

TEACHING KIT

THE BOREAL FOREST

A Global Legacy

Volume 7: The Boreal Forest



Photos: Clayton Rollins

National Forest Week 2006: September 24 to 30

The Canadian Forestry Association is pleased to announce that after careful consultation and consideration, in 2006 National Forest Week will move from spring to fall.

Based on a 100-year legacy of facilitating forest education, the CFA believes this new approach will spur increased year-round learning opportunities for interested Canadians.

Trends show that early education is key to capturing and fostering the interest of youth towards volunteerism, higher education and careers in the forest and environmental sectors. Developing the forestry leaders of tomorrow is critical to ensuring sustainability of our natural resources and the socio-economic and health benefits they provide for all Canadians.

Integral to this learning process is the Canada's Forests Teaching Kit series, which has become the cornerstone of CFA's education and outreach initiatives. Available free to educators, these kits provide tools for helping youth better understand the value of forest resources and the importance of using them wisely.

Beginning in 2006, the annual kit publication date will change to coincide with National Forest Week each September. This is in response to overwhelming feedback from teachers across Canada indicating a strong preference to receive these materials at commencement of the school year for increased and enhanced integration into teaching plans and other outreach activities.

In keeping with tradition, I invite you to join the CFA in celebrating Canada's forests — in September and year-round: plant a tree, walk through a forest or learn about forest management. Your local forestry association can provide more ideas, teaching materials and information about forest activities in your area. If you are planning a National Forest Week event — big or small — be sure to submit it to the CFA's on-line calendar at www.canadianforestry.com.

Barry Waito
Chairman and CEO, Canadian Forestry Association



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The Boreal Forest – A Global Legacy explores the unique natural wealth of Canada's boreal forest. These lessons are designed to provide young Canadians with a wide variety of learning opportunities suitable for all age levels in every classroom, from special needs to gifted to ESL (English as a second language). Lesson topics encompass Science, World Issues, Geography, Visual Arts, Math and Language Arts. Also contained in this kit, is a full-colour poster featuring major tree species in the boreal.

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The Canadian Forestry Association is dedicated to the wise use and conservation of Canada's forest, water and wildlife resources through enhanced public awareness and education programs. The CFA Teaching Kit series provides educators with the tools to help young people better understand the value of forests and the importance of protecting and conserving them.

Canada's boreal forest is unique in that it contains one-quarter of the world's forests, and is one of the largest intact forest ecosystems on Earth. The Canadian boreal region provides habitat for wildlife and people; it stimulates hundreds of thousands of jobs and generates billions of dollars for the nation's economy. Naturally, the survival of the boreal depends on the long-term implementation of sustainable forest land management policies and practices.

The CFA has made every effort to provide a balanced perspective on the interests and activities of forest professionals, biologists, landowners, Aboriginal people, rural and urban citizens, environmental groups, agriculture and industry focusing on a common goal: the judicious conservation of Canada's boreal forest resources. As they are responsible for a tremendous amount of valuable ground-level work including tree planting, habitat conservation, management, planning, and public outreach and education, the CFA dedicates this kit to them.

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Using This Teaching Kit

This kit, the seventh in the Canada's Forests series, is designed to help teachers explore with their students the natural wealth of the boreal: its biodiversity, economic value and social and cultural importance.

The introduction, including boreal maps and statistics, provides useful background information to help deliver the eight lessons that follow. Numerous teaching resources are also included for your convenience.

Target Audience

Since Canada's provinces and territories use various grade specifications and terminologies (such as primary and intermediate), we have indicated only the broad age groups and commonly used levels for each. Some activities can be used with several age groups.

Activity Key



group



hands-on



presentation/performance



writing/recording



research-based



While the CFA grants permission for the photocopying of this entire publication, the pages marked with the photocopier icon are designed specifically as student worksheets.

Curriculum Links

The lessons in this kit are designed to meet the curricula of many different grades and courses across Canada, including Science, World Issues, Geography, Visual Arts, Math and Language Arts. Each lesson includes a broad set of Learning Outcomes describing what students will demonstrate during the activity. Outcomes can be easily expanded to fit curriculum needs.

Flexible and Easy-To-Use Activities

To stimulate teacher and student creativity and engagement in the learning process, this kit includes various hooks – attention-grabbing lesson openers – and extension options.

Web Resources

Visit the CFA Web site, www.canadianforestry.com, to download lessons from previous teaching kits on a wide variety of forest topics, including forest heritage, climate change, species at risk and wetlands.

Please note that several kits, especially Volumes 5 and 6, feature role-play activities based on public consultation concerning forest land-use and management, and other resource issues. The following can be easily adapted for teaching students about the boreal forest.

Volume 6: Forests and Water

What's Your Perspective?

Changes and Choices

Creating a Forest Code of Conduct

Volume 5: Species at Risk

Shrinking Habitat: Share the Space

Live! With the Species At Risk Act (SARA)

Balancing the Cost of Protected Areas

Volume 4: Forest Sustainability

And the Award Goes To...

Volume 3: Biodiversity

Barriers to Biodiversity

Off limits

Volume 1: Canada's Forest Heritage

Forest Values

Contact Us

To order copies of teaching kits, or provide feedback, please contact the Canadian Forestry Association at 1-866-441-4006 or cfa@canadianforestry.com. We look forward to hearing from you.

The Boreal Forest – A Global Legacy

What is the Boreal Forest?

The boreal region – the largest biome on Earth – is one of three global forest types (along with tropical and temperate). Encompassing 33% of the Earth's forests, the boreal covers 11% of its surface. Fifty per cent is located in Russia, 30% in Canada, and the balance is found primarily in Alaska and the Scandinavian countries.

Reflecting the fact that the boreal contains the world's most northern forests, it's natural that the origin of its name traces back to Boreas, the Greek god of the north wind.

Such a large forest ecosystem obviously contains a diverse range of habitats:

- The southern fringe includes the mixed forests of the southern boreal shield ecozone in the east and boreal transition parkland ecozone in the west.
- The heart of the boreal, a vast expanse stretching across Canada, is dominated by coniferous forest, peat-dominated wetlands and numerous lakes.
- The northern boreal region features the taiga, an ecological intersection where the forest meets the arctic tundra. The taiga contains a unique mix of boreal forests and peatlands, and open shrublands and meadows.

By far the most dominant tree species in the boreal forest is the conifer, which has adapted well to the cold harsh climate and the thin acidic soils. Characteristic conifers include black and white spruce, tamarack, jack pine and balsam fir. The most common deciduous species are aspen, balsam, poplar and white birch.

In this land of extremes, the total area affected by massive wildfires and other natural disturbances, such as insects and disease, is five times greater than those affected by timber harvesting. Instinctively, the boreal flora and fauna have adapted to the ravages and opportunities of nature.

Why is Canada's Boreal So Important?

Around the world, the boreal is highly valued for its sustainable economic benefits, extensive recreational opportunities and breathtaking natural beauty. In Canada alone, the boreal provides petroleum products, peat, hydro-electricity and tourism dollars, and sustains over 7000 forestry businesses and 400 000 jobs. Obviously, sustaining this valuable natural resource is a priority. Only 25% of Canada's forests, including the boreal, are managed for commercial use, and only one quarter of one percent is harvested annually. As mandated by law, all harvested areas are regenerated.

