

YEARS OF DATA

- Ongoing project since September 2006

PARTNERS

- Mersey Tobeatic Research Institute
- Private Landowners
- Nova Scotia Department of Natural Resources
- Bowater Mersey Paper Company
- Dalhousie University
- Nova Scotia Department of Environment and Labour
- Natural Resources Canada
- Nova Scotia Nature Trust
- Parks Canada

A. Lavers, MTRI

Jim Crooker and his horse, Rusty, selectively harvesting in mature hemlock forest

A. Lavers, MTRI

Dead tree left standing in an old hemlock forest for biodiversity values

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