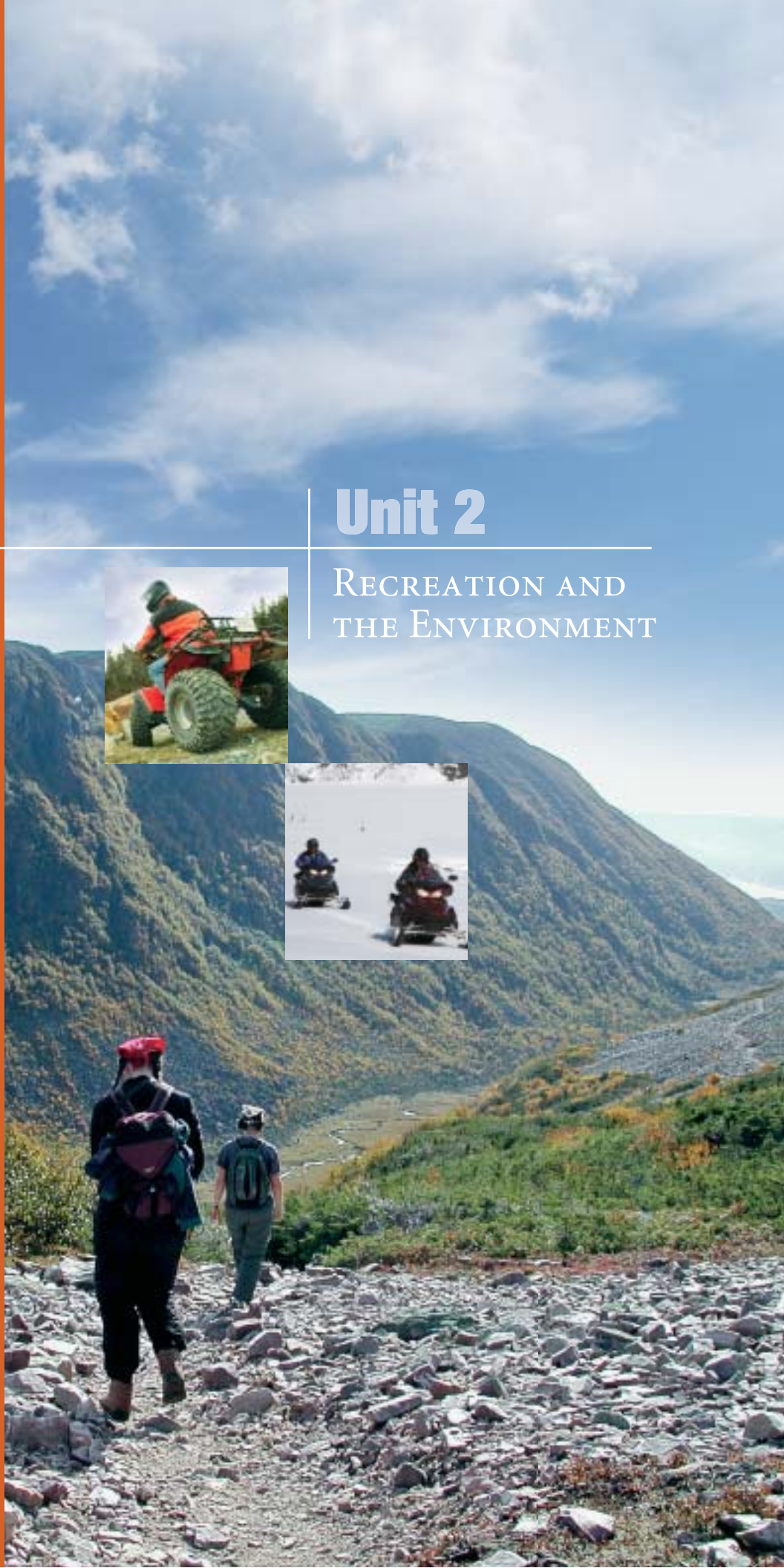
# TOWARD A SUSTAINABLE FUTURE

Challenges
Changes
Choices



## Unit 2

### Recreation and the Environment

# Chapter 6: Wilderness

## INTRODUCTION

**Figure 6.1:** The province of Newfoundland and Labrador has vast areas of wilderness. *Photo courtesy Lem Mayo*

Driving the trans-Canada highway between St. John's and Port aux Basques, you might easily believe that our province has vast areas of untouched wilderness. If you flew over the same route, however, you would see that this is not the case—the Island portion of the province, in fact, has very little untouched wilderness. Forestry, hydro development, and expanding towns and cities have all changed the landscape.

In Labrador, on the other hand, development has occurred at a slower pace. Vast tracts of wilderness still exist in the mainland part of the province. These areas have abundant wildlife, clean lakes, unbroken forest, untrodden barrens, and scores of mountains and valleys. But even in Labrador things are changing: major developments such as the nickel mine at Voisey's Bay, the Lower Churchill hydro development, and the Trans-Labrador highway, are slowly chipping away at Labrador's remaining untouched wilderness.

Just how much wilderness is left in Newfoundland and Labrador today? The answer to this question depends on your perception of what "wilderness" is. For example, citizens of St. John's might refer to Pippy Park as a "wilderness area," but a seasoned backpacker or hunter might see a thousand square kilometres of northern Labrador as the only true wilderness in the province.

In this unit you will explore the idea of "wilderness," learn how Newfoundlanders and Labradorians use the outdoors for recreation, and discover how our activities can have both positive and negative effects on wild areas.

## DIFFERING VIEWS OF WILDERNESS

Earth was covered by wilderness long before humans made their appearance. Even during most of human history the planet has been wild and the impact of humans has been minimal. The earliest peoples of Newfoundland and Labrador left a light "footprint" on the landscape. They would not have thought of their environment as wilderness but as their home—a natural, though sometimes unknown, place. Only in the last five hundred years or so have humans really begun to leave a more permanent impression on the Newfoundland and Labrador landscape.

Traditionally, the aboriginal peoples of this province considered themselves a part of the natural environment. Their social values and ideals, and knowledge of how to live with nature, meant that the land was their home—and not to be changed in any major way. Early European explorers saw these same lands as wilderness, however—and a wilderness that was threatening. They thought that they had to change the land, and impose their social values and ways of living on it, so that it would no longer be wilderness. They believed it needed to be tamed.

**Figure 6.2:** Middle Maritime Culture Hunters Returning to a Summer Camp. *Francois Girard Photo Copyright Canadian Museum of Civilization, artifact 1-A-39, Photo R. Taylor, 1995, image S95-23502*

Jacques Cartier saw Labrador as so inhospitable that he referred to it as "the land that God gave Cain." In 1497, John Cabot landed on the coast of Newfoundland. He described it as "rich with a sea that is full of fish." Many early settlers saw the land itself, however, as big and wild—a continual challenge to their survival. Because the wilderness seemed vast and threatening, they placed little value on preserving it.

As life became easier and wilderness areas became more remote from settled areas (and so less threatening), Canadians began to show their appreciation of the beauty

of the wilderness through artistic expression. One of Canada's best-known early poets, Archibald Lampman (1861–1899), wrote about his love of nature and wilderness. At the turn of the century, artists began painting the Canadian wilderness. Some were hired by the Canadian Pacific Railway to produce paintings of the scenery across the country. These paintings were used in advertisements to attract tourists and exhibited in art galleries. Members of the Group of Seven, perhaps the most famous group of Canadian artists, painted landscapes of the Canadian Shield, the Rocky Mountains, and Labrador.


**Figure 6.3:**
Archibald Lampman, and his poem "Temagami". Lampman is recognized as one of Canada's finest early poets. He wrote sonnets about nature in the nineteenth century.

*Photo: Archibald Lampman (b. Nov. 17, 1861 - Feb. 10, 1899). Ottawa, Ont., Dec. 1889 by William James Topley Source: Library and Archives Canada/Credit: Topley Studio/PA-027190*

**Figure 6.4:** "Jack Pine" by Tom Thomson, a member of the Group of Seven.

Toward the end of the nineteenth century, hunting and fishing started to become more a leisure activity and less a survival skill. At the same time, people began to realize that wilderness was not inexhaustible and had to be conserved and protected. And so protected areas, such as national and provincial parks, were established.

The first national park in the world was created in 1872 at Yellowstone, in the western United States. In 1885 the government of Canada followed suit, establishing Banff National Park in the Rocky Mountains. Newfoundland and Labrador's first national park, Terra Nova National Park, was established in 1957, and was followed by Gros Morne National Park (1973) and Torngat Mountains National Park Reserve (2005). The province's first provincial park was Sir Richard Squires Memorial Park, established in 1954. Today, enjoying protected areas such as national and provincial parks is a vital part of Newfoundland and Labrador life.

**Figure 6.5:** Elizabeth Penashue, Innu conservationist.
*Photo courtesy of Department of Education*

Elizabeth Penashue understands the importance of wilderness to culture and the human spirit. Born into hunting and trapping Innu family who lived at Kanekuanikat, Labrador, she moved to Sheshatshiu in the 1960s. Her father's hunting and trapping equipment, and also his trap lines, were lost when the the Smallwood Reservoir was created during the development of Churchill Falls.

Elizabeth and her husband Francis attempted to go back to the old way of life, to return to the land. During the 1970s and '80s, however, low-level military flying exercises out of Goose Bay were conducted over land that the Innu used for hunting. Elizabeth became a leader in the opposition to the low-level flying, which she believed negatively affected wildlife.

Elisabeth Penashue continued to promote the Innu's traditional lifestyle and relationship with the land by organizing a winter walk from Goose Bay to Miniipi Lake in the Mealy Mountains, as well as a canoe voyage along the Churchill River (to focus attention on potential problems that damming the Lower Churchill might cause). Her efforts have drawn much public attention; the Innu struggle has been the subject of many articles, a book (Marie Wadden's *Nitassinan*), and a film (the National Film Board's *Hunters and Bombers*).

Source: Memorial University of Newfoundland, 2005 Convocation Program

**Figure 6.6:** The winter walk from Goose Bay to Miniipi Lake.
*Photo courtesy Department of Education*

# PRESERVATION VS. CONSERVATION

There is some confusion about the definition of "conservation"— how you understand it probably depends on your beliefs. Most people agree that "to conserve" means to use something wisely, yet they may also think conserving *forests* means to preserve them or set them aside.

In fact, conservation of wilderness means we can use it, but in a sustainable way—so that it will be there for others to enjoy in the future. Preservation of wilderness, on the other hand, means we will set it aside and *not* use it. Both of these approaches can be appropriate, depending on our goals for a wilderness area.

One of the central controversies that surfaced during the twentieth-century's environmental movement was the disagreement between those who wanted to preserve wilderness and those who supported a managed use of its natural resources (which is sometimes referred to as "managing resources on a sustainable yield basis"). The two approaches have been explained this way: "Conservation is the maintenance of environmental quality and resources or a particular balance among the species present in a given area. The resources may be physical (fossil fuels, for example), biological (such as boreal forests), or cultural (such as ancient monuments). In modern scientific usage, conservation implies sound biosphere management within given social and economic constraints, producing goods and services for humans without depleting natural ecosystem diversity, and acknowledging the naturally dynamic character of biological systems. This contrasts with the preservationist approach which, it is argued, protects species or landscapes without reference to natural change in living systems or to human requirements."

Sources: Jastrzembski, Patrice. Conservation vs Preservation (*http://iaa.umd.edu/mfa/ee18.htm*)

Allaby, Michael. 1994. *The Concise Oxford Dictionary of Ecology* Oxford: Oxford University Press (as quoted at *www.texasep.org/html/lnd/lnd_5pub_cons.html)*

## CHECK your Understanding

1. List the landscape characteristics that make Newfoundland and Labrador an ideal place for outdoor recreation, and a desirable destination for tourists.
2. Briefly summarize early ways of thinking about the Canadian wilderness.

### For Further Discussion and/or Research

3. Authors and filmmakers have written and produced many books and videos that feature the Newfoundland and Labrador wilderness. Choose one to watch or review, and write a short report about what the creator says about the province's wilderness and outdoor activities.

4. Do you have any memorable wilderness experiences, such as fishing with your parents, hunting, hiking, or enjoying good times at the cabin? Write a short paragraph, make a drawing, or put together a photo collage or web page that communicates your experience.

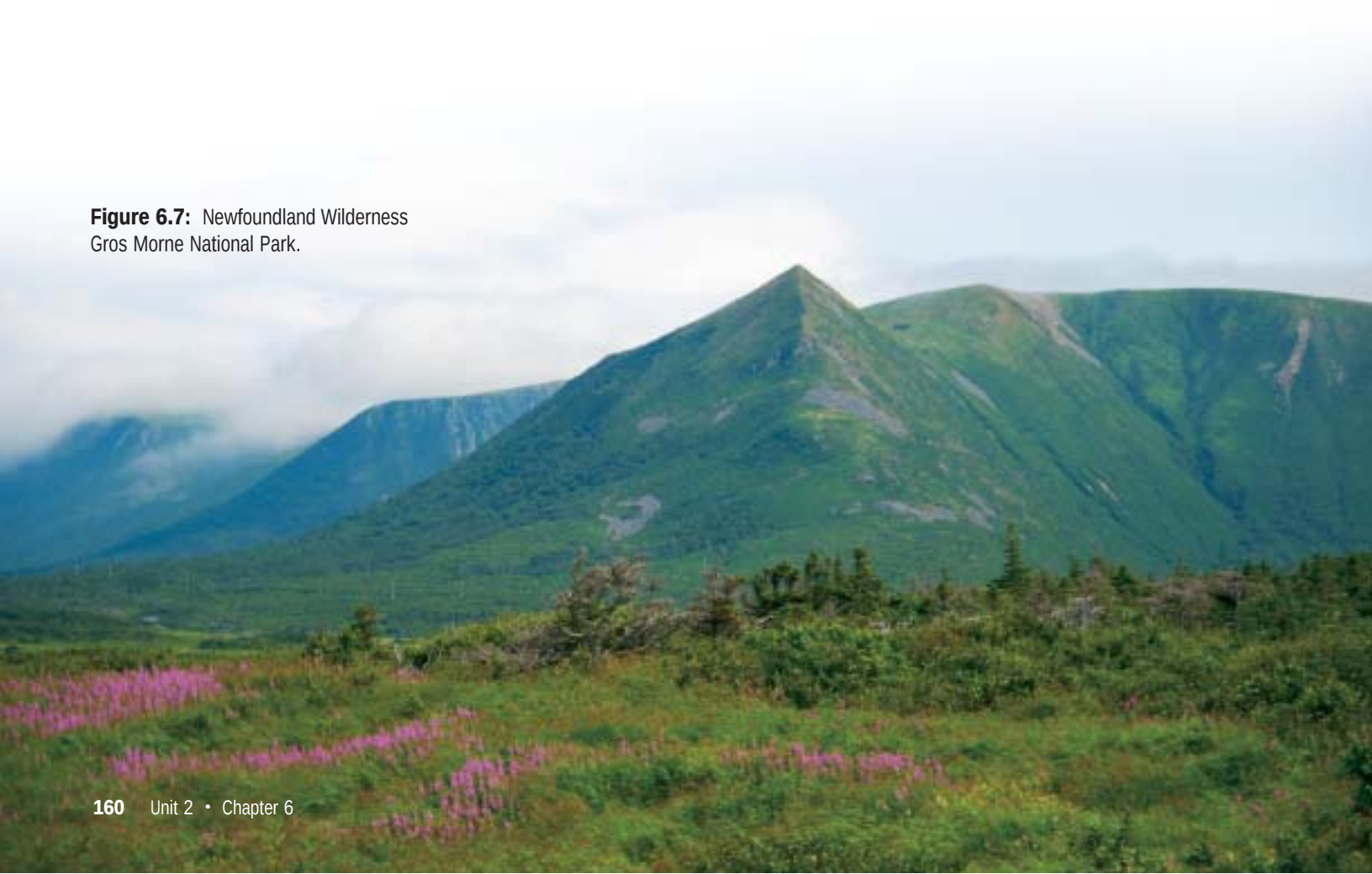


**Figure 6.7:** Newfoundland Wilderness
Gros Morne National Park.

**Figure 6.8:** Saglek Fjord in northern Labrador. *Photo courtesy Parks Canada*

## WHAT IS WILDERNESS?

Many people have attempted to define "wilderness." Some definitions are simple, such as: "a wild and uninhabited area" or "a tract of unproductive land." Others are longer and more complicated. The American *Wilderness Act* of 1964 was the first formal attempt to define and designate land as "wilderness." It defined an area of wilderness as "Undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions, and which generally appears to have been affected primarily by the forces of nature, with the imprint of man's work [human activity] substantially unnoticeable; has outstanding opportunities for solitude or a primitive and unconfined type of recreation; has at least five thousand acres of land or is of sufficient size as to make practical its preservation and use in an unimpaired condition; and may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value."

**Figure 6.9:** Teenager enjoying an evening of fishing.
*Photo courtesy Department of Natural Resources*

How do *you* define wilderness? Is it a special place in the forest near your favourite fishing or swimming hole? A special place to sit and watch moose on an early October morning? Is it a feeling more than a location on the ground?

"Wilderness," for the purposes of this course, means large areas of land without human-built structures, places where the ecosystems are largely unaffected by humans or, when we do travel there, we are visitors who leave a light footprint and do not stay long. Our definition also recognizes that "wilderness" is a human concept that can vary from person to person. The more experienced we are with the outdoors environment, the more we will associate "wildness" with "wilderness." However people define wilderness, it is generally agreed that ensuring the survival of wilderness areas is important for all of us.

Arguments for maintaining wilderness areas include:

- Wilderness provides a refuge for all wildlife, especially species at risk.
- It is a place for solitude and recreation.
- Its naturally functioning systems can serve as a baseline for ecological research.
- It can be used as a living laboratory.
- It is the planet's life-support system, producing oxygen and storing carbon dioxide.
- It is a place to see, feel, smell, and enjoy natural beauty.

## WILDERNESS AND VALUES

People value wilderness in many different ways. Wilderness values can be categorized as "personal" or "commercial." An example of a personal value is fishing in a forest pond; business ventures, such as campgrounds, tourism operations, and outfitting are examples of commercial values. Personal and commercial values associated with wilderness include:

- the enjoyment of the outdoors, reduction of stress, and our increased physical fitness when we engage in traditional and non-traditional activities such as hunting, fishing, snowmobiling, mountain biking, backpacking, riding an ATV, and backcountry skiing
- economic benefits to local communities through jobs, tax revenue, and tourism
- opportunities for families to make links between generations: wilderness provides a setting for parents to teach their children how to hike, camp, identify wildlife, hunt, and fish
- the enrichment of our culture: many noted books, plays, stories, poetry, dance, films, and artwork have themes related to our love of nature and the outdoors

- the stimulation of individual and public interest in the environment, which can increase public involvement in issues such as air and water quality, and protection of endangered species and spaces
- non-recreational benefits such as peace, solitude, and spiritual and inspirational nourishment
- its function as a living laboratory from which we can measure changes in our environment
- support for the right of all living things to exist

This is just a partial list. What values would you add to it?

Preserving wilderness is not seen as important everywhere in the world. For some people, the idea of setting land aside has little value. This is often the case in developing countries, where supporting basic human needs—food, water, and energy—overshadows the importance of preserving landscapes and biodiversity.

Even here at home, the wilderness and how we see and manage it are changing. How do you think Newfoundlanders and Labradorians will value wilderness in the future?

**Figure 6.10:** Sigurd F. Olsen was one of the first to write on the value of wilderness.
*Photo courtesy of the Olson family*

### Sigurd Olson's Wilderness Values

American author and conservationist Sigurd F. Olson (1899–1982) wrote about the values he experienced through wilderness recreation. Of the "solitude, silence and freedom of wilderness" he said: "I see more clearly those values and influences that over the long centuries have molded us as a race. One senses anew his relationship to the Earth and all life. The inner world has to do with the wilderness from which we came, timelessness, cosmic rhythms, and the deep feelings men have for an unchanged environment."

His writings identify some important qualities found in wilderness:

| | | |
|---|---|---|
| solitude | renewal | mystery |
| freedom | space | pristine and unexplored nature |
| wildness | silence | vastness |
| adventure | timelessness | |

## CHECK your Understanding

1. List five values of wilderness.

2. Some people have said "there is no such thing as true wilderness." What is your view of "true" wilderness?

3. Can wilderness be preserved by setting land aside in parks?

For Further Discussion and/or Research

4. Investigate how Aboriginal cultures used the Newfoundland and Labrador wilderness before the first Europeans arrived.

5. Rural and urban residents may have different definitions of wilderness. Ask members of your family and neighbours for their definitions of wilderness. Share and compare your results with students at a school in a different type of location than your own (rural or urban).

6. Place yourself in the shoes of someone living in an area where logging is one of the best job opportunities available. How would you respond to an agency that was interested in establishing a new protected wilderness area where the best timber is located? Is it possible to satisfy the needs and wants of both groups? Explain your answer.

7. Through research, collect definitions of "wilderness" from around the world. Through analysis, identify common themes in the definitions.

## USING WILDERNESS FOR PLEASURE AND RECREATION

For more than eight thousand years, the Aboriginal peoples and the pioneer settlers of Newfoundland and Labrador depended on the resources of the land (and the sea) for their survival. Today, many Newfoundlanders and Labradorians still use the land for partial subsistence, and many others use it for outdoor recreation. People think of the wilderness areas here as "ours to enjoy and protect."

Compared to some Canadians, Newfoundlanders and Labradorians have relatively easy access to wilderness. Wild areas are often just a few steps beyond the back door or less than an hour's drive away. The diversity of geography and climate offers opportunities for many types of outdoor recreation. Traditional activities—such as hunting, trapping, fishing, camping, and cutting firewood—have always been popular here. In recent years, skiing, birdwatching, snowmobiling, hiking, canoeing, and sea kayaking have also gained wide popularity.

These types of outdoor recreational activities depend on access to wilderness and pristine environments. Many stresses—including outdoor recreation itself—have

the potential to affect the quality of the natural environment, however. How well we protect our wilderness areas from these stresses will determine our ability to continue to use them for outdoor recreation in the future.

## Participation in Outdoor Activities

In 1999, the Federal-Provincial-Territorial Task Force on the Importance of Nature to Canadians reported that in 1996 twenty million Canadians (84.6 per cent of the population aged fifteen years and over) took part in one or more nature-related activities. In total they spent 1.5 billion days of their time on these activities, and Canadians spent $11 billion on nature-related activities in the country. This amount included $6 billion for trip-related items including transportation, accommodation, and food, $3.1 billion for special equipment, and $1.8 billion for other items needed to pursue nature-related activities.