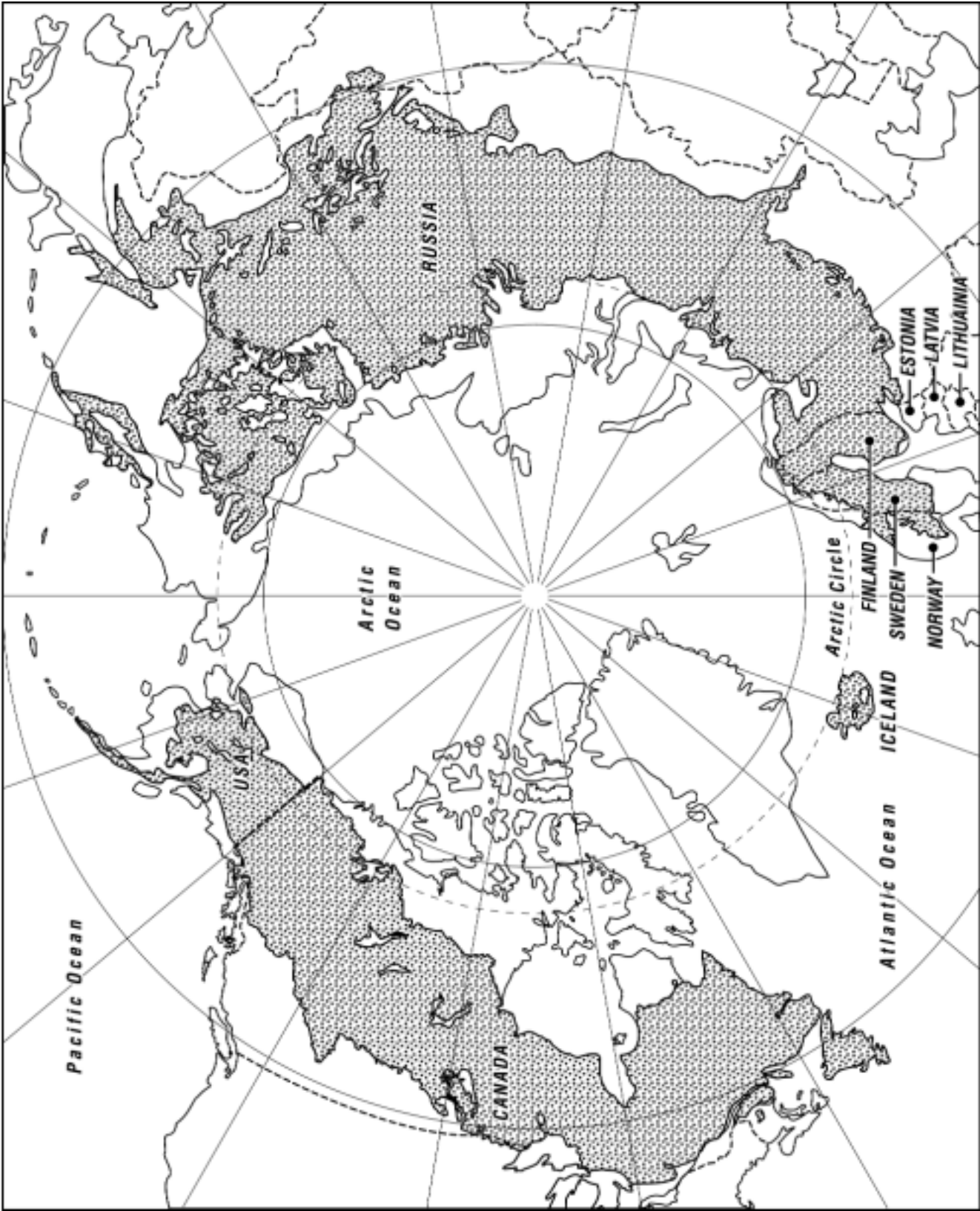
For centuries, people from all walks of life have lived in Canada's boreal communities, and as it did before the arrival of the Europeans, the natural wealth of this region helps sustain the traditional lifestyle of many of our Aboriginal people.

In terms of wildlife, the size, remoteness and variety of landscapes in Canada's boreal provide habitat to great numbers of some of the continent's largest species, including caribou, moose, bear and wolves, and billions of its smallest, such as migratory birds and butterflies. Since it holds more freshwater in its wetlands, lakes and rivers than any place else on Earth, the boreal also provides critical habitat for tens of millions of breeding waterfowl and shorebirds.

Up to three billion warblers, thrushes, sparrows, hawks and other land birds migrate to Canada's boreal region to nest each spring. As well, in dry years on the southern prairie breeding grounds, the boreal wetlands also act as a refugium for waterfowl populations displaced by drought.

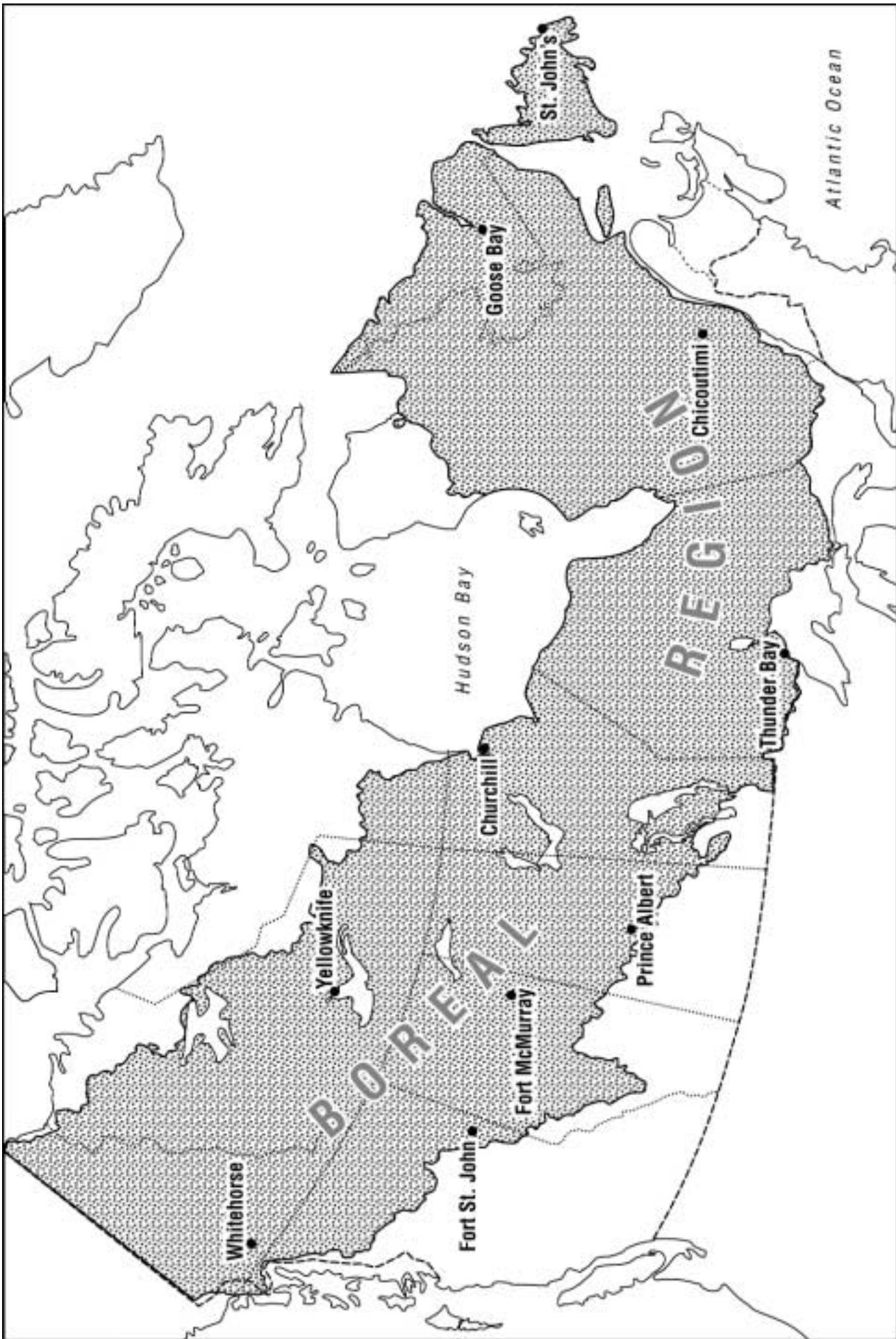
To the benefit of both wildlife and human populations, the boreal forest plays a vital role in the regeneration of natural resources. It filters millions of litres of water daily, stores carbon, produces oxygen, rebuilds soils and restores nutrients.

Boreal forests also play a vital role in mitigating the impact of climate change. They store massive amounts of carbon and comprise one of the planet's few intact natural areas capable of buffering the changes in habitat that will be experienced by many northern species.



The Global Boreal Forest





Canada's Boreal Forest



Why Should We Conserve the Boreal?

Who Cares for Canada's Boreal Forest?

Since over 90% of Canada's boreal is publicly owned, our governments are its primary caretakers. In the south, provincial legislators are responsible. In the Yukon and Northwest Territories, Aboriginal land-claim negotiations and consultations between federal and territorial governments are ongoing. Trends indicate that boreal land-use planning, industrial regulation and wildlife management will continue in this manner, while the role and influence of Aboriginal government is expected to grow.

This is a critical time for Canada's boreal. Increasingly, nationally and internationally, this forest is recognized as a rare example of management of a large-scale ecosystem to ensure sustainability. Mandating protected areas and implementing best forest land-use management practices will go a long way towards achieving this goal – and the work has already begun. In 2004 the International Union for the Conservation of Nature and Natural Resources (IUCN), more commonly known as the World Conservation Union, called for greater protection of the boreal while recognizing that governments, Aboriginal and local communities, and conservation organizations have already made significant contributions, such as:

- Canadian and International Model Forest Networks and national forestry programs;
- national and other sustainable forest-management policies;
- park expansions and protected area strategies developed with – and often prompted by – Aboriginal people; and
- the Boreal Forest Conservation Framework that aims to protect at least half of the region in large interconnected protected areas, and supports world-class sustainable development in remaining areas.

Over the next few years, strategic land-use planning by the boreal provinces and territories will determine Canada's success for generations to come. The collective wisdom of our people and government will establish sound long-term management plans based on successful forest regeneration policies of the past. Canadians are encouraged to exercise their democratic right by participating in the conservation of the economic, environmental and cultural aspects of this irreplaceable – and highly valuable – natural resource.

How Do Canadians Use the Boreal Forest Resources?

Centuries ago, voyageurs and European explorers plied the boreal's extensive waterways to explore new lands. Today, the boreal sustains a large part of the Canadian economy and fulfills many of our human needs.

Where the supply of natural resources dictates, oil and gas are extracted, peat is harvested, hydro-electricity is generated, and precious metals and minerals are mined. Timber is harvested for building supplies, paper production and numerous other by-products; trees are replanted on a continual basis. Of all the industrial sectors in the boreal region, forestry has made the most progress towards the

development, adoption and implementation of leading-edge standards for sustainability.

In the south, significant land and water resources are dedicated to agriculture and transportation. Across this vast landscape – and through four seasons – recreation amenities abound.

For Canada's Aboriginal people, the boreal holds particular cultural significance and provides the many plants that hold special dietary, medical, economic and spiritual value.

How Big is the Boreal?

Area covered by the global boreal: 6.0 million km²
(compared to the area of Australia: 7.6 million km²)

Number of trees planted in Canada's boreal in 2002: 609 million

Average age of trees in Canada's boreal: 100 years

Average forest-fire-return interval in Canada's boreal: 150 years

Portion of Canada covered by the boreal: 58%

Portion of boreal fibre available to support the Canadian forest sector (largest contributor to Canada's gross domestic product [GDP]): 75 %

Portion of Canada's annual wood harvest from the boreal: about 50%

Portion of Canada's boreal currently ecologically intact: 70%

Portion of Canada's boreal currently protected from development: 10%

Portion of Canada's boreal subject to existing and proposed land-use planning: 60%

Portion of Canada's boreal containing water or wetlands: 30%

Number of people living in Canada's boreal: 4 million+

Country with the most certified forests and most certified boreal forests: Canada

Certified forests meet sustainable management standards, and their products carry a designation.

The Boreal's Future

Challenges and Issues

Traditionally, due to their vast size and remote location, the boreal forests and associated wetlands have remained relatively intact and undisturbed by human activity. Resource development throughout much of the boreal ecosystem has been viewed as expensive and unnecessary. However, this trend is rapidly changing. Although 70% of Canada's boreal is not accessible by road, increasingly this undeveloped resource-rich wilderness is being tapped by industry.

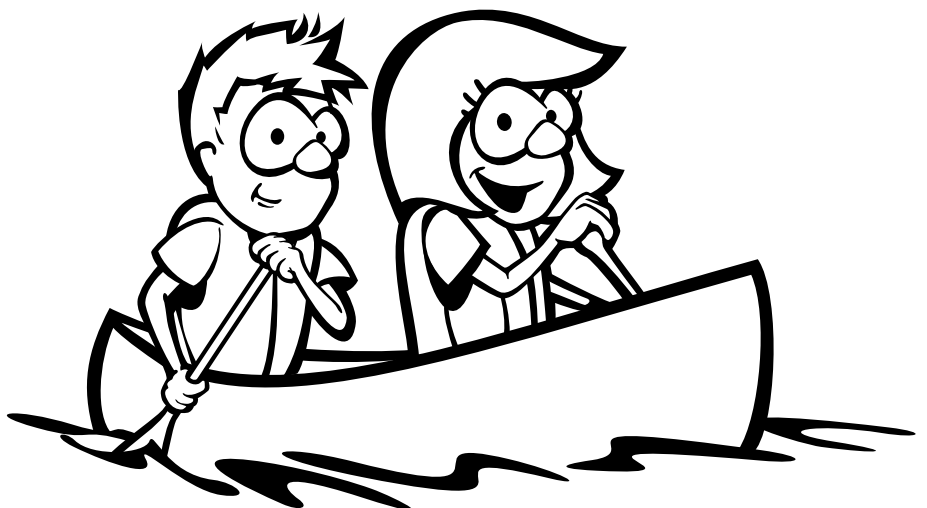
The timber of the boreal – as in all forests – is a renewable resource. However, deforestation (permanent removal of forest) for agricultural use in some southern boreal locations is similar to the role of deforestation occurring in the Amazonian rainforest. Additionally, activities such as petroleum exploration, hydro-electricity generation, peat extraction, forestry and mining create disturbances (roads, pipelines, seismic lines, cut blocks) that result in cumulative impacts and permanent removal of parts of the forest. Such developments bisect various areas of the boreal, fragmenting and disturbing habitat and increasing the potential for conflict between wildlife needs and resource development interests.