The same report reflected some of the ways that the natural environment improves the daily lives of Newfoundland and Labrador residents. In 1996, an estimated 373,000 Newfoundland and Labrador residents (82.7 per cent of the population aged fifteen years and over) participated in a wide range of nature-related activities, including swimming, sightseeing, camping, hiking, hunting, fishing, and berry picking. An estimated 206,000 residents participated in outdoor activities in natural areas. Wildlife viewing attracted 78,000 participants, fishing 138,000, and hunting 68,000. The total amount of expenditures associated with these outdoor activities was almost $200 million.

**Figure 6.11:** Participation in Outdoor Activities in Newfoundland and Labrador, 1996.

| | Outdoor Activities in Natural Areas | Wildlife Viewing | Recreational Fishing | Hunting |
|---|---|---|---|---|
| Total Number of Participants | 206,000 | 78,000 | 138,000 | 68,000 |
| Participation Rate | 45.6% | 17.3% | 30.6% | 15.1% |
| **Days** | | | | |
| Total Days | 3,939,000 | 1,584,000 | 3,000,000 | 2,000,000 |
| Average Days per Participant | 19.1 | 20.3 | 24.2 | 23.1 |
| **Trips** | | | | |
| Total Trips | 3,567,000 | 1,263,000 | 3,000,000 | 1,000,000 |
| Average Trips per Participant | 17.3 | 16.2 | 19.6 | 19.3 |

Grand Totals: 373,000 participants • 31.7 million days • 6.2 million trips

Source: Federal-Provincial-Territorial Task Force on the Importance of Nature to Canadians. (1999)

**Figure 6.12:** Sea kayakers explore the coastline.
*Photo courtesy Parks Canada / Barrett and Mackay*

Outdoor activities can be divided into two categories: consumptive and non-consumptive. Hunting, fishing, berry picking, and cutting firewood are consumptive activities because they extract resources from the environment. Non-consumptive activities do not take anything from the environment. Examples of non-consumptive activities include photography, hiking, and sea kayaking.

Consumptive and non-consumptive activities are equally important to outdoor life Newfoundland and Labrador, and participants in both share a love of the outdoors and natural environments.

MINI-LAB ACTIVITY

## Local Participation Rates in Outdoor Activities

### Background

In this activity you will survey a segment of the population in your community to find out levels of participation in nature-related activities, and compare your results with both Canadian averages and results collected by students in another Newfoundland and Labrador location.

### Purpose

To survey your community to determine the extent of nature-related activities.

### Procedure

With the help of your teacher and the following guidelines, design and distribute a questionnaire that will measure the participation in nature-related activities in your community.

1. Use simple yes/no questions and keep the questionnaire brief.
    - Design the first questions to collect demographic information about your survey group (the age, sex, employment status, etc., of respondents).
    - Choose a focus for your main question(s).
    - Develop your questions so you will be able to compare your results with those of Canadians in 1996 (See Figure 6.13).
    - You should include a question that will determine the frequency that respondents engage in outdoor activities.
2. Determine the population group(s) you wish to sample. (Remember that your choices here can influence the results of your survey.) Sample groups could be students and/or adults.
3. Determine the sample size. A sample size of 30 will generally yield excellent results if the sample is chosen randomly. A smaller sample will still give you a good idea of people's activities. Your teacher will help you determine the optimum sample size.
4. Choose your sample group (draw names, use a phone book, etc.).
5. Remember the following as you conduct your survey:
    1. Be polite and courteous.
    2. Explain who you are and why you are conducting the survey.
    3. Do not force the issue if someone does not wish to participate. Just move on to another person.

## Analyze and Conclude

1. When analyzing the results of the survey, focus on the responses of the entire sample group first, then look at the relationships to age, sex, etc. If you are familiar with statistics, apply what you have learned to the data you have collected.
2. Use a spreadsheet to tabulate data; then produce graphs and tables.
3. Discuss such questions as:
   - What do the survey results show?
   - Did the survey answer the question(s) you designed it to answer?
   - Do you have other questions as a result of conducting this survey?
   - How do your community's outdoor-activity participation rates compare to the rest of Canada (see the table below).
4. Contact another school (rural if you're urban, urban if you're rural) and exchange and compare results.

| Activity | National Rate % |
|---|---|
| Relaxing in an outdoor setting | 32.4 |
| Sightseeing in natural areas | 31.1 |
| Picnicking | 26.0 |
| Swimming/beach activity | 23.7 |
| Camping | 18.8 |
| Hiking/backpacking | 18.5 |
| Photographing in natural areas | 15.9 |
| Gathering nuts, berries, firewood | 11.0 |
| Hunting | 10.6 |
| Canoeing/kayaking/sailing | 9.9 |
| Fishing | 9.8 |
| Power boating | 9.3 |
| Cycling in natural areas | 8.6 |
| Downhill skiing | 4.7 |
| Rock climbing | 4.3 |
| Cross-country skiing/snowshoeing | 3.5 |
| Off-road vehicle use | 3.4 |
| Snowmobiling | 2.5 |
| Horseback riding | 1.6 |

### Becoming an Outdoors-woman

Women of Newfoundland and Labrador have a unique opportunity to learn about outdoor recreational opportunities through the "Becoming an Outdoors-Woman" workshop, which is offered annually at selected sites across the province. The program is designed to give women an opportunity to learn or improve the skills they need to participate in fishing, hunting, and other forms of outdoor recreation. It teaches skills needed for canoeing, kayaking, using rifles and shotguns, archery, outdoor survival, using a map and compass, birding, and fishing, and also discusses spirituality and nature.

Source: Department of Environment and Conservation

**Figure 6.13:**
Participation Rates in Nature-Related Recreational Activities (All of Canada, 1996).

Source: Federal-Provincial-Territorial Task Force on the Importance of Nature to Canadians (1999)

## Managing Outdoor Recreational Activities

Outdoor recreational activities have an impact on our environment and add to the economy, just as larger-scale industrial activities such as logging, hydroelectric development, and mining do. As discussed earlier, outdoor recreational activities are important to people living in Newfoundland and Labrador, providing personal enjoyment, connecting us to our culture and natural landscapes, and generating income. Depending on the type of activity and the number of and types of participants, however, they can also have a considerable impact on the environment. In addition, conflicts can arise among people who wish to use a wilderness area for different types of recreational—or commercial—activities. Conflicting values and uses make managing outdoor recreational activities very complex.

Managing recreational activities involves both scientifically assessing direct environmental impacts and gauging the values of both the participants and the people affected by the activity. Conflicts can arise among various groups of people ("stakeholders"). Managing recreational activities includes the challenge of balancing such values as:

- development and/or access / preservation
- increased activity / possibilities for solitude
- commercial use / personal use
- motorized access/ non-motorized access
- consumptive activities/ non-consumptive activities

Assessing and managing the issues requires an unbiased approach. To help you see all sides of the issues, consider the range of values involved, and suggest solutions that could satisfy both environmental concerns and those of a variety of stakeholders, you'll need to ask certain several questions:

1. What are the effects of this activity on the environment?

To what extent could the activity (and related infrastructure and facilities) affect key ecosystems?

- Consider the level and intensity of wilderness use, the type of access the activity requires (motorized or non-motorized), the extent of infrastructure needed, associated facilities, emerging trends, associated technology and pollution, impact on species at risk, any addition to the human footprint, etc.
- Is there potential for adverse cumulative effects? (Example: More hikers using a trail increases the loss of vegetation).
- What action could minimize or mitigate potential adverse impacts? (Example: The use of cleaner-running engines in snowmobiles may minimize the air pollution they cause.)
- Could the proposed activity damage or destroy valued natural resources in ways that cannot be mitigated?

**Figure 6.14:** Marram Grass along Newman Sound. *Photo courtesy Parks Canada*

## Ecological Integrity: National Parks Preserving Wilderness

Canada's national parks protect examples of our natural landscape. To many people this implies that parks protect wilderness. Because the perception of "wilderness" varies from person to person, from generation to generation, and culture to culture, it is impossible to manage a national park to match the whole range of ideas about what should be protected. Instead, Parks Canada manages national parks based on ensuring "ecological integrity."

According to the *Canada National Parks Act*—the law governing national parks in Canada—"ecological integrity" means, with respect to a park, "… a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes."

In plain language, ecosystems are considered to have integrity when their native natural components are intact, including: abiotic components (physical elements such as water and rocks), biodiversity (the composition and abundance of species and communities in an ecosystem—tundra, rainforest, and grasslands would represent landscape diversity; the presence of black bears, brook trout, and black spruce could represent species diversity), and ecosystem processes (the engines that makes an ecosystem work, such as fire, flooding, and predation).

Source: Parks Canada

- Can the proposed activity be managed so that it does not adversely affect the environment, unique natural features, or plants and animals?
- Do we know enough about how this activity affects the environment to assess sustainability?

2. What is the scale of the activity?

Will many people be participating in it? To assess how much effect each participant has on the environment, determine:

- Do trend data indicate a long-term demand for this activity? How many people will likely participate in the future?
- Is the activity restricted to personal use or is there also a commercial market?

3. Will allowing the activity cause conflict?

- Does this activity adversely affect the experience that other people are seeking? (Example: Do the dust and noise caused by ATV use interfere with hikers sharing the same trail?)

4. Will the activity evoke stewardship behaviour and valuing of the environment?

- Does participating in the activity help to create a "sense of place" in people and encourage their stewardship of the environment?
- Does the activity provide people with opportunities to experience the uniqueness of the environment, or to experience the outdoors in a unique way?

5. What are the benefits of allowing this activity?

- Does the activity offer cultural benefits to local communities?
- Does the activity contribute to the regional economy in a long-term, sustainable way?
- Are there environmental or social benefits for local communities associated with this activity?
- Would the activity be considered acceptable in the context of local culture?

These are the types of questions you should ask to evaluate the impact of a recreational activity on both the environment and on the people who live in it. Can you suggest other questions that will help you fully evaluate the impact of an outdoor recreational activity?

**Figure 6.15:** A whale surfaces off the east coast of Newfoundland.
*Photo courtesy O'Briens Whale and Boat Tour*

## TOURISM AND THE ENVIRONMENT

Tourism is the practice of travelling for pleasure. Providing tours and tourism services has a tremendous economic impact both locally and globally. In fact, tourism is among the world's fastest-growing and largest industries. The World Tourism Organization estimates that there were more than 898 million international travellers globally in 2007. Spending by these tourists was estimated at more than $733 billion (CAN). Globally, tourist travel is predicted to grow by an average 4.1% a year over the next two decades. It is expected that there will be a total of 1.0 billion international travellers by 2010, and 1.6 billion by 2020. Tourism is the world's largest employer, generating—directly and indirectly—nearly 200 million jobs (ten per cent of all jobs).

Tourism is a growing industry in Newfoundland and Labrador—it increased by thirty-seven per cent from 2001 to 2006, for example—and the province has great potential for further tourism development. Our unique cultures, diversity of landscapes, wilderness areas—and Labrador's remoteness—offer many opportunities for the development of the sector. Access to clean, undisturbed environments and respect for our culture must be maintained, however, if we are to take advantage of them.

At the same time, concern is growing that increased tourism could cause serious environmental and cultural damage. This is because the presence of visitors also increases the amount of:

- garbage
- sewage
- development
- traffic and wear on trails and country roads (more people, more weight)
- fuel consumption
- wildlife harvesting

The loss of biodiversity, the overuse of land and resources, and the increased demands on vegetation, on wildlife, on mountain, marine, and coastal environments, and on water resources can all degrade what attracted tourists to the province in the first place.

**Figure 6.16:** Tourists enjoying an up close view of an iceberg near Witless Bay.
*Photo courtesy Department of Environment and Conservation/Holly Hogan*

## Did You Know?

Some people argue that "ecotourism" is an oxymoron: tourists who are supposedly sensitive to environmental concerns travel to ecotourism destinations on jet planes that contribute significantly to the climate change.

## SUSTAINABLE TOURISM

When developed responsibly, tourism can benefit both the economy and the environment. This is called "sustainable tourism." Sustainable tourism is responsible tourism—it is both ecologically and culturally sensitive. It aims to have a low impact on the environment and local culture, while helping to generate income and employment.

Sustainable tourism attempts to make the best use of environmental resources while also preserving local ecosystems, maintaining essential ecological processes, and helping to preserve natural resources and biodiversity. It respects the socio-cultural authenticity of host communities, helps preserves their built and living cultural heritage and traditional values, and contributes to inter-cultural understanding and tolerance. And, finally, sustainable tourism ensures viable, long-term economic operations such as stable employment, income-earning opportunities, and social services, which provide socio-economic benefits to all stakeholders.

Sustainable tourism is a valuable approach to both conservation and tourism because it:

- gives protected areas an economic value
- generates direct income for the conservation of protected areas
- generates direct and indirect income for local people, which also creates incentives for conservation locally and internationally
- promotes sustainable use of natural resources
- promotes wise and responsible use (conservation) of natural areas
- reduces threats to biodiversity by increasing the importance of plants and wildlife as a tourism draw

## Did You Know?

Some ecotourism activities that may seem harmless actually can affect wildlife negatively. For example, repeated sea kayaking trips into remote bays and coves may inadvertently cause chronic disturbance of species. The planned expansion of La Route bleue de la Gaspésie in Québec, for example, will allow boaters alongside a known harlequin duck staging and moulting area.

### Ecotourism

**Figure 6.17:** Newfoundland and Labrador has a growing ecotourism sector.
*Photo courtesy Department of Environment and Conservation/Holly Hogan*

One branch of sustainable tourism is ecotourism. The International Ecotourism Society defines ecotourism as responsible travel to natural areas (where plants, animals, and cultural heritage are the primary attractions) that conserves the environment and improves the welfare of local people.

Ecotourism is travel that is linked to a region's biodiversity, landscape, and culture. The World Tourism Organization expects that by 2010 there will be seventy million ecotourist visits globally. Most ecotourists are expected to visit national parks and protected areas.

In 2002, more than a thousand participants from 132 countries attended the World Ecotourism Summit in Quebec City. The main outcome of the Summit was

the "Québec Declaration on Ecotourism," which states that ecotourism can be distinguished from the larger category of sustainable tourism because it:

- contributes actively to the conservation of natural and cultural heritage
- includes local and indigenous communities in its planning, development, and operation, and contributes to their well-being
- interprets the natural and cultural heritage of the destination to visitors
- lends itself better to independent travellers, as well as to organized tours for small groups

The Declaration outlined forty-nine general guidelines for the sustainable development of ecotourism. These guidelines will set the direction of ecotourism for the future and, if followed, will ensure that the effects of ecotourism on the environment and on culture are kept to a minimum.

Because tourism is a significant contributor to Newfoundland and Labrador's economy, it is important to protect the quality of the tourism product on offer, and enrich and improve sustainable tourism opportunities. The Gros Morne Institute for Sustainable Tourism was established to provide developmental training programs to enhance the quality and sustainability of tourism practices and services in the area of Gros Morne National Park.

Gros Morne Institute for Sustainable Tourism (GMIST)


The Gros Morne Institute for Sustainable Tourism (or GMIST) was established in 2004. It is a partnership effort of Hospitality Newfoundland and Labrador, the Atlantic Canada Opportunities Agency, Tourism Atlantic, the Canadian Tourism Commission, and Parks Canada. The objective of GMIST is to enhance the quality and sustainability of the outdoor and nature-based tourism experiences offered throughout Atlantic Canada by providing training programs for people who provide sustainable tourism practices, experiential tourism services, and eco-adventure tourism.

Source: Gros Morne Institute for Sustainable Tourism

Principles of Sustainable Tourism

- Reduce negative impacts on nature and culture
- Educate travellers about the importance of conservation
- Bring direct revenue to the conservation and management of natural and protected areas
- Emphasize the use of environmental and social baseline studies, as well as long-term monitoring programs, to assess and reduce impact of tourism activities
- Maximize economic benefit for citizens of the host country, particularly those living in and next to natural protected areas
- Ensure that tourism development does not exceed environmental limits
- Rely on buildings that are developed in harmony with the environment, and that minimize the use of fossil fuels, conserve local plants and wildlife, and blend with the natural and cultural environment

Source: Department of Environment and Conservation

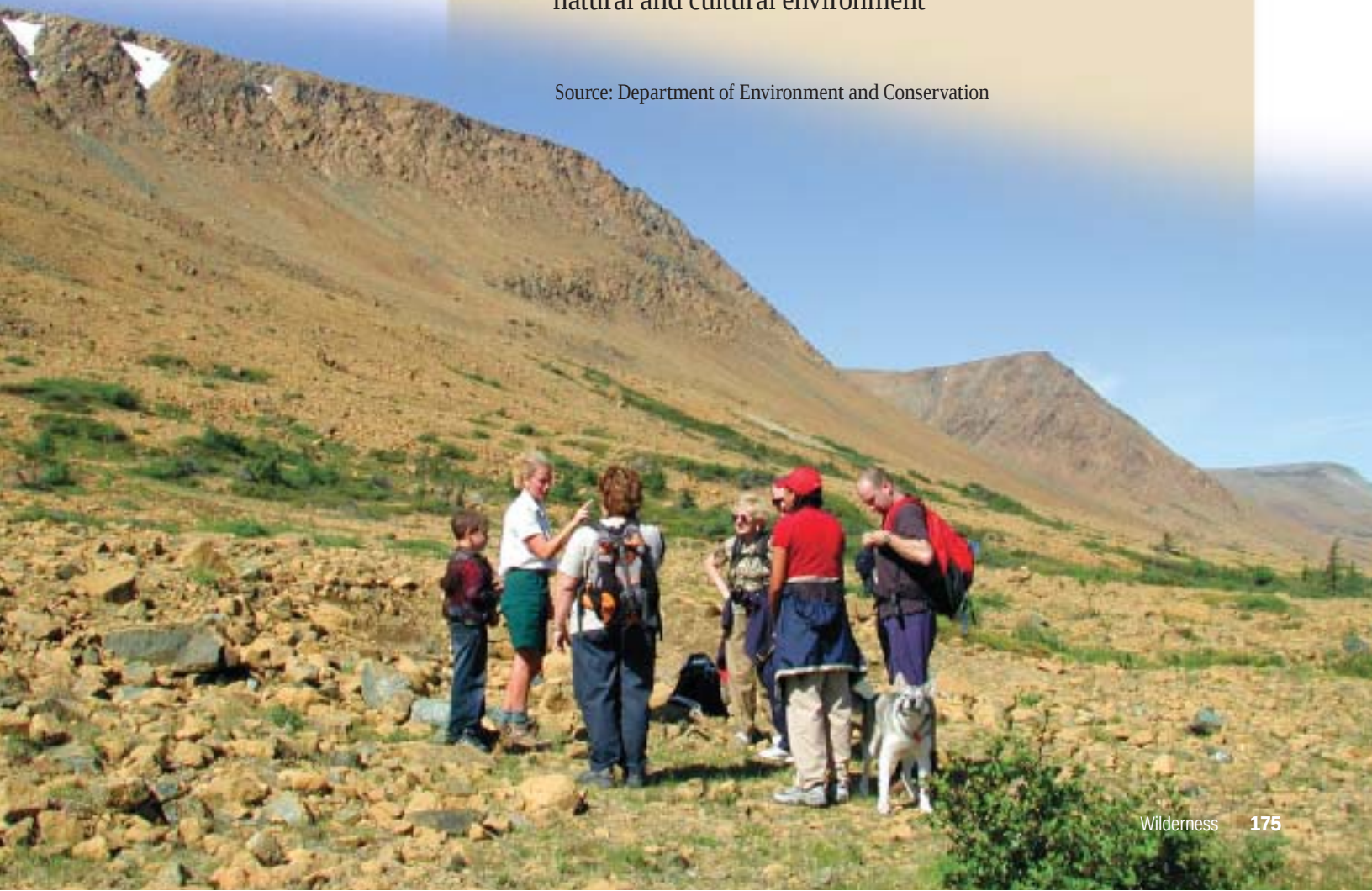


**Figure 6.18:** Visitors to Gros Morne National Park participate in an interpretation session on the Tablelands.
*Photo courtesy Parks Canada*

## ENVIRO-FOCUS

### Monitoring the Effects of Ecotourism at the Witless Bay Ecological Reserve

The Witless Bay Seabird Ecological Reserve, southeast of St. John's, protects significant breeding habitat for several seabird species.

**Figure 6.19:** A tour boat, with its engines disengaged, is approached by a humpback whale. Regulations in the Witless Bay Ecological Reserve prohibit boats from "harassing" whales by following them, but they are free to stop and watch when the giant mammals approach them. *Photo courtesy Department of Environment and Conservation/ Holly Hogan*

The islands host the largest Atlantic puffin colony in North America (with more than 260,000 pairs) and the second largest Leach's storm-petrel colony in the world (more than 600,000 pairs), for example. Three of the Witless Bay islands were included when the original bird sanctuary was created in 1964. In 1983, this protection was extended to include a fourth island and designation as an ecological reserve under the province's Wilderness and Ecological Reserves Act.

As with other seabird reserves in the province, human activity is restricted on the islands-the best way for people to view the birds is by water. The first tour-boat operations (a single vessel) started up in 1984. Today, the Parks and Natural Areas Division issues up to ten tour-boat permits , and the area has become one of eastern Newfoundland's most popular ecotourism destinations. To protect the birds from disturbance, tour-boat activity in the reserve's marine areas is restricted to only these licenced tour-boat operators.

**Figure 6.20:** The Atlantic Puffin is one of the most popular and well-known seabirds in Canada.

The "Tour Boat Operator's Licence Policy" provides for the protection and safety of seabirds, whales, and also visitors. It sets the limit on the number and size of tour boats. Seabird behaviour and populations are monitored in collaboration with Memorial University and the Canadian Wildlife Service to ensure that the tour-boat activities do not pose a risk to seabird populations. The birds' status and population trends also guide occasional revisions of the Licence Policy. In addition, a Parks and Natural Areas reserve manager works to ensure that seabird populations are healthy, and that policy and regulations are followed-and work.

Surveys indicate that most of the islands' seabird populations are currently stable or increasing (largely due to a change in fishing activities in the area, which has reduced bird mortality in fishing nets). This status bodes well for sustainable ecotourism in the area, and also spin-off activities such as shops and restaurants, which make an important contribution to the local economy.

## CHECK your Understanding

1. Define ecotourism and give two examples of companies and/or schools offering ecotourism opportunities and education programs in Newfoundland and Labrador.
2. List the principles of ecotourism that relate to the environment.
3. Explain how the loss of biodiversity in a region might affect ecotourism.

### For Further Discussion and/or Research

4. Invite a representative from a company that offers an ecotourism product, such as sea kayaking or backpacking trips, to visit your class. Ask her or him to speak about how the company incorporates conservation education into its program, and the steps it takes to reduce visitor impact on the environment.
5. The Québec Declaration on Ecotourism is available on the Internet. Review the Declaration and briefly outline the recommendations that relate to the environment.
6. Through research on the Internet, find a company that offers an ecotourism product in a developing country. What is its product? What components of the natural environment does its product depend on? Email the company, explain that you are high school student doing an environmental science course, and ask them if they would share some information about the steps the company takes to reduce the environmental impact of its activities and to ensure that residents benefit from its activities, as well.

### Evaluating the Impact of Recreational Activities on a National Park

Canada's national parks are areas set aside to protect and present nationally significant examples of the country's natural heritage. They provide opportunities to foster public understanding, appreciation, and enjoyment of nature. These opportunities usually involve outdoor recreation of some kind: hiking, sightseeing, mountain biking, snowmobiling, or camping. No matter what the activity, it must not affect the national park's ecological integrity.

Assessing a recreational activity's impact is the first step in managing its effect on the environment and understanding how it affects a visitor's experience in the park. Take, for example, the impact of hikers on the plants and wildlife of Gros Morne Mountain (described in Unit One)—an activity that is closely managed because of the potential effects on the environment.

**Figure 6.21:** Western Brook Pond, Gros Morne National Park.
*Photo courtesy Wikipedia.org*

MINI-LAB ACTIVITY

Activity:
Read the *Gros Morne Mountain Trail Guide* and review the following:

Recreational Activities Assessment Framework for National Parks

1. Sustain or enhance the character of the place
    - The activity is consistent with Canadians' aspirations for our country's system of national heritage places, and with the vision for the place expressed in the park's management plan. The activity evokes inspiration and emotion that results in enhanced value of, and respect for, the place.

2. Respect natural and cultural resources
    - Visitors who participate in the activity can do so in ways that respect natural and cultural resources. Activities that have an unacceptable impact will not be supported. Parks Canada will maintain a program of monitoring, adaptive management, and ongoing dialogue with visitors, stakeholders, and partners.

3. Facilitate opportunities for outstanding visitor experiences
    - The activity provides opportunities for outstanding visitor experiences. It responds to the needs and interests of identified audiences and may provide visitors with a sense of personal growth and accomplishment. Parks Canada will facilitate opportunities for visitors to have unique, safe, stimulating, and memorable experiences.

4. Promote public understanding and appreciation
    - Participation in the activity provides opportunities to enrich understanding and appreciation of the place. Participation in the activity may foster support of and involvement in the stewardship of national parks, national historic sites, and national marine conservation areas.

5. Value and involve local communities
    - Management of the activity creates opportunities for shared leadership with and the active involvement of the local community while respecting the rights and values of Aboriginal peoples and the interests and values of stakeholders.

## Analyze and Conclude

1. Identify steps that the national park is taking to protect the environment of Gros Morne Mountain and the experience visitors have when they hike the trail.
2. What impact might these management measures have on the local tourism industry?
3. Do you agree with the management measures taken to protect this environment? Can you identify additional ways this environment could be protected?
4. Imagine that the number of hikers on Gros Morne Mountain increases from 6,000 to 60,000. Do you think additional management measures would need to be put in place to protect this environment and its wildlife? What would these measures be? Would they change the visitor experience and affect opportunities for enjoyment, understanding, and appreciation of the natural environment?
5. Research other recreational activities in a national park. Identify how these are managed to protect the national park's ecological integrity while providing opportunities for enjoyment, understanding, and appreciation of the natural environment.
6. If there is a walking trail in your community, design a brochure that could be distributed to hikers at the trailhead.

# Chapter 7: Wilderness Access

## INTRODUCTION

**Figure 7.1:** Snowmobiling in the Long Range Mountains. *Photo courtesy Parks Canada/Sheldon Stone*

### Did You Know?

Trail bikes, quads, four-wheel buggies, and snowmobiles are all technically ATVs, but in Newfoundland and Labrador the term "ATV" is associated mainly with four-wheelers (quads).

Historically, human access to wilderness areas in Newfoundland and Labrador had little impact on the environment. Before and after the arrival of Europeans, Aboriginal people, who were relatively few in number, travelled extensively inland and along the coasts, leaving little trace of their presence. The first settlers were people of the sea; they rarely travelled more than a few kilometres inland except to cut timber or firewood, or occasionally to hunt caribou.

It has been only over the last century or so that extensive travel in, and use of, the interior of Newfoundland and Labrador has occurred. Evidence of the trails used for this access is visible near many rural (and resettled) communities. Some traditional routes are still used by those who hike, snowmobile, and drive ATVs. Today people also have access to the province's wilderness using developed trails, abandoned rail beds, transmission lines, and access roads created for timber harvesting, mining, and hydro development, as well as rivers and lakes. Strong legs or an ATV, snowmobile, canoe, boat, or aircraft are the primary methods of transportation.

Almost all of Newfoundland and Labrador is "crown land" (approximately ninety-six per cent, the highest percentage of any province in Canada). Because crown land is owned by the Province, there are few legal restrictions to public access. More than

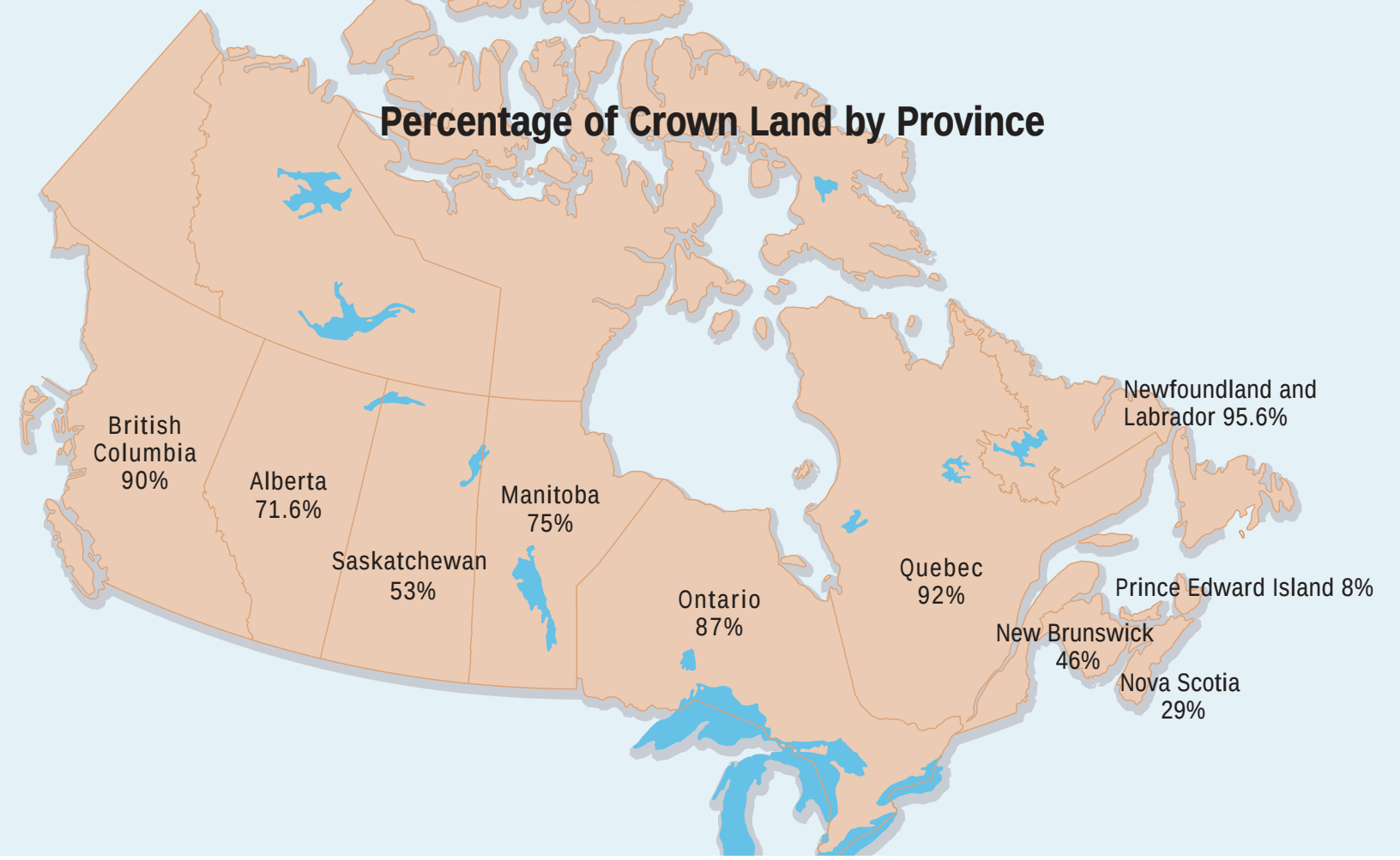



**Figure 7.2:** Percentage of Crown Land by Province. *Illustration by Vivid Communications*

proximity to wilderness and legal access—the wilderness here truly is available for all to enjoy.

## Did You Know?

Gros Morne Mountain is closed to hikers each spring to reduce disturbance of ptarmigan and Arctic hare during their breeding season (when they are most vulnerable). This is an example of a management practice developed to reduce potential negative impacts of a hiking trail.

But if we are to enjoy the wilderness in the future, wilderness access and "outdoor rights" must go hand-in-hand with responsibility. Participants in outdoor recreational activities who expect high environmental quality, clean air and water, and pristine landscape, must also promote these same standards through their own actions. Over time, the improper use of ATVs, dirt bikes, and snowmobiles, disregard for plants and wildlife, illegal harvesting of wild game and edible plants, littering, and improper disposal of human waste can degrade the places outdoor enthusiasts enjoy. Many problems can be dealt with through public awareness and education, by adopting environmentally friendly technologies and good management practices and, of course, by applying common sense.

Hunters, trappers, fisherpersons, backpackers, canoeists, and ATV users all value the outdoor experience, but each group accesses and uses the outdoors in different ways and for different reasons. It is important that each of these groups respects the values of the others. With mutual respect, everyone can continue to enjoy the outdoors.

## WILDERNESS ACCESS: THEN AND NOW

Newfoundland and Labrador's early settlers were fisherpersons who did not travel far inland, but the completion of the trans-Newfoundland railway in 1898 changed that, opening up the interior of the island portion of the province. Today, that access has been expanded in two key ways:

- Roads that serve the needs of forestry, mining, and hydro development are also used by the public for recreational activities, and they increase access to new wilderness areas.

- Snowmobiles, ATVs, and ultralight aircraft enable safe and easy access without the need for either roads or abandoned rail beds.

The following sections describe how access to the interior increased over the last century, and some of the effects that change had on the wilderness.

### The Newfoundland Railway

**Figure 7.3:** Freight train leaving Corner Brook.
*A.R. Penny Collection, Courtesy Robert Cuff/Fabian Kennedy*

The first regular "express" train departed from St. John's in June of 1898 on a 548-mile journey to Port aux Basques. Comprising two baggage cars, two coaches, two sleepers, and a single dining car, it arrived twenty-seven and a half hours later in Port-aux-Basques.

Not only did the new railway provide access to the forest and mineral resources of the interior, it also provided people with easy access to new ponds and streams for fishing, new territory for big game hunting, and new sites for building cabins.

• The Trouter's Special

The first recreational opportunity that citizens of St. John's and nearby communities took advantage of after the railway opened was the chance to try their luck in the streams and ponds that dotted the interior of the Avalon Peninsula. For years, the "Trouter's Special" left St. John's in the early morning of the May 24 weekend, heading for Argentia. The train would be packed with excited anglers who were loaded down with knapsacks and a "bamboo." It dropped them off along the route for a day or two of trouting, and picked them up on the return trip. This tradition continued until the railway closed in 1989.

**Figure 7.4:**
The Trouter's Special.
*Courtesy Lloyd Pretty*

• The Impact on Caribou

By opening the interior and allowing hunters greater access to caribou herds, the railway may have affected caribou populations on the Island. By 1930, caribou numbered no more than two thousand animals—a population decline that is often attributed to increased access coinciding with natural population cycles. Hunting was stopped in 1924 and reopened in 1936.

**Figure 7.5:** Herd of Woodland Caribou on the Buchans Plateau. *Photo courtesy Fred Thorne, Red Indian Lake Outfitting & Tours*

• Fire

In their day, steam locomotives had a notorious reputation for starting forest fires. Hot brake pads or cinders from coal-burning engines were responsible for an astoundingly high number of fires along Newfoundland's railway lines. Between 1892 and 1899, forest fires burned along railway routes on the isthmus of the Avalon Peninsula, at Placentia Junction, and between Brigus and Shoal Harbour. During this period, one Newfoundland Woods Ranger counted sixty-three fires in a 12-kilometre stretch of railway track. Repeated "cool" fires, started by steam locomotives, permanently changed the landscape along the railway line. Many originally forested areas never grew back.

**Figure 7.6:** Steam locomotives were often the cause of forest fires that destroyed large forested areas.

• Cabins

The first cabins in the interior of Newfoundland were built along the railway line. Regular scheduled service provided cabin owners with easy access. The Gaff Topsails, east of Howley, was a particularly popular area; more than fifty cabins are still there today.

There were no environmental guidelines for building these early cabins. An outhouse was a common outbuilding, and garbage was disposed of outdoors, only a short distance from the camp. Today, prospective cabin builders must follow protocols for septic tank installation, buffers around water bodies, and proper garbage disposal.

• Access Roads

Forestry, mining, and hydro development all require access roads.

**Figure 7.7:** A forestry truck hauling logs. *Photo courtesy Department of Natural Resources*

Forestry access roads are the most numerous type of resource roads in the province. They are found across the Island and in parts of Labrador. By 1999, the provincial government had constructed more than 2,430 kilometres of forest access roads. Today, Corner Brook Pulp and Paper constructs more than 100 kilometres of main forest access roads and an additional 100 kilometres of operational roads every year.

In addition, the Crown Lands Department constructs 100 kilometres of access roads a year, and 50 kilometres are built by private contractors and cabin developers. In all, approximately 500 kilometres of new roads appear in the province annually.

**Figure 7.8:** Recreational ATV use is a common pastime in Newfoundland and Labrador. *Photo courtesy Department of Government Services*

While the main purpose of these roads is to provide access for economic activities, they are open to the public, who use them all seasons of the year for a variety of recreational activities. Hunting, berry picking, trapping, cross-country skiing, fishing, hiking, ATV use, snowmobiling, and boating are all enhanced by access roads. They also provide easy access for domestic activities such as cutting firewood. Access roads both benefit employment and tourism, and contribute to the loss of wilderness.

## Access Roads and the Environment

Building access roads can affect the environment in several ways, including:

- altering natural runoff patterns
- fragmenting habitat and causing other habitat alterations
- silting nearby streams (through erosion caused by poor road and culvert construction), which can affect both fish and invertebrate populations and also water quality

**Figure 7.9:** Access roads open up large expanses of wilderness to recreational activities. *Photo courtesy of Department of Natural Resources*

The possible effects of access roads on aquatic life are harmful enough that the federal *Fisheries Act* covers prevention of habitat destruction and disturbance by siltation during road development. In addition, forest soils can be changed in at least two ways by access roads: through compaction or through removal (for fill).

The effects of access roads on wildlife include:

- disturbing natural population cycles, by opening areas to hunting, fishing, and recreation
- blocking migration routes for some species (such as caribou)
- altering food supplies

Some wildlife species, such as caribou, will walk on—and sometimes refuse to leave—access roads; they can be pushed by traffic to the point of exhaustion. Some native plant species can disappear because of habitat disturbance, and non-native plant species, such as coltsfoot, may appear along edges the roads.

Access roads lead to forest harvesting and other habitat-altering activities, which often break up the continuity of the habitat. Such habitat fragmentation can affect a range of wildlife species. For example, the Newfoundland marten prefers mature to old-growth forest as its prime habitat. Young Newfoundland marten must seek new territory; habitat fragmentation caused by clear-cutting can prevent them from moving into suitable new habitat.

Newfoundland and Labrador has strict guidelines and criteria for reducing the impact of access roads and stream crossings on the environment. Provincial and federal government departments attempt to enforce these rules strictly, but problems do occur.

## Labrador's Newest Access Road: The Trans-Labrador Highway

**Figure 7.10:** A segment of the Trans-Labrador Highway.
*Photo courtesy Rodney Barney*

When the Trans-Labrador highway is completed in 2009, it will wind 1,099 kilometres from Labrador City in the west to L'Anse-au-Claire in the southeast, and provide road access to one of North America's last intact wilderness areas. The highway can be considered one of Newfoundland and Labrador's longest access roads. It will open up new areas for outdoor recreational activities such as hunting, trapping, fishing, berry picking, and canoeing, and provide opportunities for commercial development.

Residents in Mary's Harbour and Cartwright were surveyed about the impact of the highway on their communities. They reported that, overall, the new road had not greatly affected the location of, frequency of, or participation in domestic hunting, fishing, berry picking, or other land-use and harvesting activity. Nevertheless, forty-three per cent of all interviewees reported using the road to reach traditional or new fishing and/or hunting grounds, which were mostly located near their community. In Cartwright, however, eighty per cent of interviewees report *not* using the road for their fishing and/or hunting expeditions.

Domestic woodcutting practices have been greatly affected by the construction of the road. Fifty-four per cent of interviewees use the highway either to find new cutting areas and/or to transport a snowmobile to traditional harvesting locations. Almost twenty-seven per cent do not use the road or their trucks for woodcutting operations. One interviewee in Mary's Harbour said that the road gave access to birch stands for the first time.

While no change was noticed in the abundance of resources (animals, fish, birds, berries, etc.), there is widespread fear that fishers and hunters from outside Labrador will cause a rapid decrease of the animal and fish resources in the region, especially in areas where the road runs along rivers, such as Paradise River.

Source: Sara Russo Garrido and J. Stanley. 2002. *Labrador Road Study: Local knowledge on the social and environmental impacts of the newly constructed Trans-Labrador Highway in south-eastern Labrador*. Coasts Under Stress

### Criteria for Building Access Roads

Properly constructed access roads:

- provide safe travel routes with minimal disturbance to the forest
- protect wildlife by:
  - avoiding or protecting sensitive wildlife areas
  - not blocking wildlife migration routes
- prevent erosion and soil loss
- protect wetlands, streams, and other water bodies

**Figure 7.11:** An aerial view of a forest access road.

Build bridges and water crossings to:

- protect water quality
- maintain stream flow
- allow movement of fish
- protect fish habitat and aquatic ecosystems

When considering sources of fill, such as quarries:

- limit the number of sites by:
  - using existing sites first
  - opening new sites only when necessary
- protect wetlands, streams, and other water bodies by:
  - not removing fill from these areas
  - controlling sediment-laden runoff

Source: Western Newfoundland Model Forest. 1999. *Sustainable Forest Management Training for Front Line Forest Workers*

## CHECK your Understanding

1. What effects do road networks have on wildlife, especially interior forest species?
2. Early settlers in Newfoundland and Labrador lived along the coastline and relied on the sea for their livelihoods. Outline three reasons why they might have travelled inland.
3. What positive and negative impacts did the construction of the Newfoundland Railway have on the environment of the Island's interior?
4. List three reasons why access roads are built.
5. Outline the four criteria that must be followed during the construction of access roads.
6. List the environmental damages that poor access-road construction can cause.

### For Further Discussion and/or Research

7. When access roads are abandoned, their continued use may eventually become impossible. What are the advantages and disadvantages of abandoning these roads? If the roads are kept up, who should be responsible for maintaining them?
8. Determine how many students in your class have parents or guardians who own cabins. List the ways that they access their camps in summer and winter.
9. Identify a current or former forest access road near your community and determine the different ways people use it. What was its original purpose? What is its main use today? Has its impact been positive or negative?
10. Consider this scenario: A new forest access road has opened near your community. It provides easier access to many ponds and streams and opens up new territory for hunting and wilderness camping. What responsibilities do you have regarding the use of this new road and the access it gives you? Create a poster, video, or radio advertisement that could be used to communicate these responsibilities to the public.