Acid precipitation and climate change also continue to affect the integrity of the boreal. As well, residential development is on the increase, particularly throughout southern Ontario where, from the major urban centres of Toronto and Ottawa, the boreal can be accessed within a two-hour drive.

We Can Each Do Our Part

We can all help to conserve and protect Canada's boreal forest resources:

- Recognize the importance of forest communities and the people who live there; learn how they rely on the forest for income and the fulfillment of social, recreational and spiritual needs.
- Plant native tree species in the boreal.
- Protect riparian zones within the boreal.
- Do not litter or pollute, and make an effort to remove garbage when you see it.
- Travel by canoe, kayak and other people-powered watercraft, rather than motorized boats.
- Make known to elected representatives your wishes for boreal conservation and minimal fragmentation.
- Reduce, re-use and recycle to ensure our forest resources are utilized to their fullest.
- Support non-governmental and other organizations also working to conserve the boreal.



Teaching Resources

The Web sites, publications and videos listed here contain a range of facts and opinions. Their inclusion does not necessarily signify CFA endorsement.

* *Boreal Leadership Council members with the Canadian Boreal Initiative*
www.borealcanada.ca

www.borealcanada.ca

Canadian Boreal Initiative (CBI)

Established in 2003, CBI is the convener and secretariat of the Boreal Leadership Council* whose founding members include conservation organizations, Aboriginal people, industry and others. CBI connects science, policy, and activities in the boreal; this site provides many reports and links.

www.borealbirds.org

Boreal Songbird Initiative

A comprehensive guide to 260 boreal birds; in-depth guide to 30 birds. Includes interactive migration maps.

www.bsc-eoc.org/library.html

Library of Bird Studies Canada

Includes two reports on boreal birds.

http://www.taiga.net/index.html

Arctic Borderlands Ecological Knowledge Society

This community network based in Whitehorse, Yukon provides links to reports, boreal organizations and events.

http://www.taiga.net/projectcaribou/index.html

Yukon Department of the Environment

Project Caribou features a wealth of information on caribou including the woodland variety native to many parts of the boreal. Features curriculum links for some jurisdictions, 24 caribou bingo cards, downloadable sound file of caribou grunts and links to other caribou resources. For more caribou material, check out *The Boreal Caribou Research Program* at www.deer.rr.ualberta.ca/caribou/bcrp.htm

www.ducks.ca*

Ducks Unlimited Canada

For 67 years this national non-profit group has worked with landowners, governments, NGOs and corporations to conserve wetlands and associated habitats. Click on *Resources for You* to link to:

- *Ask the Expert* (post your boreal wetland questions),
- interactive North American waterfowl migration maps,
- free bilingual teacher resources and student kits,
- information on classroom programs in your area.

Select *Wetlands and Waterfowl Conservation*, then *Conservation Programs*, then *Boreal Forest*. Senior students can use the *Search* option (keyword: boreal).

www.spaceforspecies.ca

Canadian Space Agency, the Canadian Wildlife Federation, the Canadian Wildlife Service, and the Canada Centre for Remote Sensing

Initiated by Canadian Astronaut Bob Thirsk, this interactive portal is aimed at Intermediate- to Senior-level students. All materials required by users are available on the site and are "meticulously prepared with young readers in

mind." Track the migratory boreal bird Peregrine Falcon (subspecies *Falco peregrinus anatum*). To track the Lesser Scaup visit Bird Studies Canada at <http://www.bsc-eoc.org/lpbo/lpwwrfscauptrack.html>

www.borealforest.org

Lakehead University Faculty of Forestry

This site contains a wealth of information on the global boreal, especially the Ontario region.

www.epals.com

Multi-partner Organization

An on-line school community where one can link with classrooms in and outside the boreal throughout Canada, Russia, Alaska, Finland, Norway, Sweden and the Baltic States.

http://plasma.nationalgeographic.com/mapmachine/conservationmaps.html

National Geographic Society

This portal presents various maps of the boreal relevant to precipitation and land use.

www.learnforestry.com

BC Forest Educators' Network

This site contains forest-related lesson plans, publication and film resource lists, and hyperlinks.

www.modelforest.net

Canadian Model Forest Network

This arm of the Canadian Forest Service is involved in conservation projects, international model forest partnerships, Aboriginal initiatives, and the measurement of Local Level Indicators in the study of sustainability practices. In *Find Out More About*, choose *Boreal Forest* for news and events, publications and projects. Learn more about boreal projects in the Foothills, Manitoba and Lake Abitibi Model Forests.

www.borealcentre.ca

Alberta Centre for Boreal Studies

Includes fact sheets, reports and links, plus a citizen's guide to boreal issues. *Alternative Futures: Alberta's Boreal Forest at the Crossroads* contains 125 colour photos, maps and graphs (\$22.95).

www.cpaws.ca*

Canadian Parks and Wilderness Society (CPAWS)

This national non-profit conservation group is devoted to protecting Canada's wilderness. Under *Special Programs* select *Boreal Forest*, then *Boreal Action Centre* for resources and information about specific campaigns (e.g., Quebec's Dumoine River). Choose *Education* for lessons and activities, five-minute field trips, and a list of regional CPAWS offices for links to teachers in your area.

www.natureconservancy.ca

Nature Conservancy Canada (NCC)

Through fundraising, the NCC purchases and manages land to ensure a natural legacy for future generations. To view boreal habitat-protected areas such as Beavertail Creek, Alberta Choose *NCC Projects*, then use the *Search* sidebar to select *Forests*.

www.globalforestwatch.org

Global Forest Watch

This organization provides reports on various aspects of the boreal and Canada's general biodiversity. Select *Interactive Maps* to see world boreal maps.

www.sierraclub.ca

Sierra Club of Canada

Use the *Search* option for maps and resources relevant to the boreal.

www.naturecanada.ca

Nature Canada (formerly Canadian Nature Federation)

Using the *Search* option will provide links to resources on the boreal.

www.environmentalsociety.ca

Saskatchewan Environmental Society

In *Resources*, choose *Forest* for units and activity booklets from their lending library, such as "Exploring the Boreal Forest" and "From the Ashes: Fire's Role in Renewal", both for Junior to Intermediate levels. (Free on loan, but shipping costs must be paid.)

www.wwf.ca

World Wildlife Fund Canada

From sidebar, choose *Kids and Teachers Site*. Students can select *Boreal Forest 101* for information and maps on the boreal biome. Teachers can select *Teacher's Corner* for resources.

www.hww.ca

Hinterland Who's Who - Canadian Wildlife Service and Canadian Wildlife Federation

This site provides detailed fact sheets on many Canadian species, timely articles and actions citizens can take to help wildlife. Under the section *For Educators*, there are 29 lesson plans.

www.canadianforestry.com

Canadian Forestry Association

Features information on forests, careers in forestry, other teaching kits like this one and supplementary lessons.

www.canadian-forests.com

Canadian Forests

A Web site on forestry in Canada including links to all federal, provincial and territorial governments, the forest industry, service and supply companies, associations and NGOs, consultants, education and research, forestry news and employment opportunities.