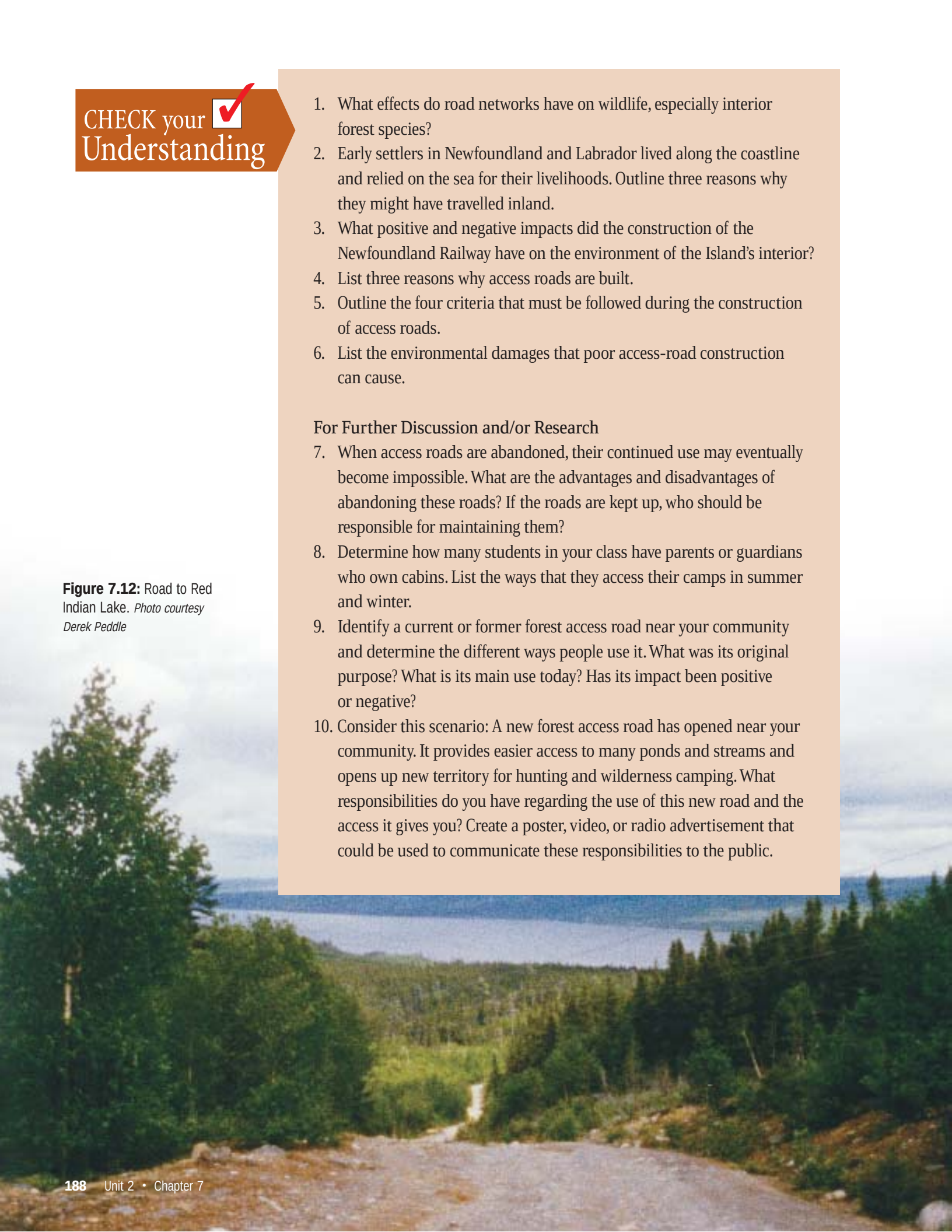


**Figure 7.12:** Road to Red Indian Lake. *Photo courtesy Derek Peddle*

## MECHANIZED ACCESS TO WILDERNESS AREAS

Before mechanization, Newfoundlanders and Labradorians walked or snowshoed, and used dog teams, horse-drawn sleighs, punts, rowboats, kayaks, and canoes to access the wilderness for work and recreation. The invention of the outboard motor and, later, the snowmobile, trail bike, and ATV forever changed how we access the wilderness. These methods of transportation made life easier and extended access into new watersheds, forests, and barrens. They also delivered their own potential negative environmental impact.

ATV use is one of the foremost recreational activities that can change the landscape and disrupt its suitability for other recreational uses. When used improperly or in sensitive environments, ATVs cause damage to soils, water, beaches, vegetation, and wildlife. In addition, the noise of the machines can disturb both wildlife and other people who are enjoying the outdoors for its peacefulness.

The impact of ATVs on the physical environment varies according to the type of terrain (hilly or flat), soil, and vegetation. Climate, season, the type of vehicle, and driver behaviour can also play a role. Some landscape features common in Newfoundland and Labrador, such as bogs and wetlands, sand dunes, and tundra, are very sensitive to ATV disturbance.

### Did You Know?

Manufacturers of snowmobiles, outboard motors, and other recreational vehicles now make units powered by four-stroke engines, which have a cleaner exhaust than machines with two-stroke engines. They cost more, but prices are expected to come down as demand increases. In the meantime, be sure to stay well back from the machine ahead of you, so you do not breathe in the exhaust.

Using recreational ATVs in wilderness areas also brings new stresses to wildlife populations. ATV access puts pressure on trout and salmon spawning areas that were previously inaccessible because they were too far inland to reach easily on foot. In addition, ATV noise, the terrain and stream damage they can cause, and harassment are all stressors for wildlife in newly accessible areas.

Many of the problems associated with ATV use can be avoided through greater public awareness and education (which can improve operator behaviour), and changes in technology.

### Environmental Impacts of Two-stroke Engines

One of the more serious environmental concerns associated with mechanized access to the wilderness is emissions—particularly from two-stoke engines. Two-stroke engines are used in outboard engines, snowmobiles, personal watercraft, and many other recreational vehicles. They have three advantages over four-stroke engines: they

are simpler and less expensive to build, they are lighter but produce the same amount of power, and they work in any orientation, which is an advantage in personal watercraft, snowmobiles, and other vehicles that operate at extreme angles.

A recent study conducted by the Southwest Research Institute Laboratory (*www.nebs.swri.org*) compared, emissions from two- and four-stroke snowmobile engines. The study was prepared for Yellowstone National Park, where snowmobile access, use, and emissions have become a major issue.

The study found that snowmobiles with four-stroke engines produce cleaner emissions than those with two-stroke engines. Four-stroke snowmobile engines release into the atmosphere:

- 95–98% less hydrocarbons (unburned fuel)
- roughly 90% less toxic hydrocarbons
- 85% less carbon monoxide
- 90–96% less particulate matter

Four-stroke snowmobiles also have approximately 40% better fuel economy than two-stroke snowmobiles. They do, however, release seven to twelve times more nitrogen compounds ($NO_x$) than two-stroke engines.

**Figure 7.13:** Comparison of Emissions from Two-stroke and Four-stroke Engines Snowmobile.

| | Emissions (g/hp-hr) | | | |
|---|---|---|---|---|
| Snowmobile Engine | Hydrocarbons | Carbon Monoxide | Nitrogen Oxides | Particulate Matter |
| Brand A Four-Stroke | 4.62 | 59.6 | 7.93 | 0.065 |
| Brand B Four-Stroke | 2.38 | 59 | 5.2 | 0.085 |
| Four-Stroke Average | 3.5 | 59.3 | 6.57 | 0.075 |
| Brand A Two-Stroke | 156 | 363.4 | 0.49 | 3.46 |
| Brand B Two-Stroke | 150.7 | 416.4 | 0.44 | 1.35 |
| 500 cc* Two-Stroke | 115.5 | 375.6 | 0.69 | 0.7 |
| Two Stroke Average | 140.7 | 385.1 | 0.54 | 1.64 |

*Kettering University student-designed machine from the Clean Snowmobile Challenge (three-way catalyst on exhaust)

## Reducing Emissions from Two-stroke Engines

Emissions from two-stroke engines can be reduced in two ways: by direct fuel injection and by using a catalytic converter on the exhaust system.

**Figure 7.14:** A Quad left idling by a small brook.

Two-stroke engines with direct fuel injection reduce hydrocarbon emissions by more than eighty per cent and are more fuel efficient. They also use only half as much lubricating oil, run more smoothly, and practically eliminate exhaust smoke.

In a conventional two-stroke engine, the fuel/oil mixture enters from the bottom of the cylinder. The piston moves up the cylinder, compressing the fuel/oil mixture, and pushing it up and around the piston to the top of the cylinder head, where it combusts. Some of the fuel/oil mixture escapes into the atmosphere through the partly open exhaust port. In engines with direct fuel injection, the oil still comes in from the bottom of the piston, but the fuel is delivered by injectors at the top of the piston. The engine is designed to wait until the exhaust port is closed before firing. As a result, no unburned fuel is mixed with the exhaust.

The addition of a catalytic converter, similar to those in automobile exhaust systems, can further reduce emissions.

## The Chemistry of the Exhaust Catalyst

Typically, exhaust emissions include:

- Nitrogen gas: Air is seventy-eight per cent nitrogen gas. Most of this nitrogen passes right through the engine and is harmless to the environment.
- Carbon dioxide: Formed when carbon in the fuel reacts with the oxygen in the air. Carbon dioxide is a greenhouse gas. (See Unit 5)
- Water vapour: Water ($H_2O$) is formed and vapourized when the hydrogen in the fuel reacts with the oxygen in the air.
- Carbon monoxide (CO): Formed by combustion under low oxygen conditions, carbon monoxide (CO) is a poisonous gas that is colourless and odourless.
- Hydrocarbons: These are unburned evaporated fuel. Sunlight breaks the hydrocarbons down to form oxidants, which react with oxides of nitrogen ($NO_x$) to produce ground-level ozone ($O_3$). Ozone is a major component of smog.
- Nitrogen oxides ($NO_x$): Formed by the combustion of nitrogen at higher temperatures, nitrogen oxides are a component of smog and contributes to the formation of acid rain.

Catalytic converters are designed to convert carbon monoxide, hydrocarbons, and nitrogen oxides into harmless compounds before they exit the exhaust pipe. The converter's "catalyst" is platinum and palladium coating on a ceramic honeycomb or ceramic beads. This is housed in a muffler-like package attached to the exhaust pipe. When exhaust passes through the converter, the catalyst helps convert carbon monoxide into carbon dioxide, hydrocarbons into carbon dioxide and water, and nitrogen oxides into nitrogen and oxygen gases.

### Fuel Spills in the Newfoundland and Labrador Wilderness

To understand how snowmobile use can affect the environment, imagine a day on which two hundred conventional two-stroke snowmobiles visit a wilderness area. If each machine burned 25 litres of fuel (about one tank) and a third of the machines left the exhaust unburned, at least 1,650 litres of gasoline would be released into the environment as unburned hydrocarbons.

**Figure 7.15:** Snowmobile recreation.

Four-stroke engines and improvements to two-stroke engines would reduce the amounts of unburned fuels and air pollution. How would these improvements reduce the pollution caused by this day of snowmobiling?

## CHECK your Understanding

1. List the three reasons why two-stoke engines have such high emissions.
2. List the impacts the following emissions have on the environment:
   - carbon dioxide
   - hydrocarbons
   - nitrogen oxides
3. Construct a bar graph that compares average emissions from two- and four-stroke engines.
4. Explain what an exhaust catalyst is and how it works.

For Further Discussion and/or Research

5. Use the Internet to find and compare data about emissions from two different models of ATV.
6. Select one traditional method of accessing the wilderness. Construct a table to compare and contrast its characteristics with those of a modern access vehicle, such as a quad or snowmobile.
7. Which environmental impacts caused by ATVs could be reduced through public education?
8. Are the advantages of 2-stroke over 4-stroke engines worth their environmental impacts? Explain your reasoning.

### Outboard Engines and Personal Watercraft

A 70-horsepower two-stroke outboard motor releases about the same amount of hydrocarbon pollution in one hour as a new car does when it is driven 8,000 kilometres.

Unlike a car's exhaust, outboard motor exhaust is released into the water. Studies of its effect on lakes show that most of the hydrocarbon compounds released into the water evaporate into the air within six hours. Water samples taken a metre below the surface show no hydrocarbon contamination. Heavier hydrocarbons, such as oil and grease, remain on the surface for a longer period, however, and can affect living organisms.

The personal watercraft (PWC) is designed and marketed as a form of high-speed recreation. PWCs are often operated in shallow water close to shore. Shallow water areas that are often important and sensitive ecosystems. Operating high-powered watercraft in shallow areas at speeds greater than eight kilometres per hour affects the lake bottom in the same way that directing a jet of water from a pressurized hose would (see "How a Jet Drive Works"). Evidence clearly shows that it can have severe environmental impacts in these shallow areas: it increases turbidity, which affects shallow aquatic plants, and disturbs and mixes up bottom sediments, which often contain toxic substances that can enter the food chain.

How a Jet Drive Works

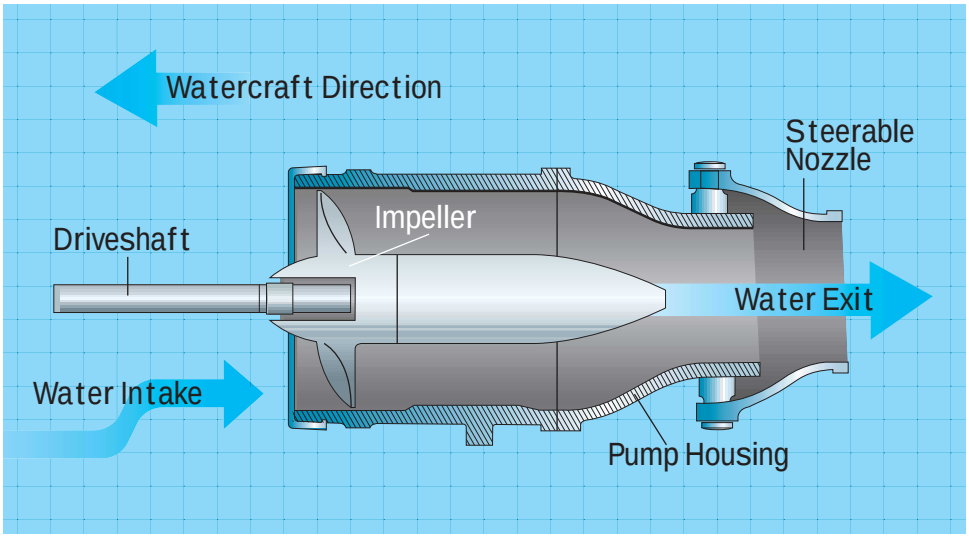



**Figure 7.16:** A typical jet drive. *Illustrated by Vivid Communications*

A personal watercraft has a two-stroke inboard gasoline motor that drives a jet water pump. This pump draws water in through a water intake on the bottom of the PWC and over an internal propeller (an impeller). This creates a jet of high pressure water that exits through a nozzle on the back of the PWC and propels the machine. On some models, a moveable gate can be dropped over the nozzle to provide reverse thrust.

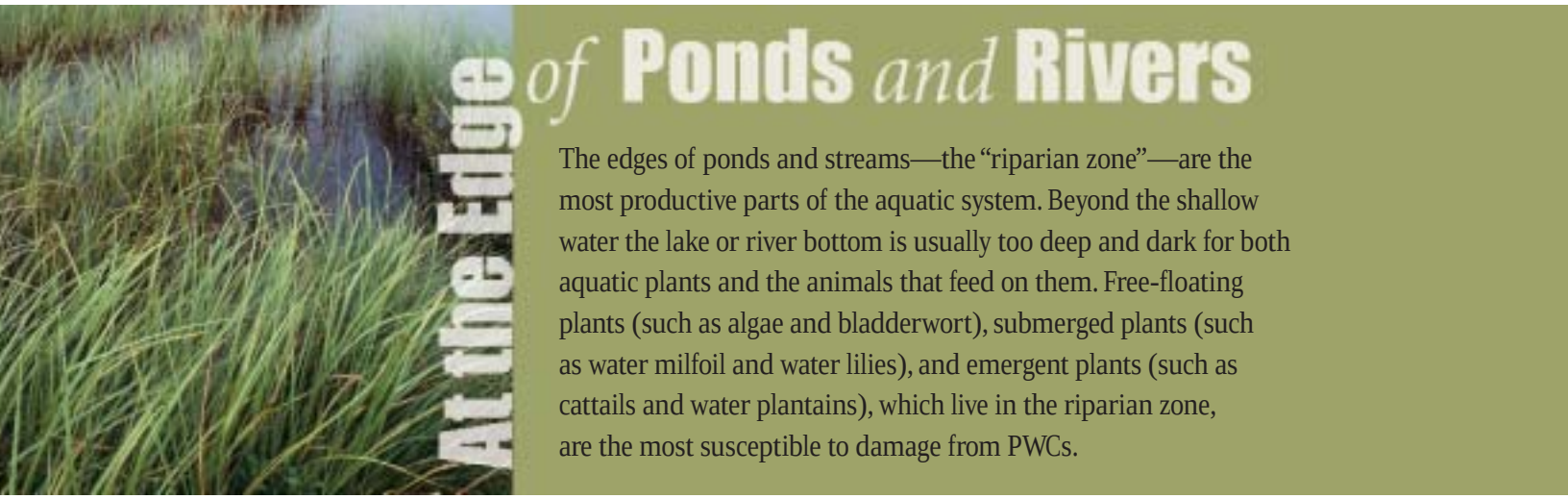



**Figure 7.17:** Riparian zone.

## All-terrain Vehicles

ATVs—sometimes called simply "quads" or "trikes"—play a big role in Newfoundland and Labrador life, especially in rural communities. These vehicles were originally developed for non-recreational use in isolated and mountainous areas. When they appeared in North America in the 1970s, however, they were marketed and sold as recreational vehicles.

Newfoundlanders and Labradorians use ATVs for recreation and to gain access to remote areas. The vehicles provide disabled and senior citizens, and those who are

physically unfit, with access to areas they would not otherwise be able to reach. In isolated communities, such as Nain, the ATV replaces the automobile as the primary vehicle of transport.

MINI-LAB ACTIVITY

## ATV Tires: Surface Area and Ground Pressure

### Background

ATVs have wide low-pressure tires that have little or no side-wall rigidity. Low-pressure tires enable the tire's "contact patch" (the area of tire that touches the ground or driving surface) to change size as the vehicle load changes. This maintains a constant pressure in the tire and on the ground surface. In other words: when the load increases, low pressure allows the soft side-wall tires to change shape and a greater area of each tire to touch the ground. A larger contact patch distributes the weight of the vehicle over a larger area. The low-pressure and soft-sided tires of ATVs means the vehicles can carry a load without increasing the pressure they exert on the ground.

### Purpose

To study the relationship between ground pressure and surface area.

### Materials

- Graph paper (1 cm squares)
- Piece of 6.0 mm-thick plywood (61 x 61 cm)
- ATV (a quad for which weight is known, see Analysis)
- Fine-point marker
- Bathroom scale

### Procedure

1. Attach the graph paper to the plywood.
2. Park the ATV on level ground so that one tire is on top of the graph paper. CAUTION: Make sure that the parking brake is on.
3. With no one sitting on the ATV, use the marker to outline the area where the tire touches the surface (the tire patch).
4. Leaving the graph paper in place, ask one student to sit on the ATV. Repeat step three.
5. Leaving the graph paper in place, ask two students to sit on the ATV. Repeat step three.
6. Leaving the graph paper in place, ask three students to sit on the ATV. Repeat step three. (This scenario is roughly similar to the weight of one driver and two quarters of moose).
7. Weigh each student.

**Figure 7.18:** A typical low-pressure ATV tire. *Photo courtesy Department of Government Services*

## Data Analysis

1. Describe how the tire changed shape and size as the load on the ATV increased.
2. Calculate the area of each tire patch by counting the number of squares within each outline. Record the data in a table (see sample, below) and calculate the ground pressure.

| | Trial 1 | Trail 2 | Trail 3 | Trail 4 |
|---|---|---|---|---|
| Area of Tire Patch ($cm^2$) | | | | |
| Mass of ATV* | | | | |
| Mass of Students (Load) (kg)* | | | | |
| (A) Total Mass of ATV + Load (kg) | | | | |
| (B) Tire Patch Area X 4 | | | | |
| Ground Pressure A / B $kg/cm^2$ | | | | |

* Determine the mass of the ATV by consulting the owner's manual or the Internet.
** The "load" is the total mass of the students sitting during the test.

3. Create a graph of the relationship between Total Mass and Ground Pressure.
4. Suggest another method of measuring tire patch size and shape that could yield more accurate results.

## Analyze and Conclude

1. With a fifty per cent increase in load, what is the percentage increase in ground pressure? You will need to extrapolate from the graph to get your answer.
2. Low-pressure ATV tires have a deep tread to increase traction. What damage might this type of tread do to soil or plants?
3. How might driving techniques reduce damage to the substrate caused by deep-tread tires?
4. Investigate new tire and tread designs that further reduce substrate damage.
5. Does the ground pressure exerted by a snowmobile change if there is more than one rider? Explain your answer.
6. Describe any ATV damage to vegetation on bogs or fens that you have observed.

Extensions

7. Determine the differences in ground pressure that long- and short-track snowmobiles exert.
8. Determine the differences in ground pressure that different shaped and sized snowshoes exert.

## Environmental Impacts of ATVs

Many people operate ATVs responsibly. As with many other recreational activities, however, an irresponsible minority can easily tarnish the reputation of the majority.

Several approaches can help reduce the harmful impact of irresponsible ATV use on the environment. They include:

- distributing information
- safety courses
- environmental education
- regulations that:
  - designate trails or areas for ATV use
  - regulate hours for ATV traffic (as the Newfoundland T'Railway does through communities)
  - create buffer zones to reduce environmental damage
  - call for daily or yearly permits to limit ATV use in specific areas

All ATVs have the ability to travel off-road, and there are some situations in which allowing ATV travel may be less destructive than creating a more permanent road. Some of the potential effects of ATVs on the environment are described below.

**Figure 7.19:**
A responsible ATV rider takes actions to help minimize negative environmental impacts.

**Figure 7.20:** Willow Ptarmigan nest.

Potential Impact of ATVs on Wildlife

- Habitat disturbance and destruction

  Forest floors, barrens, beaches, and wetlands are all vulnerable to ATV damage. Wetlands and bogs, which consist mainly of partially decomposed plant material, are particularly sensitive. Because they are saturated with water and poor in nutrients, the rate of plant growth in these areas is extremely slow. It can take wetlands and bogs up to fifty years or more to recover from damage (which can be caused even by walking on them). Riparian zones are also extremely sensitive to damage.

- Harassment

  Harassing wildlife is both illegal and difficult to measure. Increases in heart rate have been monitored in studies of mammals to measure the effects of harassment. The studies show that ATV use, that alarms animals, can result in decreased reproduction and changes in behaviour.

- Increased harvesting

  Bag and catch limits for hunting and fishing are designed to prevent over-harvesting, and increasing harvesting limits is sometimes beneficial. For example, many moose management areas in the province are inaccessible by road. Limited access means fewer hunters can get into these areas and expected harvest rates may not be reached. If this occurs over many years, the moose population can increase unchecked and cause irreparable damage to the environment. The use of ATVs in the fall hunt and snowmobiles in the winter hunt can contribute to achieving forecasted hunter success rates, and allow better management of the resource.

**Figure 7.21:** A brook trout in shallow water.

### Potential Impact of ATVs on Water Resources and Fish Habitat

Disturbance of the vegetation and soil in riparian zones can have a serious impact on both habitat and water quality. Disturbance occurs when ATVs damage stream banks at crossing sites and damage vegetation on trails that follow the banks and shores of lakes and ponds. The effects of disturbance include:

- Loss of vegetation cover near rivers and streams
  This leads to soil erosion, which, in turn, increases sedimentation in the water. Bank damage can also release sediment into freshwater habitats during heavy rains. Loss of vegetation cover can also reduce the shade over the water, which can result in an increase in water temperatures beyond the tolerance level of the fish.

- Disturbance of the stream bottom
  Usually caused at stream-crossing sites, this disturbance can create plumes of silt that drift downstream. Silt and sediments can cover fish eggs and prevent them from hatching. Sediments can also cover and destroy aquatic insect habitats.

- Stream blockage
  This can occur when repeated crossings cause stream banks to collapse.

- Changing spring melt patterns
  When snowmobiles travel over streams, they can cause a thick band of hard frozen snow to build up, which takes longer to melt than the surrounding snow and ice. (This phenomenon is called "aufeis" in nature, from the German for "ice on top.") The presence of aufeis can contribute to flooding problems during spring break-up.

- Fuels and lubricants in the ecosystem
  All machines release these fluids, which are moved by runoff and eventually collect in streams and ponds.

- Destruction of fish eggs
  Driving ATVs in spawning areas when fish eggs are incubating in stream gravels can destroy the eggs.

**Figure 7.22:** The forest understory, i.e., leafy plants and naturally regenerating trees, may be crushed by ATV traffic.

### Potential Impact on Forest Resources

The forest industry is concerned about damage ATVs can cause in both silviculture areas and naturally regenerating sites. Recreational vehicles destroy areas of tree regeneration by breaking or crushing young trees.

The severity of the damage depends on several factors including how often the route is travelled and the time of year (which affects whether the ground is wet, dry, or frozen).

### ATV Restrictions in Newfoundland and Labrador

In this province, ATV use in wetland areas (bogs, marshes, and barrens) is permitted only on a trail approved by the Department of Government Services. In order to develop a trail, a "licence to occupy" must be obtained from the Department. Many areas of the province have no restrictions, because of reduced habitat impact and social need.

**Figure 7.23:**
Young people on dirt bikes.
*Photo courtesy Environment Canada/ Peter Thomas*

Areas in which ATV use is approved without restriction include:

- forested lands underlain by mineral soil (hard ground)
- properly constructed and licenced trails
- beaches, unless prohibited by the Minister
- abandoned railway corridors and highways
- forest access roads and a variety of resource roads
- privately owned lands of less than 10 hectares (25 acres)
- any lands that are snow-covered and frozen below the ground surface, except in protected areas
- lands in Labrador north of 54th parallel

Source: Government of Newfoundland and Labrador

## How You Ride Makes a Difference

ATVs were intended to provide access to wilderness, not to harm it. Responsible ATV riding can be an environmentally sound way to experience the backcountry and enjoy the outdoors.

Following these tips will help you negotiate the terrain, enjoy the ATV experience, and protect the environment. Anyone can drive quickly, but it takes a truly skilled operator to ride slowly over challenging terrain with minimal impact on the ground. Using skill and common sense, not speed, will help you get there smoothly, safely, and in style.

**Figure 7.24:** Environmental effects of ATV use. *Photo courtesy Environment Canada/Peter Thomas*

Wet and Slick Trails

- Reduce ATV travel when and where soil is wet or muddy, to reduce damage to the ground.
- Throttle back. Many operators think it's better to use more throttle on wet trails, but usually the opposite is true. When wheels spin quickly the tires pick up mud and turn trails into "slicks."
- Use the manual clutch (if your machine has one) to "feel" for traction. The goal is to maintain forward motion while minimizing wheel spin.

Streams

- Cross only at established crossing points and check water depth.
- When following someone else's tracks, avoid digging the wheel grooves deeper.
- Be wary of slippery tree roots or rocks that span the ruts.

Boggy Areas

- These areas deserve special protection—do not drive through them. Look for trails around the edges, where the ground is firmer and drier.
- Use trails designed for ATV use.

Source: Tread Lightly on Land and Water: *www.treadlightly.org* and *A Guide to Responsible ATV Riding*

## CHECK your Understanding

1. Describe five ways ATV use affects wilderness areas.
2. Which types of terrain are most susceptible to damage by ATVs?
3. How has the introduction of the ATV, which made more areas accessible for moose hunting, been useful for managing moose populations?
4. What additional roles do ATVs play in the management of big game populations, especially moose?
5. If a well-used ATV trail runs parallel to or crosses a steam near a community, how can environmental damage be prevented?
6. What is the Department of Forestry's major concern about ATV use?
7. How can ATVs damage newly planted and thinned areas of the forest?
8. Outline ways that an ATV operator can reduce the vehicle's impact on: muddy trails, stream crossings, and wet and boggy areas.
9. Most of the problems associated with ATV use can be dealt with through education and legislation. List six different approaches that could be taken to reduce the impact of ATVs on the environment.
10. Outline the impacts of ATVs on water resources.

### For Further Discussion and/or Research

11. Design a poster that could be used to educate the public about the environmental impacts of ATV use.
12. Conduct research to determine the major problem wildlife biologists face when determining the impact of ATVs on wildlife populations?
13. Document the environmental impact of ATV use around your community using video or photographic images. Suggest ways that any damage can be reduced.
14. Discuss: should ATV use be further restricted for better protection of the environment?
15. Why do boggy areas "deserve special protection"? Conduct research and share your findings with the class.

## Snowmobiles

**Figure 7.25:** Snowmobiling in the backcountry. *Photo courtesy Parks Canada/Michael Burzynski*

The first snowmobile was built and tested by a Canadian, Joseph-Armand Bombardier, in 1922. The introduction of the "Ski-Doo" in 1958 started a snowmobile boom, opening up new recreational opportunities for Canadians in winter.

Today, the snowmobile has replaced many traditional modes of winter transportation and has had a positive impact on winter tourism. In 2005, the snowmobile industry contributed $192 million to the Newfoundland and Labrador economy. With almost thirty thousand operating snowmobiles registered in the province, the snowmobile has also changed the recreational landscape for residents.

These are the snowmobile's positive contributions. At the same time there are concerns about the impact these vehicles are having on the environment, including their effects on wildlife populations, soils, and vegetation, and the increased access to remote areas they allow. Gros Morne National Park and the Province's Wildlife Division have been doing important field research to determine the effect snowmobiles are having on caribou populations, ground vegetation, and soils.

### Impact on Wildlife: Caribou

Between 1993 and 1997 Parks Canada and the Newfoundland Wildlife Division studied the impacts of snowmobile use on the Gros Morne caribou herd. The potential impacts they identified included behavioural changes due to stress, and the shifting of traditional ranges.

The study involved capturing caribou and fitting them with radio collars. The radio collars allowed researchers to monitor caribou movement and habitat use, and gauge the effects of snowmobile activity on the animals' energy requirements. Changes in caribou ranges were determined by plotting the position of collared animals on a map and analyzing the relationship between their range and snowmobile routes.

Field observation was also used to determine the effects of snowmobile activity on the animals' energy requirements. The goal was to determine the range at which caribou were disturbed by snowmobiles, and how far away they ran from the machines. Observations showed that when approached by snowmobiles, caribou ran 60 to 237 metres from their initial location.

### Potential Impact on Arctic Hare

The winter habitat of the Arctic hare includes small valleys, rock outcrops, and wind-blown areas. Snowmobilers use valleys for travel and visit outcrops and wind-blown areas to take in the breathtaking views found in such locations. Because humans and hares use the same habitat, it is possible that snowmobile activity can adversely affect the smaller mammal.

**Figure 7.26:** Arctic hare.
*Photo courtesy Parks Canada / Sheldon Stone*

Arctic hares have a low metabolism rate for their size, an adaptation that helps them survive in very cold environments. They spend much of their time sitting, which uses little energy. Snowmobiles can startle and frighten these animals, causing them to run from areas of cover when they should be conserving energy. This extra use of energy may increase winter mortality rates.

**Figure 7.27:** This snowmobile trail is clearly visible in summer. *Photo courtesy Department of Natural Resources*

**Figure 7.28:** Sphagnum moss bogs are very sensitive to Snowmobile traffic. *Photo courtesy Department of Natural Resources*

## Impacts on Vegetation

The sphagnum bogs on the coastal lowlands of western Newfoundland are sensitive to snowmobile traffic because of the shallow depth of winter snow cover.

Studies have shown that just twenty passes of a snowmobile affect both woody and leafy plants. This suggests that widespread activity on coastal lowlands with low levels of snow cover could have large-scale impacts on vegetation.

## Snow Compaction

Compacted snow can affect soils. Snow is the natural blanket that keeps the ground warm during a long cold winter. In Newfoundland, temperatures can hover around -2°C at the bottom of the snow pack when the air temperature is -14°C. When snowmobiles repeatedly travel over the same track, snow compaction eliminates air pockets, which reduces the snow's insulating capacity. The thermal conductivity of compacted snow is eleven times greater than that of undisturbed snow. Snow compaction can result in soil temperatures up to 11°C cooler than under undisturbed snow. One study showed that soil underneath a compacted snowmobile trail froze a month earlier and thawed, on the average, two to three weeks later than the soil under non-compacted snow.

MINI-LAB ACTIVITY

## Impact of Snow Compaction on Underlying Soil and Vegetation

### Purpose

To discover the possible impacts snowmobile use can have on animals and vegetation.

### Hypothesis

Develop an appropriate hypothesis for this activity.

### Procedure: Part 1 – Measuring the temperature gradient of a snow pack

Temperature gradient is the rate of change of temperature over a specified distance in a given direction, usually vertically. Do this activity in mid-winter on a cold day for the most dramatic results.

1. Dig a trench in the snow to expose the ground next to a heavily used snowmobile trail. CAUTION: Choose a straight stretch of the trail to ensure oncoming snowmobiles see you. The side of the trench wall nearest the trail will be compacted snow, the other side will be undisturbed snow.
2. Push thermometers into the snow pack on each side at 10 cm intervals.
3. Record your results in a both a table and graph.

### Procedure: Part 2 – Impacts of snow compaction on habitat

In winter, many small animals, such as voles, live beneath the snow cover. They rely on it to help insulate them from the often dramatic shifts in night-time temperatures.

1. Does compaction of the snow pack affect its temperature? To find out, fill empty film containers (or other small plastic containers) with water at body temperature (around 37°C).
2. In the evening, bury them at various depths in the snow pack and leave them overnight, placing one on top of the snow as a control.
3. In the morning, dig the containers out and record your observations.

### Analyze and Conclude

1. How does compacted snow affect the temperature gradient of a snow pack?
2. How does compacted snow affect the insulating effect of snow cover?
3. What conclusion can you draw about the effects of snow compaction on plant and animal life, based on your observations?
4. Based on your observations, what recommendations can you make to snowmobile operators?

## NON-MECHANIZED ACCESS TO WILDERNESS AREAS

**Figure 7.29:** Hiking the Trans Canada Trail. *Photo courtesy Department of Tourism, Culture and Recreation*

How to Reduce Recreational Impacts on Soils and Vegetation

- *Designate hiking and ATV trails (quads and snowmobiles)*
- *Use boardwalks, stairs, water bars (reduce erosion) on walking trails*
- *Harden the trail surface (modifying it with gravel and other material)*
- *Design routes and trails appropriately (avoiding sensitive areas)*
- *Educate the public*

Many communities in Newfoundland and Labrador have developed walking and hiking trails, parks, and campgrounds. The trails and parks provide recreational opportunities for residents, and enhance the attractiveness of the community to visitors and tourists. At first glance, it might appear that walking and hiking have minimal impact on the environment, but this is not always the case. Many of the effects caused by vehicle access to the wilderness can also occur when access is on foot.

The soils in Newfoundland and Labrador have taken thousands of years to form and have evolved from rock and organic matter. Glaciers, moving water, heat and

frost, chemical processes, and living organisms have all helped form Newfoundland and Labrador's thin layer of soil. These thin soils can be affected by recreational uses such as walking or activities around campsites.

### Recreational Impacts on Soil

Soil damage occurs in stages. It begins with the loss of soil litter (organic matter: leaves, sticks, twigs, and partly decomposed plant material) and the humus level, and is followed by the loss of nutrients (which were contributed by the litter), compaction and reduction of macro-porosity (the spaces between soil particles that allow air and water to move), reduction of air and water content, reduction of water infiltration, increased runoff, and increased erosion.

### Compaction

*Compaction is the most studied effect of recreational use on soils. The extent of compaction is influenced by the amount of organic matter in the soil, soil moisture, and soil texture and structure. Soil compaction is measured using one of these methods:*

- *Penetrometry: The force required to drive a rod of known length into the ground.*
- *Bulk Density: The soil density (mass of soil per unit volume)*
- *Permeability: The rate at which water soaks into the soil.*

### Litter

Soil litter is quickly lost along paths and on campsites. Its absence or loss of the soil's humus layers greatly reduce the soil's ability to capture rainwater, accumulate soil organisms and nutrients, or cushion underlying mineral soil. Unprotected mineral soil is susceptible to wind and water erosion.

### Compaction

Soils that have a wide range of particle sizes and low organic content, and that are walked on when wet, are generally more susceptible to compaction. Compaction can occur quickly with even light use of a trail or campsite. Measurement of percolation rates has shown that one litre of water takes up to 86 minutes to soak into the ground at a high-usage picnic site but only four minutes at an undisturbed site.

Compacted soil has a serious impact on vegetation. Seeds take longer to germinate, water and air movement to plant roots is reduced, and soil composition changes. Trees become unhealthy when the soil around them is compacted. Soil can return to its natural state following frost action, reduced or no traffic, and movement caused when trees sway in the wind, but the process takes many years or even decades.

Soil compaction can affect soil temperature, soil organisms, and soil chemistry. On a cold autumn night, for example, soil in trampled areas may freeze to a greater depth than soils that have not been compacted.

Solutions for dealing with the problems of compaction vary. Some people feel that it is best to limit the area affected by the compaction by encouraging or requiring people to stay on well-defined trails. Others feel it would be better to spread out the impact—build no trails, so no single area gets the heavy use that causes compaction. Still others feel that people should not be allowed into sensitive areas at all, if compaction will cause damage. These conflicting ideas apply as much to paths on the school grounds as they do to wilderness trails.

### Macro-porosity

Macro-porosity is a measure of the spaces between soil particles. These spaces are important because they hold water, they allow air to move through the soil, and they are the route by which water is absorbed into the soil. Compaction reduces the size of the spaces between soil particles.

Moisture in the soil usually decreases as compaction increases. For some soil types, however, compaction increases soil moisture because it reduces the size of the spaces to the point where capillary action retains water.

### Erosion

Erosion is the most permanent result of soil compaction, and while wind is the major eroding mechanism for sand and peat, water is the master of erosion. "Sheet erosion" occurs when water flows in a sheet across the surface of the ground, picking up material as it moves along. It is the type of erosion that can happen in campsites, picnic areas, and on level ground. "Gully erosion" occurs when water is concentrated in channels, roads, trails, and stream banks and wears away soil in a restricted area. Gully erosion usually causes more damage than sheet erosion.

**Figure 7.30**: Soil horizon showing distinct soil layers.
*Photo courtesy Wikipedia*

### Studying Soils

Soils are studied by digging a pit. The walls of the pit reveal different soil layers (the "soil profile"). The layers differ in colour, texture, thickness, and chemical properties.

Soil profiles usually have at least three distinct layers, or "horizons," capped by a loosely packed layer of dark-coloured duff or litter, composed of partially decomposed plant matter. The three horizons below the litter are:

- "A" horizon: Commonly called "topsoil," this layer undergoes the fastest chemical and physical changes, and has the greatest amount of plant and animal activity.
- "B" horizon: This layer is the mineral soil in which organic compounds filtering down from the "A" horizon accumulate. The organic compounds are converted into inorganic compounds by decomposers in the "B" horizon.
- "C" horizon: Composed of modified weathered rock that is the parent material for the mineral or sandy soil components. "C" horizon is outside the zone of most biological activity.

Source: "Where Continents Collide: An Outdoor Education Curriculum. Newfoundland and Labrador School District 3. 1999.

## CHECK your Understanding

1. What processes play a role in the formation of soils in Newfoundland and Labrador?
2. Describe the three soil horizons. Which horizon is the most biologically active? Why?
3. List six ways that recreation can affect soils.
4. What are the effects of soil compaction? How is soil compaction measured?
5. How does a reduction of micro-porosity affect plant life?
6. List ways to reduce recreational impacts on soils.
7. In addition to percolation rates, what other soil characteristics are affected by soil compaction?

### For Further Discussion and/or Research

8. As a class project, select a community walking trail or ATV trail. Document the impacts of the trail and any of its viewing stations or picnic sites on soil, vegetation, and streams. Through research on the Internet, investigate ways to address the problems you have identified, and prepare a set of recommendations to present to your community council.

## CORE LABORATORY ACTIVITY

### Soil Compaction and Water Percolation Rates

#### Outcomes

The student will be able to:

- explore and classify a variety of soils
- determine soil types such as sand, clay, and silt
- determine the percolation rate in relation to compaction and soil types
- formulate research questions and hypotheses, plan field studies and experiments, collect and record data
- identify the effects of soil compaction on plant and animal life
- discuss the implications of trail development in wilderness areas and parks

#### Introduction

In this activity you will form and test hypotheses about areas in the schoolyard where the rates of water percolation could differ.

One of the most common ways our activities can affect soil's porosity is through compaction. Many activities cause compaction—the degree is determined by both the type of activity and the type of soil. Once compacted, soil particles do not easily separate from one another—the soil has become less porous, with all the related effects that brings.

### Problem Question

Does soil compaction affect percolation rates of water into the soil?

### Hypothesis

Propose a suitable hypothesis for this activity.

### Materials *(for each group of students:)*

- two matched percolation cans, both ends removed
- tape (brightly coloured) or a permanent marker
- measuring cup/container (volume 250 ml or greater)
- bucket or container of water
- thick gloves
- stopwatch or watch with a second hand
- ruler

### Procedure

CAUTION: The cut end of the tin can may be very sharp.

1. Make a line on each can, 2 to 4 cm from one end, using the tape or marker. Marks must be identically placed on both cans. The marks allow you to push each can into the soil to an equal depth.
2. Choose **two adjacent sites** that have similar soil. One site should be on a path or in a high-traffic area. Remove any grass or plants to ensure that both sites have the same amount of vegetation.
3. Push one can into each site, rotating or "screwing" it into the ground until the tape mark is level with the surface of the ground. Avoid moving the can side-to-side—this will create air spaces at the sides of the cylinder. CAUTION: Wear thick gloves to protect your hands from the can's sharp edges.
4. Pour 250 ml of water into one can. Use the stop watch to time how long it takes for the water to disappear into the soil. Repeat the process with the second can. Record your data in a table.
5. Choose two more sites and repeat steps 1 through 4.

## Analyze and Conclude

1. Were there any differences in the times recorded?
2. What factors can you identify that may contribute to these time differences?
3. Did you notice any differences in the ease or difficulty of screwing the cans into the soil? If so, which one posed the most difficulty?
4. Why was it important that the test sites be located near each other? Explain how this could affect your results.
5. Were the soil types similar in both sites? What were the soils composed of?

Discussion/Extension

1. Do you think your schoolyard has a soil compaction problem? If so, is there anything that could/should be done to reduce the problem?
2. Are there are any public areas in your community (popular ATV sites, parks, or trails, for example) where soil compaction is a problem? If so, could/should something be done about it? Explain your answer.
3. Can soil compaction be avoided? Can your answer be applied to heavily used trails in or around your community where soil compaction may be a problem?
4. Should people be kept out of sensitive environments to avoid soil compaction? Should trails be eliminated so that the "damage" is less concentrated, or should people be restricted to trails to limit the "damage" to only specified areas?

# Chapter 8: Consumptive Recreational Activities

**Figure 8.1:** A successful caribou hunt on Deer Pond / Malais Lake in Middle Ridge Caribou Management Zone 64. *Photo courtesy Pine Ridge Lodge/Wayne Hollaway*

Hunting, trapping, and fishing are popular recreational pastimes in this province. Fifteen per cent of Newfoundlanders and Labradorians participate in hunting, forty-nine per cent take part in recreational fishing, and approximately 1,500 people participate in trapping activities every year. In addition, in many of our rural and remote areas, hunting, trapping, and fishing still provide partial subsistence.

Wildlife is a renewable resource subject to many stresses, such as over-harvesting, disease, habitat loss, and the introduction of exotic species. These stresses can usually be controlled through careful management.

## HUNTING, TRAPPING, FISHING, AND CONSERVATION

As in the past, today's hunters and fishers play a major role in fish and wild-game conservation. Since both groups greatly value wildlife, it is not surprising that the roots of the conservation movement can be traced to proponents of recreational hunting and fishing. The first National Park in the United States (Yellowstone), for example, was established to protect habitat in which people could hunt. The goal of early conservation organizations was to ensure that there would always be enough wild game to hunt and fish.

Today, government and non-government agencies invest millions of dollars in habitat conservation projects, and consumptive resource users such as hunters

and fishers are major contributors to these efforts. For example, from 1990 to 2005 in Canada, hunters have contributed $336 million directly towards habitat conservation projects and paid more than $600 million during the same period in licence fees. Hunting and related activities also contribute $600 million directly to the Canadian economy.

Hunters founded and continue to support two important conservation organizations in Canada: Ducks Unlimited and the Nature Conservancy of Canada. These two groups have conserved, restored, or protected more than a million hectares of habitat across the country. East coast hunters have contributed nearly $50 million over the last fifteen years to these organizations, with an average annual contribution of $3,195,000 and 90,000 volunteer hours per year.

Ducks Unlimited Canada
CANADA'S CONSERVATION COMPANY

### Hunting, Trapping, and Fishing Regulations

Both federal and provincial agencies regulate hunting, trapping, and recreational fishing activities in Newfoundland and Labrador. Migratory birds that cross international boundaries, including game birds such as ducks and geese, are protected under the *Migratory Birds Convention Act*, which was passed after Canada and the United States signed the Convention in 1916. Federal and provincial agencies cooperate in enforcing its regulations. Non-migratory game, such as grouse, partridge, snowshoe hare, coyote, moose, black bear, and caribou, is managed under provincial legislation. Federal legislation about wildlife species is enforced by the Wildlife Enforcement Division of Environment Canada, and recreational fishing is regulated by the federal Department of Fisheries and Oceans according to the *Fisheries Act*.

## Did You Know?

Trapping is the oldest land-based industry in North America, with a history going back more than 400 years. Prior to the arrival of Europeans, native peoples trapped furbearing animals for clothing, food, and shelter. Deadfalls, snares of rawhide or bark, pit falls, arrows, clubs, and spears were common harvesting tools.

Game, fur, and fish management involves setting seasons and bag limits, and determining where hunting, trapping, and fishing are allowed. It governs the harvest and ensures that there is sufficient breeding stock.