http://npsc.forest.ca

National Forest Strategy Coalition

This coalition comprises various governmental and non-governmental organizations and individuals working towards a sustainable forest.

www.cif-ifc.org

Canadian Institute of Forestry

Information about forestry policy, practices and career opportunities.

www.mrn.gouv.qc.ca/forets/quebec/index.jsp

Natural Resources of Quebec (predominantly French)

Contains several reports in PDF format on all aspects of forestry in Quebec.

www.envirothon.org

Canon Envirothon

Canon Envirothon is an annual North America-wide competition for Senior-level students among state/provincial teams for recognition and scholarships. Teams demonstrate knowledge of environmental science and natural resource management through hands-on problem-solving activities in the wilderness. The site provides information on how teams can qualify. Recent Envirothon results are also posted on www.canadianforestry.com

www.nrcan.gc.ca/cfs-scf

Canadian Forest Service

The mandate of this federal department is to promote sustainability of forests and competitiveness within Canada's forest sector. This site includes many reports on various research projects; the spring 2005 *Viewpoint* newsletter contains various articles on boreal issues.

www.fpac.ca

Forest Products Association of Canada (FPAC)

Hosted by Canada's wood, pulp, and paper producers, this portal features reports on the size and nature of various forest types including the boreal, and information on wildlife and sustainable forest management practices. Links to member companies such as Al-pac and Tembec provide access to forest education resources.

www.careercruising.com

Career Cruising

Provides information on jobs in forestry and forest management.

www.jobfutures.ca

Government of Canada

Use this career-planning tool to learn more about forest-related jobs.

www.tbs-sct.gc.ca

Treasury Board of Canada

Find contaminated land and water sites in and around the boreal. Choose *Navigate by Topic A-Z*, then click on *Contamination*. Once in the database, search for contaminated sites by province, territory or electoral district.

VIDEOS

L'Erreur boreale (1999)

Acpav Inc. (Montreal, QC)

T: (514) 849-2281

70 minutes

French with English subtitles

This documentary on logging in Quebec's boreal forest features the work of director Robert Monderie and renowned writer-composer Richard Desjardins. The film critiques Quebec's timber supply and forest management agreements, the use of software to permit cutting beyond regenerating capacity, and the government's relationship with the forest industry.

Being Caribou (2004)

National Film Board

www.beingcaribou.com

72 minutes

Available from NFB and Mountain Equipment Co-op

\$20 for home use; \$49.95 for school

From April to September 2003, environmentalist Leanne Allison and wildlife biologist Karsten Heuer followed the vast boreal/barrenland Porcupine caribou herd on foot across 1500 km, from Old Crow in the Yukon to the Alaskan calving grounds and back. The NFB states "Dramatic footage and video diaries provide an intimate perspective of an epic expedition. At stake is the herd's delicate habitat, which could be devastated if proposed oil and gas development goes ahead in the herd's calving grounds in Alaska's Arctic National Wildlife Refuge." Suitable for Intermediate-level students. Contains scenes of a grizzly bear encounter and caribou calving, which may not be suitable for very young viewers.

King Motion Pictures

www.thislivingworld.com

T: (800) 630-7840

\$24.95 each, shipping included

A series of 18 films on Canadian forests and nature, several featuring boreal content:

Canada's Forest (18 minutes)

The Forests of Canada (48 minutes)

Water (24 minutes)

Alberta: A Centennial Forest History (48 minutes)

Westland Television

www.westlandtv.com

T: (250) 353-2697

Back On Track Productions

\$89/video

This series of detailed videos focuses on land-use planning in the boreal region around Fort St. John, BC.

BOOKS AND TEACHING UNITS

Cool Woods: A Trip Around The World's Boreal Forest

Jane Drake and Ann Love (*Tundra Books*, 2003) ISBN 0887766080

Winner of the Skipping Stones Honor Award in the Ecology and Nature Books category. Readers aged 7 to 9 years are introduced to flora and fauna and the lifecycle of the boreal, from the Siberian Taiga and the Old World forests of Norway to the Boreal Shield of North America and the birch forest of northwest Russia.

Plants of the Western Boreal Forest and Aspen Parkland

Derek Johnson (*Lone Pine Publishing*, 1996) ISBN 1551050587

A good reference book for higher level elementary and secondary school projects, this field guide provides detailed information about plants in the region extending from Alaska to western Ontario. It includes more than 800 colour photographs, 900 line drawings, clear descriptions of species with intriguing notes about edible plants, Aboriginal uses of plants and origins of plant names.

Ecosystem Dynamics of the Boreal Forest:

The Kluane Project

Stanley A. Boutin (*Oxford University Press*, 2001) ISBN 0195133935

A good source of research material for Senior-level biology students, this book describes The Kluane Boreal Forest Ecosystem Project, a 10-year study by nine of Canada's leading ecologists on the impact of the snowshoe hare cycle on plants and fellow vertebrate species in the boreal forest. Researchers traced the plant-herbivore and predator-prey relationships in this ecosystem to determine what drives small mammal population cycles.

Aboriginal Plant Use in Canada's Northwest

Boreal Forest

Robin J. Marles, Christina Clavelle, Leslie Monteleone (*UBC Press*, 2000) ISBN 0774807385

A good reference for higher level elementary and secondary school projects, this handbook describes the traditional use of more than 200 different Canadian boreal forest plants significant to the dietary, medical, economic and spiritual well-being of Aboriginal people. It is the result of original ethno-botanical fieldwork in 29 communities across the boreal forest of Manitoba, Saskatchewan and Alberta, including contributions from over 100 Native Elders.

The Boreal Kingdom: Life in the Great Northern Forest

Wayne Lynch (*Fitzhenry & Whiteside*, 2001) ISBN 1550416170

Another good project reference for higher level elementary and secondary school students; examines the life of boreal flora and fauna throughout the seasons.

BOREAL RESEARCH PROJECT IDEAS

1. What is the size of the global boreal forest? What is Canada's place in the global boreal? What are the key boreal issues in various countries and how are they being handled?
2. Research a boreal community. Tell how it relies on the boreal for income, cultural and spiritual activities, recreation, transportation and food.
3. Study the relationship between Aboriginal people and the boreal. What plants and animals play specific roles in various cultural and spiritual traditions? How are Aboriginal people involved in partnerships in forestry, oil and gas, mining and other industries?
4. Learn about industrial activities within the boreal such as mining, peat extraction, forestry, non-timber forest products, petroleum, tourism, hydro-electricity generation, and agriculture.
5. What tree species live in the boreal? How have they adapted to their environment?
6. Why is the boreal a very important place for migratory and non-migratory resident birds?



Following the Caribou

Age range: 10 to 15 (Junior/Intermediate; see *Extensions* for Senior option)

Time: 60 minutes

Subjects: Geography, Math, Science, World Issues

Resources: *Tracking the Porcupine Caribou Herd* (page 13) map, *The Eight Lifecycle Seasons of the Porcupine Caribou Herd* (page 14) chart, and *Following the Porcupine Caribou Herd* (page 15) worksheet.

Learning Outcomes

Students will become familiar with the lifecycle seasons of the 123 000 Porcupine caribou that live in Canada's boreal region.



Hook: Why Migrate?

Show a video such as the *Earth Navigators*, which features the how's and why's of migration by various species. (PBS 1999; 60-minutes; \$19.95 plus shipping and handling from www.pbs.org, (800) 336-1917.)

Procedure

- 1 Discuss the definition of migration** and explain that there are short and long migrations in the natural world. (Migration is a critical behavioural adaptation: a strategy that boosts an individual's chance of survival and successful reproduction overall, but one that can also result in loss of life. In certain areas when the weather gets colder, birds such as the Robin decide for or against migration, depending on the food supply.)
- 2 Invite two students to come to the chalkboard or flip chart** and act as recorders. Have the students list as many organisms as possible that migrate on a yearly basis (e.g., the monarch butterfly, many birds, whales, bighorn sheep, caribou and salmon).
Next, have students think of methods animals use to find their direction (e.g., position of the sun, landmarks, Earth's magnetic field).
- 3 Now, have them brainstorm** the negative aspects of migration (e.g., energy expended, uncertainty of food sources, natural dangers such as storms and predators, chance of catching disease, man-made obstacles such as roads, communities, mines, transmission towers).
- 4 Ask the students to discuss and record** the reasons animals migrate as part of their lifecycle (e.g., food sources are consumed and must be replaced, favourable living and breeding conditions must be sourced at various times of year).
- 5 Ask each student to use the handouts and worksheets** to map the movement of the herd and answer the related questions.

Extensions

Have older students track the movement of individual caribou using latitude and longitude coordinates from October 1997 to the present. For seasonal lifecycle movements, visit <http://www.taiga.net/satellite/all_seasons.html>. For weekly movements, visit <http://www.taiga.net/satellite/data_archive.html>.

Ask students to create a poster illustrating the eight lifecycle seasons of the caribou with arrows linking the various stages.

Ask students to imagine they are a caribou cow, bull or calf. Have them keep a diary of what is happening in their lives, logging at least two entries for each lifecycle season.

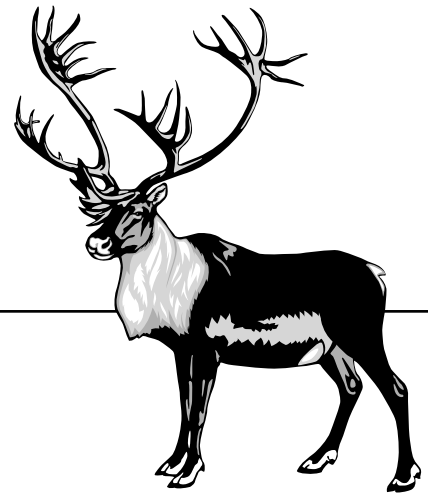
Watch the 2004 film *Being Caribou* (see *Video Resources*, page 9).

Answers

Following the Porcupine Caribou Herd (page 15)

(all measurements are approximate)

- 7.2 cm x 50 km/cm = 360 km
 - 1.1 cm x 50 km/cm = 55 km
 - 3.8 cm x 50 km/cm = 190 km
 - 4.2 cm x 50 km/cm = 210 km
- 22.3 cm x 50 km/cm = 1115 km, but actually the herds travel greater distances (see # 3).
- The points are not totally accurate for two reasons:
 - because the herd moves around frequently at, and between, each point for several kilometres north, south, east and west.
 - because the herd is divided up into smaller groups that move apart from each other and spread out over many kilometres.
- Pregnant cows begin travelling north first as they have a driving instinct to reach the calving grounds along the coast.
- The ocean coast makes a good calving ground because there is an ocean breeze to alleviate insect attack, there are no wolves and there is energy-rich food.
- The herd splits into smaller groups to look for food and windy snow ridges where insect attack will not be as bad.
- Fighting between bulls is a very exhausting endeavour that weakens them. If a predator attacks, the bulls may not have the strength to fight or run.
- We can educate and alert residents and visitors about the caribou migration seasons. We can also reduce snowmobile and other motorized traffic near migrating herds.



THE CANADIAN WILDLIFE SERVICE AND CANADIAN WILDLIFE FEDERATION HAVE FORMED A PARTNERSHIP TO PRODUCE INFORMATION ABOUT MANY CANADIAN WILDLIFE SPECIES, INCLUDING THE CARIBOU. TO LEARN MORE, VISIT THE HINTERLAND WHO'S WHO WEB SITE:

WWW.HWW.CA

WHICH FEATURES VIDEO CLIPS, FACT SHEETS AND MUCH MORE. FOR THE CARIBOU FACT SHEET, SELECT *SPECIES* THEN *MAMMALS* OR *SPECIES AT RISK*, THEN *CARIBOU*. SPONSORED BY THE FOREST PRODUCTS ASSOCIATION OF CANADA, THIS ONLINE PORTAL INCLUDES A MAP ILLUSTRATING THE RANGES OF DIFFERENT CARIBOU TYPES, ADDITIONAL HYPERLINKS, DIAGRAMS AND IMAGES, PLUS INFORMATION ON PHYSICAL CHARACTERISTICS, HABITATS AND HABITS, CULTURE AND ECONOMIC IMPORTANCE, FEEDING, POPULATION STATUS AND BREEDING. WATCH FOR MATERIAL RELATING TO THE BOREAL FOREST IN EARLY 2006.



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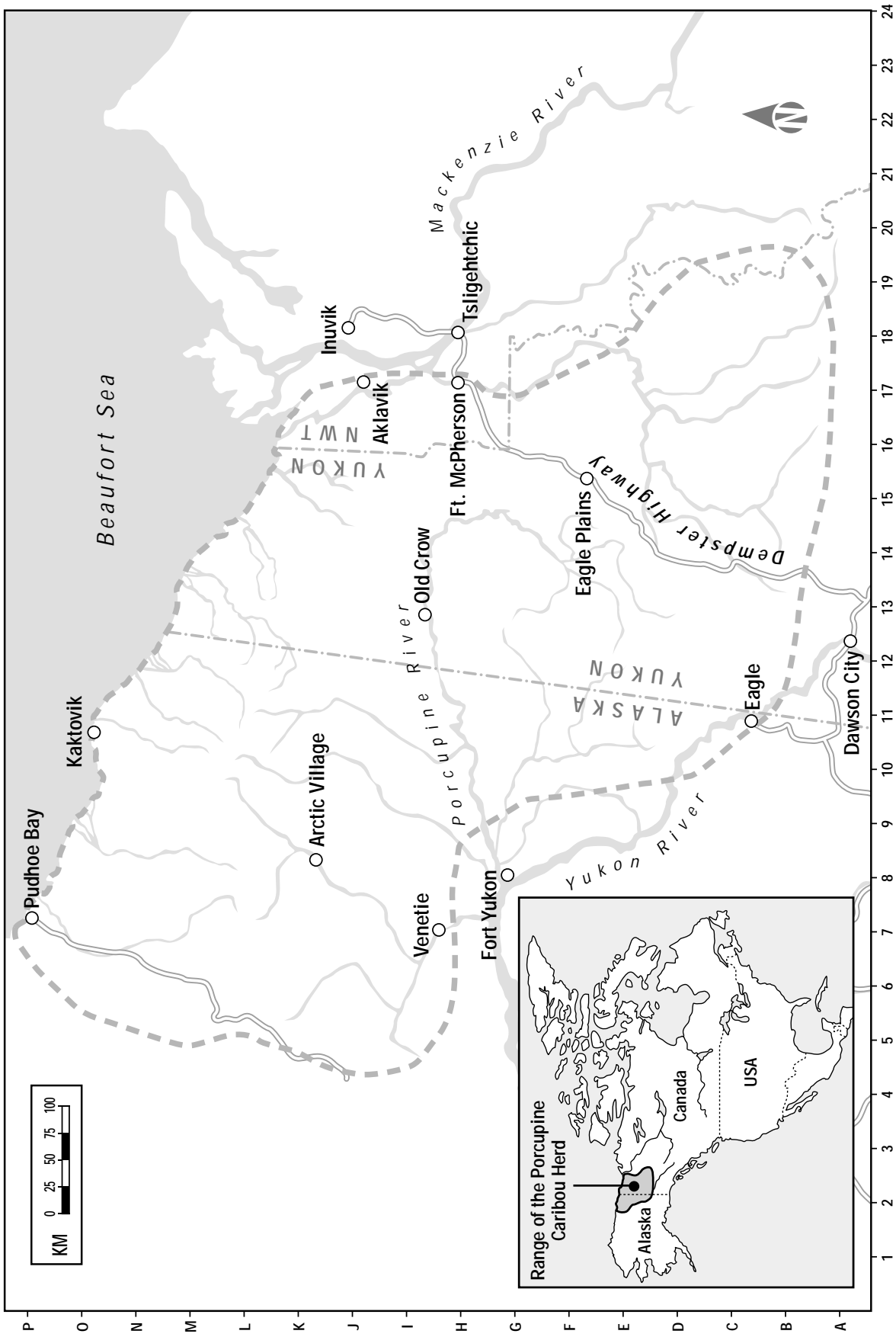
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Tracking the Porcupine Caribou Herd