Game-animal populations are managed using one of two strategies. Ducks, grouse, hare, and most other small-game species have high natural mortality rates (due to predators, illness, and starvation). Many individuals do not live long enough to reproduce. To compensate, these species often produce many young each year, which increases the chances that some offspring will survive. Big game, such as moose and bear, have small populations, low natural mortality, and low reproductive rates. These species (particularly moose) are managed so that their populations do not reach the point where they exhaust their food supply. In both strategies, managers tailor the harvest to remove animals that are either surplus to the population needs of each species, or that might otherwise die from natural causes.

Despite efforts to protect or conserve species for the benefit of society, a small percentage of the public will still break the law. Wildlife enforcement is thus a necessary tool for effective wildlife management. Whether it be securing a trophy moose head for sale or netting a salmon river, almost all serious poaching activity has an economic motivator. Crimes against wildlife and habitat are addressed by professional, well-trained, and well-organized provincial and federal personnel.

## Ducks Unlimited Canada

**Figure 8.2:** Common eider ducks (Somateria millissima), the largest sea-duck in the northern hemisphere. Adult male (left) and female.

Ducks Unlimited Canada is a science-based organization launched in 1938 by sportsmen to preserve the wetland habitat that supported game-bird populations. It continues to support conservation of these habitats today, and provides research to guide conservation.

In 2004, Ducks Unlimited Canada began research in Newfoundland and Labrador under its Eider Initiative, an eider duck research program designed to fill in knowledge gaps about this iconic coastal species. More than 150,000 breeding pairs of common eider ducks once thrived along the province's coastlines. Over time, human activity, industry, and a growing predator population reduced their numbers to a mere 12,000 breeding pairs. The Eider Initiative research program will eventually provide a scientific foundation for an eider conservation and education strategy.

Source: Ducks Unlimited Canada

## CHECK your Understanding

1. Describe how game populations are managed.
2. Explain how individuals involved in hunting, fishing, and trapping, play a role in conservation.
3. Not all Newfoundlanders and Labradorians feel the same way about hunting and fishing activities. Respond to the following position: "Newfoundlanders and Labradorians have always depended on the land for subsistence. Taking caribou, grouse, ducks, and a variety of fish species was always part of the life of the people. This should be allowed to continue, especially in rural and remote areas of the province."

For Further Discussion and/or Research

4. The population dynamics of snowshoe hare and moose are different. What are these differences and how do they determine the way each population is managed?
5. Investigate the history of the conservation movement in North America and compare its development with what occurred in Europe.
6. In your opinion, why do some people poach wild game? Do you think their reasons justify their actions? Why or why not?

## Did You Know?

### Snowshoe Hare Population Cycles

The populations of most small game species cycle naturally over periods of seven to eleven years. For snowshoe hares, the cycle has a period of seven to nine years, and peaks in abundance can be up to 300 times higher than the cyclic lows. The cycle is similar to that of the lynx, which lags a year or two behind the hares. Many reasons are proposed for these cycles, none of which is linked to hunting.

### What Is a Snare Night?

One snare night is counted for every night a single snare is set. Thus ten snares set for seven nights is seventy snare nights.

## HUNTING SMALL GAME

"Small game" in Newfoundland and Labrador includes ruffed and spruce grouse, snowshoe hare, and rock and willow ptarmigan (known locally as partridge).

The province has two hare species—the Arctic and the snowshoe—but no rabbits, though "rabbit snaring" is a commonly used term. Though Arctic hare is a native species in Newfoundland, snaring is not permitted on the island portion of the province because of low population numbers. The snowshoe hare was introduced to the Island in the 1800s as a food source; the first hunting season for the species opened in 1879.

Between 500,000 and 1.5 million snowshoe hares are harvested each year in the province. Bottled, baked, fried, or pied, the snowshoe hare has been a part of our diet for more than a century. Hunters also sell hares to supplement their income. There is little chance that this harvesting will have a major impact on hare populations. A prolific reproducer, snowshoe hares can produce up to four litters (averaging from two to eight young) a year.

Most snowshoe hares are harvested with snares—totalling about 26.4 million snare nights each year in the province. Traditional snares are not selective in what they catch, however, and although larger animals such as fox and lynx can easily break snare wire and escape unharmed, smaller animals, such as the Newfoundland marten, cannot escape.

## ENVIRO-FOCUS

### How to Avoid Snaring a Newfoundland Marten

One of only fourteen extant mammal species native to the island of Newfoundland, the Newfoundland marten is now listed as an endangered species.

**Figure 8.3:** Newfoundland Pine Marten. *Photo courtesy Parks Canada*

Unregulated trapping, habitat loss through fire, and habitat damage by insects and logging all contributed to its population decline. As early as the 1790s Newfoundlanders were trapping marten, and exporting hundreds of pelts annually. Harvesting continued until 1934, when declining numbers led to a permanent closure of the marten trapping season. In the early 1980s, the provincial Wildlife Division estimated that between 630 and 875 marten were left on the Island. This small population led the Committee on the Status of Endangered Wildlife in Canada to list the Newfoundland marten as "Threatened" in 1986. In April 1996, updated population estimates indicated only 300 animals on the Island; the marten's status was revised to "Endangered."

Although trapping for this species is not permitted, accidental snaring is an issue. To reduce this, a modified snare and new wire types have been developed.

The new snare design was based on the differences between snowshoe hare and marten behaviour. Snared snowshoe hares usually jump forward and back to try to escape the wire. Marten immediately drop to the ground and spin their bodies. In the modified snare, the wire loop is attached to the tree by a coil. If the snare is set properly, the motion of the snared marten will twist the loop off the coil—the marten escapes and the wire snare around its neck falls off.

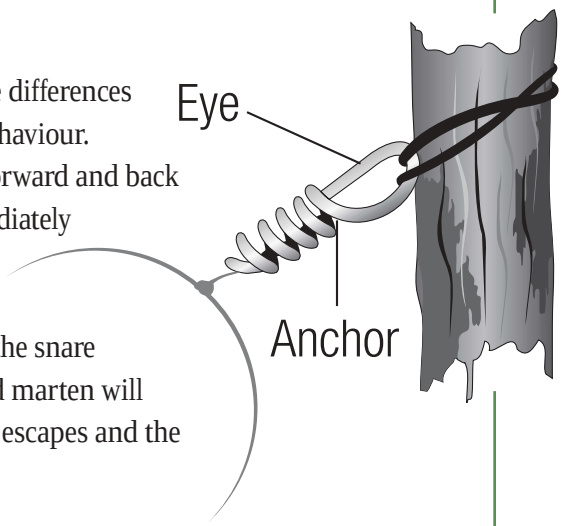



**Figure 8.4:** A modified snare. *Illustration courtesy Vivid Communications*

Three drawbacks to the modified snare system limit its effectiveness:

1. It takes longer to set than the traditional snare
2. Setting it incorrectly is easy to do (and means it won't work)
3. It is not being used by all trappers.
4. It is more expensive than the traditional snare.

## Did You Know?

### Flagging Tape

Flagging tape tied to trees has been used to mark everything from trails and survey lines to rabbit snares. Traditional flagging tape comes in a variety of colours but is made of environmentally unfriendly plastic. An unsightly addition to a natural landscape, it takes years to break down. Bio-degradable flagging tape is now available—a more environmentally friendly tool.

Using the modified snare when trapping in specified areas (such as near Grand Lake and Red Indian Lake in known marten habitat) is now a legal requirement. Yet in 2000 and 2001, seventy per cent of the snares examined on the north shore of Grand Lake were either the illegal type or set incorrectly.

To deal with the problem of non-compliance, a marten stewardship project was developed for resource users in the Red Indian Lake area. The project raised awareness through a public awareness and education campaign (incorporating signs, videos, posters, pamphlets, press releases, advertisements, radio interviews, ads in the *Hunting and Trapping Guide)*, demonstrations of the modified snares, and distribution of free modified snares. The education and stewardship program resulted in almost ninety-nine per cent compliance (98.6); less than one per cent of the snares examined were set incorrectly.

**Figure 8.5:**
The Pine Marten.
*Illustration Courtesy Parks Canada*

Meanwhile, a second approach was being investigated. Experiments showed that snowshoe hare and Newfoundland marten exert a different amount of force on the snare wire. Hares exert an average maximum tension of 1.284 kilograms, and marten exert 2.254 kilograms. The second approach involved finding a type of wire that could be used in a traditional snare, and that would be strong enough to hold the hare yet weak enough to break and release the marten. Tests showed that six-strand picture frame wire released marten every time but retained snowshoe hare eighty-four per cent of the time—perfect snare wire for the job.

**Figure 8.6:** Results of Wire Testing.

| Wire Type | Hare Retained | Marten Released | Escape Time (Marten) |
|---|---|---|---|
| Six-strand | 84.2% | 100.0% | 844 seconds |
| 22 brass | 88.6% | 90.9% | 2,116 seconds |

Source: Journal of Wildlife Management. 69(4):1743–46

## ENVIRO-FOCUS

### Monitoring Rock Ptarmigan Numbers on Gros Morne Mountain

#### Background

The rock ptarmigan is an arctic bird that is found in tundra and arctic-alpine areas of North America. The island of Newfoundland is home to one of the most southerly populations of rock ptarmigan and is the only place where the subspecies *Lagopus mutus welchi* is found.

**Figure 8.7:** A female rock ptarmigan. *Photo courtesy Parks Canada/Sheldon Stone*

In Gros Morne National Park, rock ptarmigan are found in arctic-alpine areas of the northern Long Range Mountains and on Gros Morne Mountain. A hiking trail up the mountain makes this small ptarmigan population relatively accessible, and so potentially vulnerable to disturbance by visitors. For these reasons, the area is used for an annual ptarmigan census as a part of the monitoring program at the park.

**Figure 8.8:** The female rock ptarmigan's coloration makes it difficult to see against the rocky background. *Photo courtesy Parks Canada/Sheldon Stone*

#### Goals

- Determine the number of rock ptarmigan breeding on Gros Morne Mountain.
- Determine the timing of incubation, to provide information to set dates for trail opening.

#### Project Description

Each spring, during the last week of May, a census is conducted on Gros Morne Mountain to determine the number of breeding rock ptarmigan. The birds are counted using a sweep survey. In spring, male rock ptarmigan are highly

**Figure 8.9:**
Gros Morne Mountain.
*Photo courtesy Parks Canada/ Sheldon Stone*

territorial and easily observed—their breeding plumage is white. Female ptarmigan are darker and less likely to be seen. The numbers of male ptarmigan observed during these surveys more likely represents actual population trends. The number of female ptarmigan encountered can indicate the timing of incubation, which is factored into decisions about when to open the trail to park visitors.

Ptarmigan surveys have been conducted each year since 1999. The number of male rock ptarmigan observed declined through 2005, with a slight increase observed in 2006. Populations of ptarmigan in other locations have been observed to cycle at about ten-year intervals, so the fluctuations observed in the Gros Morne Mountain population may be normal. Continued monitoring will shed more light on the population trends of these rock ptarmigan.

Project Team
Jennifer Hoffman, Shawn Gerrow, Gros Morne National Park staff and volunteers

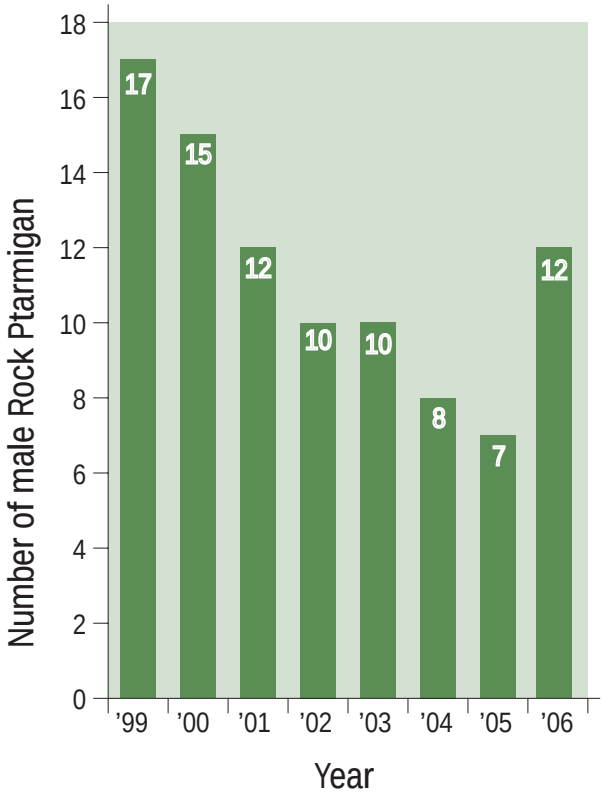



**Figure 8.10:** Number of male rock ptarmigan observed on Gros Morne Mountain during censuses conducted from 1999 through 2006.

## HUNTING BIG GAME

**Figure 8.11:** Hunter taking aim.

In Newfoundland and Labrador, the big-game species are moose, caribou, and black bear. Moose hunting in Newfoundland began in 1935, just over thirty years after the species was introduced to the Island. More than 20,000 are now being harvested annually. The highest density of moose in the world—seven moose per square kilometre—occurs in Gros Morne National Park. A small number of moose were also introduced in southern Labrador in 1953. As many as 185 moose are harvested in Labrador each year.

**Figure 8.12:**
Caribou running while being counted from above.
*Photo courtesy Department of Natural Resources*

Caribou are native to both Newfoundland and Labrador. The two types found in the province are migratory barren ground caribou and sedentary woodland caribou. Labrador is home to one of world's largest migratory caribou herds—the George River herd—currently estimated at 450,000 animals. About 15,000 George River caribou are harvested annually. The three woodland caribou herds in Labrador are considered "Threatened" by COSEWIC and are not hunted.

On the island of Newfoundland, more than 80,000 woodland caribou are distributed in twenty-nine herds. The herds experienced steep population declines in the early 1900s, to the point where hunting was banned (1924). The hunt was reopened in 1936 and approximately three thousand animals were harvested on the Island each year since then. Today, the Island's caribou herds are again in decline. The reasons for the decline have not been clearly identified; hunters and wildlife officials are cooperating in efforts to discover the cause.

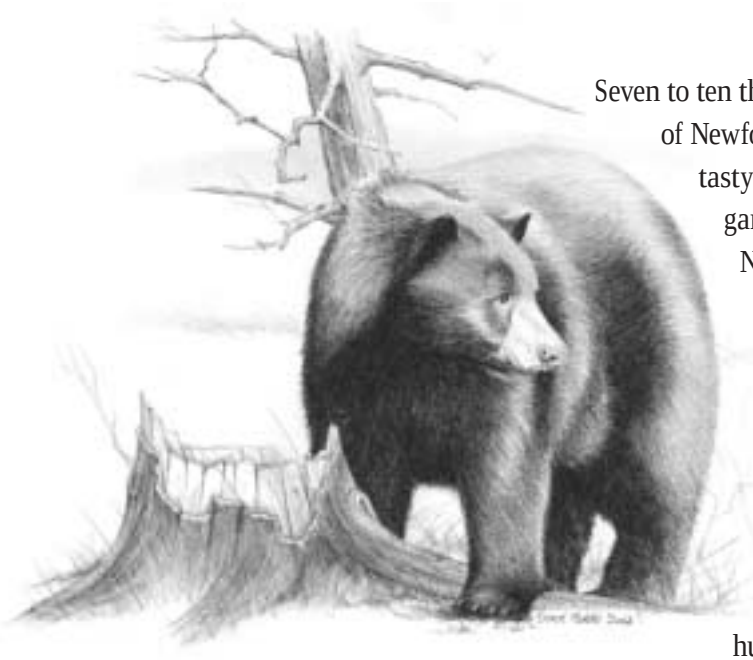


**Figure 8.13:** A Black Bear.
*Illustration courtesy Parks Canada*

Seven to ten thousand black bears roam the forests and tundra of Newfoundland and Labrador. Large in size and offering tasty meat, these bears could be an attractive big-game animal, but they are not a popular target for Newfoundland and Labrador hunters. They easily habituate to human presence and can become serious pests where humans create food sources for them—particularly garbage.

Managing the populations of moose, caribou and bear in Newfoundland and Labrador is the job of the provincial Inland Fish and Wildlife Division. They use aerial survey information, input from hunters, and jawbone data to set annual hunting quotas.

Moose and caribou (on the Island), and woodland caribou (in Labrador), all tend to stay within specific geographic areas. As a result some populations are more accessible to hunters than others. In addition, some populations fluctuate greatly (the Avalon caribou herd, for example), while others do not. All of this information is considered before annual quotas are suggested in each year's Big Game Management Plan. The Plan also addresses issues raised by conservation officers, hunters, and other members of the public. The Division reviews boundary changes, quota allocations, and animal-human conflict issues and recommends appropriate changes in the annual Plan.

## Did You Know?

A big game animal shot through the lungs with a bow or rifle will die in less than half a minute. An animal starving from malnutrition may suffer for weeks before perishing. This is one of the reasons some people see the responsible harvesting of wildlife as an effective and humane form of population control.

When the Plan is approved by the Minister of the Department of Environment and Conservation, the annual *Application Guide* and *Hunting and Trapping Guide* are produced for distribution to the public; then the cycle starts again.

The goals of big-game management are to oversee wildlife populations so that they persist indefinitely for all to enjoy, and to ensure that populations maintain levels that do not degrade or damage the habitat. This is accomplished by determining the maximum number of moose, caribou, and black bear that can be harvested each year to allow each total population to remain at—or reach—the desired size. Wildlife management considers humans as part of the ecosystem; the goal is to enable humans and wildlife to live together for the long term.

CORE LABORATORY ACTIVITY

## Moose Population Census

### Outcomes

Students will be able to:

1. Perform a census of a large-mammal population in a management area on the island of Newfoundland.
2. Estimate the size of the chosen animal population.

Students will take part in a simulated aerial survey to estimate the moose population in selected moose management areas.

### Introduction

Trying to accurately determine the number of moose—or any mammal—is a challenging task. The island of Newfoundland covers more than 111,000 $km^2$ and Labrador is almost three times as big. Counting every moose in such large areas is impossible. Instead, wildlife managers take a census during aerial surveys and estimate populations.

Several variables can affect the reliability of a census. The province's terrain is rugged and, in some areas, heavily forested. Aerial surveys take place in the winter (when snow limits animal movement), but many large areas have heavy conifer cover, which hides moose from view. And since the surveys can take place on more than one day, a moose counted in one area might be re-counted later in a different location. The size of the area surveyed and human error during sampling also can affect census reliability. Nevertheless, aerial surveys are still the most practical way to estimate wildlife populations.

Moose management areas (MMAs) are divided into numbered 4-square-kilometre blocks. To determine the blocks to be surveyed, block numbers are drawn at random, and surveyed first in a stratification flight (about 200 metres above the ground). During this flight, each block is ranked as high, medium, or low population density. Blocks in each category are then selected in the same percentage as the density profile of the whole MMA. Aerial census flights ("the count") are conducted at about 100 metres above the ground, over twelve to fifteen per cent of the MMA's area. (For example, if an MMA has an area of 2,400 square kilometres, ninety blocks would be surveyed—90 x 4 $km^2$ = 360 square kilometres or fifteen per cent of 2,400 square kilometres.)

Ideal conditions for aerial surveys include clear skies, light wind, and a fresh snowfall (which provides better sighting and tracking conditions). Aircraft altitude varies with environmental conditions and habitat type.

Over open barrens or areas with cutovers and/or low stem density (canopy cover), aircraft can fly higher and faster without causing the census taker to miss tracks or moose. Where stem density is high, aircraft must fly at treetop height to enable observers to see through the canopy. The search time over each block is limited to fifteen minutes, if conditions are good.

The final calculation to estimate the total moose population in the MMA is a complex model based on high-, medium-, and low-density blocks, the percentages of each, and the density per section. Population estimates are based on a "count" of a representative area (around fifteen per cent) within an MMA as described above. The estimate is then corrected for "sightability," a calculated value that takes into account the factors that influenced how well the person counting could see the moose. A sightability multiplication factor of two is commonly used. In other words, if observation suggest a population of 1,200 animals, the final population estimate (after "sightability" is applied) is 2,400 animals.

**Figure 8.14:** Aerial survey's of moose are often conducted during the winter months when their coloration makes them more visible against the background of white snow.

Aerial surveys of moose are time-consuming and expensive, requiring complex factoring to be as accurate as possible. However, managing moose populations is dependent on these sampling estimates.

This activity simulates simple sampling techniques.

## Materials

- Population sampling board
- Grid reference numbers
- 100 – 150 Dry peas or beans
- Small paper (or plastic) cup
- 8.5"x 11" envelope
- Pencil
- Graph paper

## Procedure:

### Part A

1. Using the population sampling board—which simulates a moose management area—determine how many blocks are needed to sample fourteen to fifteen per cent of this "MMA." For example, a grid with 140 blocks would need 20 sampling blocks (140 x 0.14 = 20). Each square on the grid represents a four-square-kilometre block that in real life would be surveyed by helicopter.

2. Randomly distribute 100 peas/beans over the entire area of the grid. Not all squares need to be covered.
3. Cut out the grid reference numbers (1 to 140) individually, put them in a container, and randomly select twenty—the number needed to sample fourteen to fifteen per cent of the MMA. Write the grid reference numbers in the Moose Population Census Data Table (see sample below). NOTE: The number of plots selected must be the same for each survey.
4. Count the number of "moose" (peas/beans) in each of the randomly selected plots.
5. Record the number of moose counted on the data sheet under the appropriate survey. Multiply the numbers of moose (peas/beans) counted by seven—the multiplication factor needed to convert your sample size (20 blocks) into the total MMA size (140 blocks). This will yield a rough estimate of the population size.
   NOTE: If you designed an MMA with a different number of blocks, the multiplication factor will change.
6. Leave the peas on the grid and repeat steps 3 to 5 at least three more times. Remember to keep the number of plots surveyed constant. If you surveyed 20 plots in Survey #1, then survey twenty plots for Surveys #2, #3, and #4.
7. Average the population estimates for each survey. Record the average population estimate in the table. Is the average higher or lower than the actual number of peas/beans you have? What would account for the number being higher or lower?

### Results

Copy the following table in your notebook (adding additional rows to accommodate your twenty plots).