The Eight Lifecycle Seasons of the Porcupine Caribou Herd

Season	Dates	Characteristics
Winter Feeding	December through March	The weather is very cold. The days are short and snow covers the ground.
Spring Migration and Pre-Calving	April and May	Some snow cover has melted. Pregnant cows begin moving north at a rate of 20 km/day. Deep snow and spring floods can add difficulty to the already taxing journey. Other obstacles include streams, rivers, roads and the Dempster Highway. Bulls, yearlings and dry cows follow weeks later.
Calving	First half of June	The herd travels to the coast of the Arctic Ocean where the winds make this area virtually insect-free. There are fewer predators here as wolves do not travel to the coast because of a lack of denning sites. However, grizzly bears, Bald Eagles and harsh weather can cause mortality in the newborns. The nutritious food allows the new mothers to replenish their energy stores; the cottongrass is in full flower and the willow leaves are budding. There is little or no snow cover.
Post-Calving	Latter half of June	Because of swarming mosquitoes and oestrid flies, the caribou begin to move south. Willow leaves emerge as the herd covers up to 25 km/day, favouring locations along windy ridges for relief from insects.
Movement South	First half of July	Mosquitoes are now at their peak. The herd splits into smaller groups in search of good forage and cool humid areas that provide insect relief.
Movement Southeast	Mid-July to Mid-August	The herd continues to move in small groups, sometimes driven to madly fleeing from the swarming oestrid flies, which are now at their peak.
Late Summer and Fall Migration	Mid-August to early October	The caribou migrate south in a widely dispersed manner, moving slowly or stopping as long as the weather is mild. A sudden drop in temperature or early snow storm speeds them up. Obstacles can again include streams, rivers, roads and the Dempster Highway.
Rut and Late Fall	Mid-October to end of November	There is snowfall at this time of year, but melting occurs. The spectacular rut involves sparring and chasing among the males for mating privileges. This can lead to exhaustion, which makes the bulls easier prey for the bears and wolves that follow the herd.





Following the Porcupine Caribou Herd

Plot the following points on the map, corresponding to eight seasons in the Porcupine caribou herd lifecycle. These points represent the approximate middle of the herd at that point of the year when the number of animals is vast and the herd covers a large area at all times.

1. Winter Feeding (December through March): F/14.5
2. Spring Migration and Pre-Calving (April and May): I/13.5
3. Calving (first half of June): M/11.5
4. Post-Calving (latter half of June): L/12.0
5. Movement South (first half of July): J/12.0
6. Movement Southeast (mid-July to mid-August): H/13.0
7. Late Summer and Fall Migration (mid-August to early October): F/14.0
8. Rut and Late Fall (mid-October to end of November): C/17.0

Answer the following questions on a separate piece of paper, converting cm to km using the map scale.

1. Approximately how far do the caribou move:
 - a) during spring migration (from winter until calving)?
 - b) from calving until early summer (post-calving)?
 - c) from latter half of June until mid-August?
 - d) during fall migration (late summer until rut)?
2. What is the average movement of the herd throughout the year? (Join all the points and measure each line segment. Add all these measurements to calculate the sum.)
3. Why are your points on the map not a completely accurate representation of the herd's movements?
4. What members of the herd first begin travelling north in the spring? Why?
5. Give three reasons why the ocean coast makes a great calving ground.
6. Describe two reasons why in the summer the herd splits into smaller groups.
7. Why is the rut a dangerous time of year for bulls?
8. What can we do to reduce the man-made obstacles and activities that present challenges for the caribou during migration? (Consider roads, highways and towns, snowmobiles and other traffic.)





Boreal Medicine and More

Age range: 12 to 16 (Intermediate)

Time: 45 to 75 minutes,
depending on age

Subjects: Science, Geography,
World Issues, Language and
Reading Comprehension

Resources: *Lost in the Boreal* (page 18)
worksheet.

Learning Outcomes

Students will investigate boreal non-timber forest products (NTFP) that hold economic, social, spiritual and historical significance by hunting through the fact sheets and answering questions. A discussion and paragraph summary will follow.

Backgrounder

Print copies of the 8-page fact sheet *Our Life, Medicine Path: Non-Timber Forest Products of the Boreal* (2005) published by the Taiga Rescue Network, <http://www.taigarecue.org/_v3/files/pdf/102.pdf>. This includes an excellent overview of the role of NTFPs in sustainable forest management, a critical look at some of the most pressing issues concerning the development and marketing of NTFPs, and highlights of the ethno-botanical properties of several boreal species. (You may decide not to copy pages 2 and 8.)

For a detailed Canadian perspective entitled *Non-Timber Forest Products and Sustainable Development in the Boreal Forest* visit <http://www.nrcan-rncan.gc.ca/cfs-scf/national/what-quoi/sof/sof05/special04_e.html> (in *Special Articles* see *The State of Canada's Forests 2004/2005* by Natural Resources Canada).



Hook: Treasures of the Forest

Like all forests, the boreal contains a wide variety of living things that have been used by Aboriginal people and European immigrants for income, food and medicine, and social, cultural and spiritual purposes.

Invite two students to the chalkboard or flip chart to act as recorders. As a class, brainstorm all the useful resources that the forest produces, besides timber. Consider the categories of food, medicine, transportation, art supplies and dyes, and natural species used for social and spiritual needs. Encourage students with strong ties to the land to explain how these various species are used in their family and culture.