Sample Moose Population Census Data Table

| Survey #1 | | Survey #2 | | Survey #3 | | Survey #4 | |
|---|---|---|---|---|---|---|---|
| Plot # | Moose Counted | Plot # | Moose Counted | Plot # | Moose Counted | Plot # | Moose Counted |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Total counted = | | Total counted = | | Total counted = | | Total counted = | |
| Pop. estimate = | | Pop. estimate = | | Pop. estimate = | | Pop. estimate = | |
| Population estimate for management area = | | | | | | | |

NOTES:

(i) Population estimate (for each survey) = total counted multiplied by "X" where "X" is the multiplication factor (see step 5).

(ii) Population estimate for management area = average of population estimates for all surveys.

Part B

8. Repeat the entire procedure with an uncounted number of peas and determine the accuracy of the sampling.
9. Record the average population estimate and the actual population numbers for each group on the board. (Count the peas/beans *after* you have completed your estimate, and compare the actual number with your estimated number.)

## Analyze and Conclude

1. Why are the plots chosen randomly?
2. Suggest reasons why this type of sampling may not be highly effective for determining moose populations in Newfoundland and Labrador.
3. Determine the average moose population in the classroom. Combine the average populations (Part B) and the actual populations for each group's MMA. Determine the percentage error of your estimation using the following formula:

$$\frac{|\text{estimated population} - \text{actual population}|}{\text{actual population}} \times 100$$

Extensions

1. Find out how a population census of a different wildlife species is carried out.
2. Conduct your own population census of a mammal in the schoolyard or a nearby park.
3. Investigate why knowing the population of a species is important for wildlife researchers and managers.
4. List other factors (age and sex, for example) that could be taken into account during a population census to provide a broader picture.
5. Investigate how wildlife researchers and biologists can effectively estimate the age and determine the sex of moose during aerial surveys.

## Determining Population Sizes

Research and science form the backbone of effective wildlife management. Without them, decisions regarding the province's wildlife and habitats are only best-guess scenarios. To calculate how many moose, caribou, or bear can be safely harvested in a Management Area, the Wildlife Division must first determine how many animals are present. For moose and caribou, aerial surveys can be used to estimate the number of bulls, cows, and calves of moose or caribou, and give an idea of how many young are surviving to adulthood (the "recruitment rate").

Helicopter time is expensive, so aerial surveys are not usually performed every year. Using existing data (collected over a number of years), it is possible to determine population trends—whether a population is increasing or decreasing. Trend data are used to estimate population size for the periods between surveys.

The Wildlife Division also makes use of the information that hunters include on their licence returns, as well as measuring the jawbones of moose and caribou returned by hunters. These can help the Division assess whether hunter success, number of animals seen, and days hunted are increasing or decreasing, and also if the age and sex structure of the population is changing. Input from the hunting public is extremely valuable in guiding efforts to manage the province's moose, caribou, and black bear.

**Figure 8.15:** It is estimated that black bears account for around 30% of moose calf mortality.

## Setting Licence Quotas

Return data from one year's licences guide the Division in adjusting the next year's quota allocation. These data reveal whether the quotas being set are helping achieve target population levels or not. Poaching of big game animals and hunters failing to submit licence returns make it much more difficult for managers to evaluate strategies, and jeopardizes the long-term persistence of big game populations.

When the Division wants a population to remain stable, it sets licence quotas so that harvest plus natural deaths (mortality) is roughly equal to the recruitment rate. If a population increase is desired, recruitment must exceed mortality and the license quota is lowered. If the Division wants a population to decrease, the quota is raised. Quotas are adjusted so that target populations will be achieved and maintained over a long period.

### Setting Target Population Sizes: The Importance of Habitat

Knowing the direction of a population trend (increasing, decreasing, or stable) is a key factor in big-game management. This is particularly true for moose, which will over-exploit their habitat when populations are high and then, as a result, experience a drastic population decline. Recovery can occur only after the habitat regenerates, which may take many years.

Wildlife managers use forest inventory data to determine the amount of suitable moose habitat in each moose management area. When setting population goals they aim for a base target density of two moose per square kilometre of forested area. Other considerations, such as the forest type and the presence of communities, cabins, roads, or farms, can alter target densities within each moose management area.

### The Quota Calculation

The following data are used in the quota calculation:

$$\textbf{Licence Quota} = \frac{P \times (PR - (PL + NM + DC))}{HS}$$

| | |
|---|---|
| Population estimate | P |
| Productivity | PR |
| Poaching and crippling loss | PL |
| Natural mortality | NM |
| Desired change | DC |
| Hunter success | HS |

**Figure 8.16:** A young bull moose. *Photo courtesy Parks Canada/Michael Burzynski*

### Quotas and Socio-economic Concerns

In addition to the scientific data used in calculating and allocating quotas, managers also consider social and economic factors, which can affect how licences are distributed among hunting areas and between resident and non-resident hunters. For example, the number of active outfitters and the projected number of non-resident hunters expected to visit the province for a hunt will influence the size of quotas assigned to outfitters. Managers also consider district and regional concerns, the number of resident hunters, as well as forest harvesting plans.

### Mattie Mitchell

Mattie Mitchell (1846–1921), a hereditary Mi'kmaq chief who knew and respected the land, is officially designated a "person of national historic significance" by Heritage Canada. His exploits included guiding the party herding Lapp reindeer 650 kilometres from St. Anthony to Millertown during a bitter Newfoundland winter. A hunter, prospector, sportsman, and guide, he was described by one client as "without exception the greatest and most resourceful guide and woodsman I have ever known," and is credited with discovering the ore deposits at Buchans.

**Figure 8.17:** Mattie Mitchell. *Photo courtesy the Mattie Mitchell web page/Fred Powell*

## CHECK your Understanding

1. How does the Wildlife Division set the target population size of moose or caribou in a management area?
2. How might forest harvesting affect moose populations?
3. What role does the hunter play in big game management?

### For Further Discussion and/or Research

4. The entire moose population on the island of Newfoundland is descended from four introduced animals. Do you think it is unusual that no negative effects have followed from such a small founder population? Explain your answer.
5. Use the data in the table below to calculate a sample Licence Quota:

| Data | Results |
|---|---|
| Population Estimate (P) | 3,345 |
| Productivity (PR) | 0.47 |
| Poaching and Crippling Loss (PL) | 0.04 |
| Natural Mortality (NM) | 0.07 |
| Desired Change (DC) | 0 |
| Hunter Success (HS) | 0.89 |

6. Repeat the quota calculation, but this time with the goal of reducing the population by fifteen per cent (use -0.15 for Desired Change). How has the Licence Quota changed?

# ROLE PLAY

## Moose in Gros Morne National Park

### Background

Dramatic increases in the population of moose, which are without natural predators on the Island, may be threatening the ecological integrity of Gros Morne National Park. The moose are reducing the diversity and amount of available cover in the forest understorey—the trees and shrubs that grow under the canopy formed by the taller trees. This is critical habitat for forest-floor animals and birds. In areas designated for domestic woodcutting, excessive moose browsing may also be affecting forest regeneration, and thus future wood supplies.

In this role play, the class should be divided into five groups. Each group will take the part of a particular stakeholder (see list below), and will prepare a short position paper (no longer than a page) on what—if anything—should be done about the moose population, from the stakeholder's point of view. Groups then present their position to the class and debate the issue.

### The Stakeholders

*Parks Canada Wildlife Biologist*

You have a Master's degree in Biology and have worked at Gros Morne National Park for the past decade. During this time, you have observed an increase in the moose population and in the number of moose/vehicle accidents in the park. You are also concerned about the effects the moose are having on wildlife habitat. You would like to find ways to control the moose population.

*Parks Canada Plant Biologist*

You have a Master's degree in Biology and have worked at Gros Morne National Park for two years. You have reviewed data related to the effects of moose browsing on the forest composition, and have observed and quantified the damage during your fieldwork. You are interested in finding ways to keep the impact of browsing to a minimum, both inside and outside the cutting blocks where local residents harvest timber.

*Local Resident*

You have lived near Woody Point all your life and are a respected member of the community. During your many years of working in the woods, you have observed changes in the forest as the moose have increased in number.

*Moose Hunter*

Your family has lived in the region for generations. Your father used to hunt moose in areas that are now inside Gros Morne National Park. You are also an avid moose hunter. From what you understand, the moose population in the park has grown since your father's time, partly because hunting has been prohibited. You support the reinstatement of a limited moose hunt inside the park for local residents.

*Member of the Local Tourism Association*

You know that most tourists admire moose and see them as majestic creatures. It is common to see cars stopped on the side of the road in Gros Morne National Park as people try to get a better look at a moose. You do not support a moose cull because you fear it would result in bad publicity for the park and potentially reduce tourism revenue.

## Issue Details

*Moose*

- Outside the park, there is a provincially regulated moose hunt in which 28,000 hunters take more than 20,000 moose each year.

- The park and enclave communities were closed to moose hunting between 1974 and 2005, when a limited hunt was introduced in the Cow Head Enclave. Today moose are hunted in both the Cow Head-St. Paul's Enclave and the Rocky Harbour Enclave during the regular moose hunting season.

- There are no significant predators of moose (other than hunters) inside park boundaries. Black bears will prey on moose calves, but do not have a major impact on the overall moose population.

*Domestic Timber Harvest*

- Domestic harvesting of timber for houses, buildings, boats, and heating has a long tradition in Newfoundland and Labrador.

- The federal-provincial agreement that established Gros Morne National Park allows for eligible residents to continue harvesting timber for domestic purposes.

- The domestic timber harvest inside the park is restricted to twelve cutting blocks with a total area of 194 square kilometres. These blocks account for just over ten per cent of the park area, but contain twenty-five per cent of its forested land.

- Residents who are eligible for timber permits are those people who resided inside the boundaries of Gros Morne National Park or one of its thirteen enclave communities and were 19 years of age or older on August 13, 1973 (the date the

park was established)—and their children. Domestic woodcutting inside the park will cease with the passing of these two generations.

- The potential: 1,600 residents are eligible for timber permits, and each has the right to cut ten cords per year. This means the annual allowable harvest could be as high as 16,000 cords.

- The reality: on average, 260 eligible residents actually cut wood in the park each year. The average total cut was 1,470 cords annually.

Observations

- Moose make heavy use of the small patch-cuts from domestic woodcutting.

- Moose feed most heavily in areas where forests are regenerating. Generally, this includes the forest understorey and the edges of disturbed forest sites.

- Larger natural forest disturbances, such as insect kills, are only significantly exploited by moose when they occur near the forest edge. The centres of these disturbed areas do not appear to be heavily used by moose.

- The moose population in Gros Morne National Park has increased dramatically since the park was established in 1973; there are now approximately 7,800 animals inside its boundaries. The average density is 4.3 moose per square kilometre, but in some locations, the density is as high as 19.5.

- The size of the moose population in the park is mainly regulated by food supply.

- The rapid increase in the moose population is typical of introduced species, which usually overexploit their new habitat and exceed its carrying capacity. This increase is often followed by a crash in the population size before the numbers stabilize at more sustainable levels.

- In Gros Morne National Park, the percentage of total available twigs that moose browsed annually has increased from an average of five per cent in 1977 to thirty-eight per cent in 1996.

- In 1977, the most important sources of browse for moose in the park were Canada yew, mountain maple, balsam fir, white birch, and chuckley pear.

- Between 1977 and 1996, the availability of Canada yew, mountain maple, white birch, and chuckley pear within Gros Morne National Park decreased from 14.6% to 2.2%.

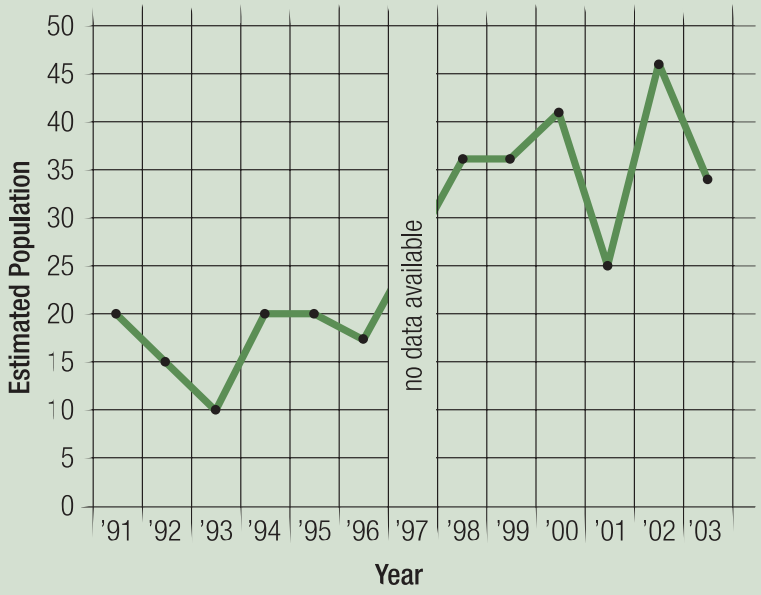
**Figure 8.18:** Estimated Moose Population in Gros Morne National Park, 1971–1998.

| Year | Estimated Population |
|---|---|
| 1971 | 271 |
| 1974 | 1016 |
| 1976 | 600 |
| 1977 | 812 |
| 1991 | 2,200 - 3,200 |
| 1995 | 6,110 - 9,350 |
| 1998 | 6,440 - 9,065 |

- Availability of the same vegetation outside the park appears to be unchanged in the same time period.

- Inside the domestic cutting blocks, the current rate of moose browsing may result in a changed forest canopy. Selective browsing by moose will likely eliminate white birch, and spruce will replace balsam fir as the dominant tree species.

**Figure 8.19:** Moose/vehicle accidents, 1991–2003.




- In all of the park's forested areas, moose browsing has been having a major effect on the forest understorey. The removal or drastic thinning of the understorey also affects other wildlife that rely on it for cover.

- Moose/vehicle accidents are a concern. Currently, there are between thirty and forty accidents on park roads.

**Figure 8.20:** Percentage of available twigs browsed by moose at ten locations in Gros Morne National Park.

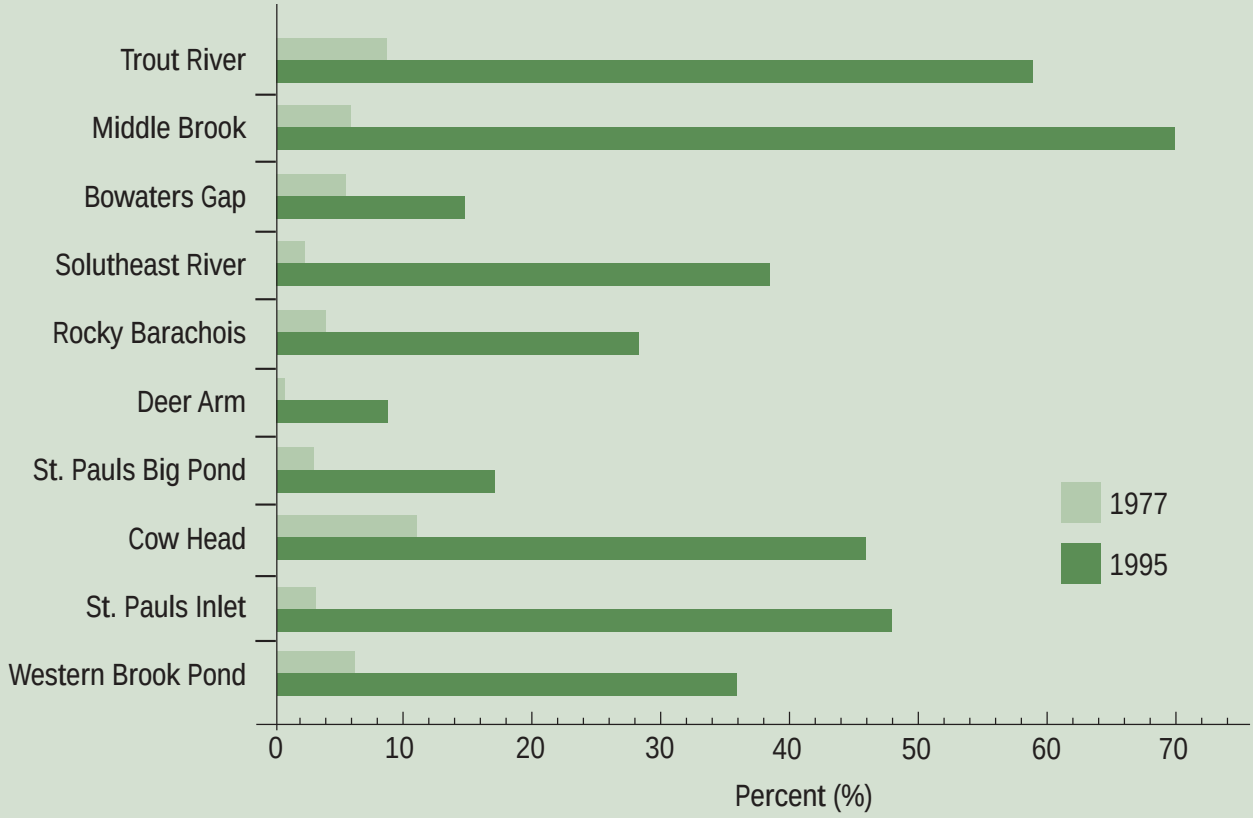


**Figure 8.21:** The Northeastern coyote, a new predator on the island of Newfoundland.

### The Arrival of the Coyote

The appearance of the coyote (*Canis latrans*) has been described as the most significant terrestrial ecological event to occur on the island of Newfoundland since the introduction of the moose. The animal's range now extends over virtually all of the Island, and reports of human-coyote interaction have increased.

To manage this species successfully will require collecting information about the population's health, range, and territory, and its impact on populations of species such as caribou and moose. Coyotes on the Island exist in a unique ecological system: caribou are present and wolves are absent. In other words, coyotes have a food source and no natural predator. Discovering additional differences—if any exist—between coyotes here and elsewhere in North America could also be critical for the management of both the coyote population and its big-game prey.

## ENVIRO-FOCUS

### Coyotes and Newfoundland: Ecosystem Impact

For more than a decade, debate has raged about the appearance and impact of the Northeastern coyote on the island of Newfoundland. How did it get here? How many animals are there? Should there be a coyote bounty? Will a coyote kill the last caribou? A predator species, the coyote's migration to the Island is of concern to outfitters, guides, hunters, berry pickers, and many others with an interest in the outdoors.

During the winter of 1985, there were reports of wolf-like dogs coming ashore off the ice near the Port au Port Peninsula. These were quite likely the earliest known incidents of coyotes arriving on the Island. The first confirmed coyote on the Island of Newfoundland was a pup hit by a car near Deer Lake in 1987. By the mid-1990s, coyote presence had been confirmed in most of the Island. More recently, reports from Goose Bay confirm the animal's presence in central and southern Labrador, as well. The howl of the coyote can now be heard in virtually all parts of North America.

**Figure 8.22:** Coyote carcass collection, Department of Environment and Conservation.
*Photo courtesy Department Environment and Conservation/Wildlife*

The collection and analysis of coyote carcasses has provided considerable information and has answered questions about the species' morphology (physical appearance), body condition, diet, and the age structure of the population. In addition, it has revealed some basic biological differences between coyotes from forested and barren-ground habitats. This information may affect how coyotes are managed in the two distinctly different environments.

To date, the province's Wildlife Division has analyzed more than four hundred carcasses submitted by hunters and trappers on the island of Newfoundland. Some of the information gleaned from this work includes:

- Almost all coyotes had moderate to abundant fat stores, indicating they were in good physical condition. They may be preying more heavily on large prey (caribou) during periods when snowshoe hare populations are low.

- The average age of the coyotes was 1.8 years, and sixty-eight per cent (from 2004–05) were pups and yearlings. The presence of young animals in a harvest usually suggests a healthy and growing population. It also illustrates that adults are difficult to harvest. Efforts to reduce coyote populations in specific areas will need to focus on adult breeding pairs.

- Stomach samples analyzed indicate that caribou, moose, and snowshoe hare

are the principal sources of protein in the coyote's diet from October through April. Other foods included berries, beaver, squirrels, voles, grouse, ptarmigan, and cattle. The moose meat in the samples came mostly from carrion.

- The size of the coyotes ranged from11.2 to 22.7 kilograms, but live animals appear larger. Coyotes on Newfoundland average fifteen to twenty per cent larger than their western cousins.

- Most coyote harvesting is taking place on or adjacent to open barren ground habitats on the south coast and Northern Peninsula, possibly indicating the coyote's preference for open habitat.

**Figure 8.23:** Radio telemetry study.
*Photo courtesy Wildlife Division, Department Environment and Conservation*

During the winter of 2005–06, nineteen coyotes were captured and fitted with radio transmitters. Some of these animals subsequently travelled extraordinary distances. One moved 170 kilometres from its original collaring site, and another moved 110 kilometres. Home ranges of adult paired coyotes are between 140 and 190 square kilometres. This is many times greater than the home ranges reported from other provinces, which confirms that the coyotes on insular Newfoundland occupy a unique niche.

Despite what has already been learned, there is more to know about the coyote in Newfoundland and Labrador. What are the real impacts on game populations? Do coyotes spend more time on open barren-ground habitat than in forested areas? Has the coyote population reached its peak on the Island? The Wildlife Division will attempt to answer these and other questions and gain a better understanding of the biology and behaviour of the animal.

## CHECK your Understanding

1. What is the coyote's main food source on the Island?
2. In what circumstance might coyotes be considered dangerous to humans?
3. What evidence is there that coyotes are a threat to caribou and moose populations in Newfoundland and Labrador?

### For Further Discussion and/or Research

4. If you were a farmer in Newfoundland and Labrador, what would be your best strategy to reduce the threat of coyotes to your sheep and cattle?
5. What should you do if you see a coyote near your community?
6. What can we do to prevent any unwanted contact between coyotes and family pets?
7. Prepare a position paper arguing for or against putting a bounty on coyotes in Newfoundland and Labrador.

Adapted from: *Coyote News* John Blake, Wildlife Division, Department of Environment and Conservation

## RECREATIONAL FISHING

**Figure 8.24:** Catch and release programs allow for recreational fishing activity as well as the protection of the spawning population.

Recreational fishing in Newfoundland and Labrador is among the best in North America. Freshwater fishing (mainly for trout and salmon) is part of our culture: Newfoundland and Labrador has the second highest resident participation rate in this activity of all provinces and territories in Canada. The economic value of the recreational fishery in this province exceeds $100 million.

The management of recreational fishing is the responsibility of the federal and provincial governments. Federal government responsibilities (management of the resource and its habitat) are carried out by the Department of Fisheries and Oceans (DFO) under the authority of the *Fisheries Act*. For example, DFO sets season dates and bag limits, determines which rivers will be scheduled for licenced salmon fishing, regulates fishing methods and equipment, and protects rivers from disruption by other activities.

The provincial government, through the Department of Environment and Conservation, Wildlife Division, is responsible for setting guide requirements, and for the sale and distribution of fishing licences. The two levels of government co-operate on inland fisheries enforcement.

### Recreational Fish Species

Fifteen freshwater fish species are native to the lakes and ponds on the island of Newfoundland. Another twelve species occur in Labrador. Most of the freshwater habitat is dominated by salmonid species—the trout and salmon family.

Some fish species on the Island are different from those in Labrador. Because Newfoundland was repopulated after glaciation by fish that could only arrive from the ocean, its waters have no true native freshwater fish (a species that can live only in freshwater). Most of the fish species found on the Island today are able to spend at least part of their lives in salt water.

**Figure 8.25:** Brook trout in their natural habitat. *Photo courtesy Department of Natural Resources*

Five salmonid species have been introduced to Newfoundland: the brown trout, rainbow trout, lake whitefish, lake trout, and pink salmon. Lake trout and pink salmon did not survive. Brown trout, rainbow trout, and lake whitefish are found only in some areas of the Island.

The primary game fish in Newfoundland are the salmonids; both the salmonids and northern pike are important in Labrador. The salmonids include Atlantic salmon, Arctic char, and various species of trout. They require habitat that is clean, cool, and well oxygenated, and are very sensitive to changes in their environment.

## Fish Habitat

The federal *Fisheries Act* defines fish habitat as the parts of the environment that fish depend on, directly or indirectly, to carry out their life processes. Three basic requirements exist for this: they must have food, must be able to reproduce, and must have cover to protect themselves from predators. Fish use the biological, chemical, and physical features of streams, rivers, and lakes to meet these basic requirements. Fish habitat is thus any area or set of features that provides fish with food or cover, or an environment for reproduction. Since the areas or features necessary for each purpose are not always the same, migratory corridors are also needed to allow fish to move from one location to another.

Fish habitats are sensitive to human activities such as timber harvesting, resource-road construction, herbicide and pesticide spraying, and cabin development. In Newfoundland and Labrador three activities—timber harvesting, resource-road construction, and mining—potentially have the greatest impact on fish habitat.

### Emma Tapper

Emma (Em) Tapper was Newfoundland and Labrador's first female licenced hunting and fishing guide. She grew up in Woody Point, learning how to hunt and fish from her father, who gave her her first fishing rod when she was twelve years old.

Emma began work as a guide at Killdevil Lodge, at Lomond in Bonne Bay, in 1946. She was hired by Lee Wulff, an American sportsman, fly fisherman, pilot, and filmmaker who had set up a series of hunting and fishing camps on the west coast of Newfoundland. Many of her clients were surprised to see her land salmon with her bare hands, rather than with the preferred tool of the time, the dip net. Emma was also an expert hunter who killed her own moose and caribou each fall, and a seamstress who made her own clothes. She travelled the dirt roads of Bonne Bay on an Indian motorcycle in the late 1940s and early 1950s, a time when motorcycles were scarce on the coast. She was described as "a remarkable person and an exceptional guide, who had the gift of making every minute of fishing a joy for those fortunate enough to be under her guidance."

**Figure 8.26:** Emma Tapper (left) preparing a meal for a client. *Photo courtesy Parks Canada*

Source: Parks Canada/Gros Morne National Park

## Habitat Requirements for Brook Trout

The habitat requirements for the brook trout change at different points in its life cycle.

### Spawning

- Occurs from September to November in gravelly areas in headwaters of streams with gravel sizes sub-medium to large (25 to 60 mm in diameter) and low amounts of fine sediment
- Requires a water depth greater than 9 cm with velocities between 0.08 and 0.1 metres per second

**Figure 8.27:** The North American brook trout *(Salvelinus fontinalis)*.

### Fry

- Require areas of low water velocity
- When they first emerge, fry prefer shallows along stream edges, backwater eddies, or slow-current areas midstream

### Juveniles

- Prefer areas of low velocity, gravel/cobble substrate and available cover (in stream debris, cobbles, undercut banks)

### Adults

- Require cool well-oxygenated streams with gravel/cobble streambeds or beaver ponds and pool habitat with low water velocities
- A water depth greater than 0.7 m and water velocities of 0.08 to 0.26 metres per second is required
- Undercut banks, overhanging and in-stream vegetation, and rocks that provide cover from direct sunlight and help keep water cool

## The Amazing Atlantic Salmon

**Figure 8.28:** Salmon fishing. *Photo courtesy Department of Tourism, Culture and Recreation*

The Atlantic salmon is an anadromous fish—it spawns in fresh water but spends much of its life at sea. The Atlantic salmon's historic range included the North Atlantic Ocean and its freshwater tributaries from Ungava Bay to Lake Ontario and southward to Connecticut in the west, and from Russia's White Sea to Portugal in the east. Many of these runs are now reduced or extinct, though Atlantic salmon can still be found in the rivers of Ireland, the United Kingdom, Canada, the Faroe Islands, Iceland, Norway, Sweden, Finland, Russia, France, Spain, and the United States.

### Atlantic Salmon Life Cycle

An Atlantic salmon undergoes many changes during its life. In autumn, salmon spawn in riverbeds. Early the following spring, thousands of tiny Atlantic salmon alevin emerge. Each alevin, about 2 centimetres long, lives off its attached yolk sac and hides from predators in the gravel of the streambed. When the yolk sac is nearly gone, the young fish wriggles up into the water. From this point until they reach 5–8 centimetres in length they are called fry.

When Atlantic salmon develop vertical markings on their sides, they have reached the "parr" stage of life. Parr have dark backs, with nine to eleven bars, the "parr marks," along their sides, which act as camouflage. Parr remain in the river for two to six years, depending on water temperatures and food supply.

When they reach 12–24 centimetres in length, parr undergo a springtime transformation into "smolt." Parr marks are replaced by a silvery coat for better

camouflage at sea. Their internal systems adapt for saltwater life and the fish leave their streams, travelling to ocean feeding grounds. There they grow rapidly on a diet of small crustaceans and fish.

After a year or more at sea, following a hereditary route and timetable, Atlantic salmon return to fresh water, often to the same rivers in which they were born. These extraordinary journeys can cover more than 4,000 kilometres of open ocean. If they return after one winter at sea, they are called "grilse." If they spend two or more winters at sea, they are called "adult salmon." Entering the river between April and November, they navigate upstream, leaping obstructions up to 3 metres high, to spawn in the shallows in late fall.

Some Atlantic salmon populations never go to sea, inhabiting lake and river systems in areas bordering the North Atlantic. These fish follow a cycle similar to sea-run salmon, except that they migrate between deep -lake feeding areas and spawning grounds along shorelines or in tributaries. In Newfoundland and Labrador these land-locked salmon are often called "ouananiche" (pronounced wa-na-nish).

Salmon Counts at Western Brook, Gros Morne National Park, 1984–2008

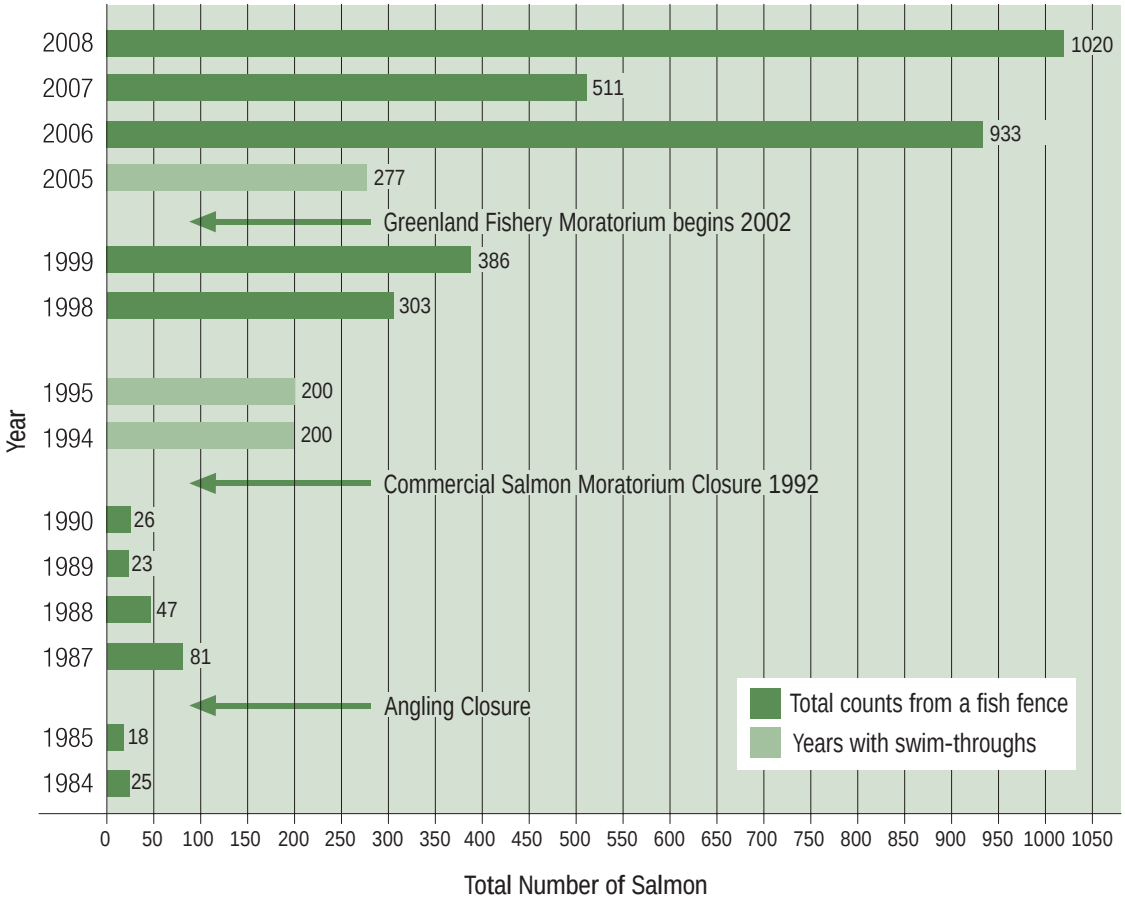



**Figure 8.29:**
In this graph of Western Brook salmon counts since the early 1980s, the solid green bars represent total counts from a fish fence. The shaded bars are counts from years when swim-throughs were conducted. Though swim-throughs are unlikely to count all of the fish in a system, they provide a known minimum number.

### Pressures on Recreational Fishing

There are increasing pressures on the recreational fishery in Newfoundland and Labrador. With tourism becoming a major contributor to the economy, the province will continue to promote itself as a place to experience unspoiled nature and some of the best fishing in North America. As the population ages and more people move into retirement, interest and participation in recreational fishing is expected to increase.

Recreational boating activity is also expected to grow, which may adversely affect aquatic habitats. Increased demand for cabin and resort development will place additional pressure on pristine environments, as well as on those already under a variety of stresses.

## CHECK your Understanding

1. Define fish habitat and list its three components.
2. Describe the lifecycle of the Atlantic Salmon. How might this life cycle make it difficult to manage the population?
3. Outline the responsibilities of the provincial and federal governments in managing the recreational fishery.

For Further Discussion and/or Research

4. Research the effects of forest harvesting and road construction on fish habitat.
5. Have people's views about "outdoors-women" such as Emma Tapper changed? How have they changed?
6. Outline the importance of the following for fish habitat:
    a. food
    b. cover
    c. migration routes
    d. water quality
    e. suitable areas for reproduction
7. Through research on the Internet, find out more about efforts to rehabilitate the Rennie's River and Waterford River systems in St. John's, or a river in your area.
8. Suggest ways that a brook or stream in or near your community can be rehabilitated.

## CAREER SPOTLIGHT:

### Scientist: Fisheries and Oceans Canada

**Figure 8.30:** Dave Reddin, Research Scientist.
*Photo courtesy Department of Fisheries and Oceans*

***Dave Reddin** is a research scientist with the Science Branch, Salmonids Section, in the Aquatic Resources Division at Fisheries and Oceans (DFO), Newfoundland and Labrador Region.*

*Childhood Influences:*
Dave Reddin grew up in Windsor, Ontario, and moved to Newfoundland to attend Memorial University in St. John's. He says that all his teachers influenced him, but the major influences came from his family.

*Main Outdoor Interests:*
Dave has enjoyed being outdoors since childhood—canoeing, hiking, and studying different types of wildlife, particularly fish. He says, "Today I am still interested in the same things. The nice thing is that I get to study different types of wildlife and fish as part of my job."

*Major Life Influences:*
As a child Dave was influenced by his cousin, who worked at the Fisheries Research Board (which is now DFO Science). "My cousin's job intrigued me because of my interest in wildlife and my love of being outdoors." He thought that someday he might end up doing similar work—and as it turns out he works for the same employer. His grandfather encouraged him to do what he wanted to do, and believed that Dave could succeed in any job he was interested in and worked hard at.

*University Background:*
Dave graduated from Memorial University with a Masters in Science. He did his undergraduate degree (Bachelor of Science) at the University of Windsor, and studied marine biology at the University of Guelph.

*Favourite University Courses:*
"My favourite courses were all biology-related," Dave says, "but the best was probably invertebrate biology, which I took at Memorial University. I also really enjoyed fish biology and organic chemistry."

*Typical Work Day:*
In this job, there isn't really a "typical" day. Dave spends a lot of time in the field and he has many different tasks to do.

"Some of my time in the field is spent doing research," he says. "I spend a lot of that time in coastal Labrador, doing stock assessments. I've had some of my most exciting experiences in the field. I am so fortunate in being able to visit places in Labrador that most people will never see—and some have never even heard of!

"I also spend time talking to the public, to anglers and outfitting camp operators, about salmon biology and how it relates to fisheries management. Because most of my field work and research is done in Labrador, I also find I spend a lot of time talking about fisheries biology—specifically stock assessments—with Aboriginal people. Sometimes you'll find me talking with communications people about stock assessments and fish management.

"When I'm in the office, you'll usually find me arranging budgets, preparing data for papers or other documents, and meeting with colleagues about different projects I'm working on, and department projects. When I'm on my computer, I'm usually reading or writing papers, and analyzing data," says Dave.

*"When we understand the behaviours of animals and their relationship with the environment, we can more easily come up with solutions to preserve the environment and the animals living in it."*

*On the Importance of His Work:*
Dave says, without hesitation, "I think it's very important to learn about the environment and animals. When we understand the behaviours of animals and their relationship with the environment, we can more easily come up with solutions to preserve the environment and the animals living in it. I think it's important that we do this, so that future generations can enjoy the environment in the same way that we do."

Dave continues, "In saying this, I wish persons, specifically those in the fishing industry, would understand the salmon life history—because that underpins everything we do. If you don't understand the biology, then it will be very difficult to understand how fisheries management plans are built. I think this is so important, because this knowledge gap causes a lot of unnecessary conflict in the fishing industry."

*Career Advice:*
"To achieve a position in the public service these days will not be easy— but it's not impossible. You have to be willing to work hard, enjoy what you're doing, and understand what you're talking about. I think it's important to get as much education as you can in fish biology and marine science. I also think that once you're old enough, it would be to your advantage to look for summer jobs or internships in your field of interest, within the federal government."

"A career as a research scientist can be very rewarding. I get to do something I love doing, and I meet interesting people and go to interesting places. I've always had an interest in animals, and now it's my job to research fish, salmon, trout, and char."

## Backcountry Ethics for Everyone

No matter what the nature of our wilderness recreational activities—hunting, fishing, hiking, or coastal paddling—we owe it to ourselves and to those who will come after us to take care of the wilderness environment. Little things might seem insignificant, but a thousand of them can have a tremendous impact and ruin the wilderness experience for those who follow in your footsteps.

**Figure 8.31:** While backcountry hiking provides an opportunity to see vast, untouched areas of our province, hikers have the responsibility to minimize their impact on the environment. *Photo courtesy Department of Tourism, Culture and Recreation*

### Travel and Camp on Durable Surfaces

- Travel on durable surfaces: established trails and trailways, rock, gravel, dry areas, or snow.
- Protect riparian areas by camping at least 20 metres from lakes and streams.
- Good campsites are found, not made. Altering a site is not necessary.
- In popular areas:
  - Use existing trails and campsites.
  - Walk single file in the middle of the trail, even when it is wet or muddy.
  - Keep your campsites small. Focus activity in areas where there is no vegetation.
- In pristine areas:
  - Disperse over the area you use to avoid creating campsites and trails.
  - Avoid places where you can see that human activity is beginning to have an impact.
  - Collect firewood rather than cut it.
  - Where possible, try to restore the site so that it resembles the surrounding area.
- Where possible, avoid blazing trails.
- If you must make a trail, use biodegradable flagging tape and remove it if the route is temporary.

### Dispose of Waste Properly

- The rule is: pack it in, pack it out. Inspect your campsite and rest areas for trash or spilled foods and pack out all trash, leftover food, and litter.
- Clean up garbage you find.
- Coastal paddlers should collect and pile plastics above the high tide mark so they do not wash out to sea again.
- In forest ares, deposit solid human waste in holes dug 15 to 18 centimetres deep and at least 60 metres from water, campsites, and trails. Cover and disguise the hole when finished. Burn toilet paper. In coastal areas, dispose of waste below the low tide mark. On the barrens and tundra, leave it exposed.
- To wash yourself or your dishes, carry water 60 metres away from streams or lakes and use small amounts of biodegradable soap. Scatter strained dishwater.
- When cleaning big game, fish, rabbits, etc. dispose of panch, skin, and entrails in an appropriate manner.

### Leave What You Find

- Preserve the past: examine—but do not touch—cultural or historic structures and artifacts.
- Report archaeological finds to the province's Historic Resources.
- Leave rocks, plants, and other natural objects as you find them.
- Avoid introducing or transporting non-native species.
- Do not build structures or furniture, or dig trenches.

### Minimize the Impact of Campfire

- Campfires can cause lasting effects in the backcountry. Use a lightweight stove for cooking and enjoy a candle lantern for light.
- Where fires are permitted, use established fire pits.
- Keep fires small. Use only sticks found on the ground that can be broken by hand. Coastal paddlers should burn wood found along the shore.
- Burn all wood and coals to ash, put out campfires completely, and scatter ashes when they're cool.

**Figure 8.32:** Campfires can be very damaging to the backcountry.

### Respect Wildlife

- Observe wildlife from a distance—do not follow or approach.
- Never feed animals. Feeding wildlife damages their health, alters natural behaviours, and exposes them to predators and other dangers.
- Protect wildlife and your food by storing rations and trash securely.
- Control pets at all times, or leave them at home.
- Avoid wildlife during sensitive times: when they are mating, nesting, or raising young.
- Respect bag limits.
- Close or remove snares at the end of the season.
- Use appropriate snare wire or modified snares.

Source: Parks Canada

### For Further Discussion and/or Research

All forms of outdoor recreation have the potential to affect the environment. Mitigating measures and management practices are put in place to reduce or eliminate their impact. In this unit you have looked at a few recreational activities and their potential affect on the environment. There are many more that can be studied.

Select a different recreational activity that takes place in an outdoor setting. The many to choose from include mountain biking, white water canoeing, bow hunting, backcountry skiing, off-roading (in ATVs or four-wheel drive trucks). Using the Internet or other sources, gather and assess information on the effect of one form of recreation on the environment. Write a one-page report, create a poster or brochure, or perform a song or skit, describing the activity and its potential negative effects on the environment, and suggest ways to mitigate those effects.

### Summary

Newfoundland and Labrador covers a vast area and is fortunate still to have a few large expanses of wilderness. Life in the outdoors has always been part of the culture here—hunting, fishing, berry picking, and cutting firewood have been, and continue to be, both necessary and pleasurable.

With more leisure time than we enjoyed in the past, however, and with increased globalization and a growing tourism sector, the demands placed on the province's wilderness resources will doubtless continue to grow. Just as natural-resource industries depend on healthy natural environments, outdoor recreation has its own challenges and requires monitoring and management to ensure that wilderness remains for all to enjoy in the future.

# Unit 2: For Further Reading

## Books

Wilderness Management, 3rd Edition: Stewardship and Protection of Resources and Values: John C. Hendee, Chad P. Dawson

Soft Paths: Bruce Hampton and David Cole, Stackpole books, 5067 Ritter Road, Mechanicsburg, PA 17055

Sustainable Development: Discussion Document on A Proposed Sustainable Development Act. Government of Newfoundland and Labrador, 2006.

## Articles

Riche, L. (2007, December 5). Winter Fun Ahead. The Nor'Wester, Springdale, Newfoundland and Labrador.

## Websites

"Leave No Trace" is a national and international program designed to assist outdoor enthusiasts with their decisions about how to reduce their impacts when they hike, camp, picnic, snowshoe, run, bike, hunt, paddle, ride horses, fish, ski, or climb. *www.leavenotrace.ca*

Motorized Snow Vehicles and All-Terrain Vehicles Regulations (Amendment) under the Motorized Snow Vehicles and All-Terrain Vehicles Act. *http://www.assembly.nl.ca/legislation/sr/annualregs/2004/nr040154.htm*

Newfoundland and Labrador Snowmobile Federation. *http://www.nlsf.org/faq.html*

Department of Environment and Conservation, Government of Newfoundland and Labrador (2007). *Environmental assessment: a guide to the process.* Retrieved March 18, 2009, from *http://www.env.gov.nl.ca/env/Env/EA%202001/pdf%20files%202007/GuideText April262007.pdf*.

The Nature Conservancy (2009). *What is ecotourism?* Retrieved March 18, 2009, from *http://www.nature.org/aboutus/travel/ecotourism/about/art667.html*.

Department of Environment and Conservation, Government of Newfoundland and Labrador (n.d.). *All terrain vehicle information - lands.* Retrieved March 18, 2009, from *http://www.env.gov.nl.ca/env/lands/cla/atv_info.html*.

Department of Environment and Conservation (2008). *Strategic plan 2008-2011*. Retrieved April 9, 2009, from *www.assembly.nl.ca/business/tabled/envirocon_strategic08-11.pdf*.