Procedure

- 1** Divide students into groups and give each group one or two copies of the *Our Life, Medicine Path* fact sheets. Provide each student with a copy of the *Lost in the Boreal* (page 18) worksheet and read it as a class.
- 2** Have groups read through the fact sheets and answer the questions on the *Lost in the Boreal* (page 18) worksheet.
- 3** As a wrap-up, have students share their comments with the rest of the class or write a paragraph describing:
 - What did they learn about the way the boreal forest can meet physical, economic, social and cultural needs? What surprised them or interested them the most?
 - How do they think people around the world discovered the uses of various NTFPs (e.g., accident, trial-and-error, deduction)?
 - What are some NTFPs that are commonly harvested (e.g., berries, mushrooms, peat)?
 - What is involved in sustainable harvesting practices of NTFPs (see page 7 of *Our Life, Medicine Path*) and how are these similar to sustainable forestry practices? Why are these practices so important to a secure and fruitful way of life, now and in the future? (If we harvest too much of our renewable resources on an on-going basis, and/or do not make sure to replenish the resource, we will no longer be able to benefit from the resource and future generations will do without.)

Extensions

Using collage, have students make a poster, wallet card or small guidebook of non-timber resources in the boreal. Be sure to include information on how to harvest these products in a sustainable manner (see page 7 of *Our Life, Medicine Path*).

Have students research recipes for making antiseptics from blueberry leaves or pine. Be sure they try them out at home.

Have students compare the effectiveness of insect repellent made from the juice of Labrador tea leaves against commercial repellents.

Answers

Lost in the Boreal (page 18)

(Page number indicates relevant reading in *Our Life, Medicine Path*)

1. Bearberry (page 4).
2. Scots pine (*Pinus sylvestrus*) (page 6).
3. Blueberry/bilberry; fruit (page 5).
4. Birch page (page 4).
5. Sphagnum peat moss (page 6).
6. Mushroom; yes (page 3).
7. Labrador tea (page 5).
8. Bearberry (page 4).
9. Sphagnum peat moss (page 6).
10. Labrador tea (page 5).





Lost in the Boreal

Unbelievable but true! While camping with a few friends in the boreal forest, you have become lost. Fortunately it is summer and you are surrounded by the natural resources of the forest. But which species are useful and for what? More good luck: one of you has thought to pack a copy of *Our Life, Medicine Path: Non-Timber Forest Products of the Boreal*. Now you have the information you need to care for yourselves until you are rescued!

1. It's very hot and you have been hiking through the forest. You and your friends have developed some nasty rashes. What is the name of the boreal bush whose leaves can be used to make a salve that will soothe your rash?
.....
2. Supplies are running low and everyone is getting hungry. You have managed to snare a few snowshoe hare and voles, which you'd like to eat on sandwiches. List the species of tree with inner bark that can be ground into flour for making bread.
.....
3. One of your friends (not you, of course) has developed hemorrhoids. What species can help him seek relief, and what part of the plant is needed?
.....
4. After having your backpacks stolen by a wild animal you decide to make baskets for gathering food and medicinal plants. What part of which species can be used to make baskets? (Hint: You can also make temporary shelters using this material!)
.....
5. Ouch! You have cut yourself on a rock. Which species used by soldiers in World War I would you pick to dress your wound?
.....
6. If you were in the Arkhangelsk region of Russia's boreal, what other common food besides berries could you eat? Is this food also available in the Canadian boreal forest?
.....
7. The bugs are driving you crazy! a) Which plant carries leaves that can be used to create a tincture for killing mosquitoes, lice and fleas?
.....
b) Describe the plant for your friends so that they can recognize it.
.....
8. One of your friends has kidney disease. Which plant should this person steer clear of?
.....
9. Someone in the group has had a flare-up of a skin condition known as eczema. What plant do you require and what must you do with it to procure a treatment?
.....
10. Your group has been in the bush so long that you are developing scurvy (a softening of the gums and cartilage due to Vitamin C deficiency). To solve your problem, which leaves should you harvest to make herbal tea?
.....





Boreal Superheroes

Age range: 8 to 12 (Junior)

Time: 30 minutes

Subjects: Science, Geography

Resources: *Tree Superheroes of the Boreal* (page 21), *Animal Superhero of the Boreal* (page 22) and *Match-Up: Superheroes of the Boreal* (page 23) worksheets.

Learning Outcomes

Students will learn how physical and behavioural adaptations of two common boreal species – one tree, one animal – enable them to thrive in the world's most northern forest.

Backgrounder

The boreal is the world's most northern forest. Along its northern edge, the boreal forms the treeline, above which no trees grow. Trees have to be hardy to thrive here. As indicated on the activity sheets, the most dominant tree species are conifers, which are well adapted to the cold temperatures, thin and acidic soils, short growing seasons and dry climate. These include black and white spruce, aspen, birch, tamarack, jack pine and balsam fir. In European and Asian boreal forests, Norway and Siberian spruce dominate. Throughout the vast Siberian section of Russia and in wet areas, larches are most common.

The snowshoe hare is also well suited to flourishing in the boreal. With an adaptable fur colour, long reach, broad feet and hardy young, it is no wonder this species is so prolific. Sometimes, as many as 600 animals live in one square kilometre!



Hook: Superheroes of Adaptation

Explain to your students that there are many animals and plants of the world that are extremely well adapted to their environment.

Procedure

1 **Divide students into small groups**, and have each group describe on paper as many adaptations as possible of some or all of the following organisms. Afterwards, ask groups to present results.

cactus: desert (thick and waxy coating, shallow and widespread roots, spines to protect them from being eaten, slow growing, rigid structure)

camel: desert (special eyelids to protect from sandstorms, storage of water and fat in hump, relatively light coloured, wide-spread feet for walking on sand)

seal: land and cold water (large fat stores, oily fur to prevent cold water from reaching skin, nose closure when diving, flippers and tail)

dolphin: underwater (sonar clicks, long-range vision, aerodynamic body shape, ability to hold breath a long time, bradycardia: slowed heart rate during diving)

birds of prey: hunting from the air (talons to grip prey, extremely sharp vision, ability to dive quickly, sharp beak to tear flesh, thin lightweight bones for flying)

2 **Have the students work through the activity sheets** to discover the great extent to which conifers and snowshoe hare are adapted to Canada's boreal.

Extensions

Have students conduct research and make presentations about other species that have adapted to living in the boreal. These include: caribou, Golden Eagle, beaver, river otter, Arctic fox, grizzly bear, snapping turtle, bison, moose, lemming and many insect species. (For an extensive list, visit www.borealforest.org).

After these presentations, have the class vote on the best-adapted boreal species.

Answers

Tree Superheroes of the Boreal (page 21)

1. The conical shape of most conifer trees promotes shedding of snow and therefore prevents damage to branches. (Answer: Spruce)
2. Having narrow needles or leaves reduces the surface area through which water is lost, especially during winter when the frozen ground prevents plants from replenishing their water supply. As well, the needles of boreal conifers are covered in a thick waxy coating that is waterproof. (Answer: Pine)
3. The dark colour of spruce and fir needles helps the foliage absorb maximum solar energy. (Answer: Spruce, Pine)
4. Evergreens such as pine, fir and spruce retain their foliage over the winter, which means in spring they can begin photosynthesizing immediately. They do not need to waste valuable time in the short growing season to first grow leaves.
5. Conifers are pine, fir, spruce and larches (a deciduous conifer).

Animal Superhero of the Boreal (page 22)

1. Large, furry, long claws, powerful, broad (like a snowshoe!), widely spread toes.
2. Insects, bark, plants, grass, worms, frogs, shrubs and buds. A hare will even scrape flesh off a dead animal carcass for extra protein.
3. Eyes open, fully furred, can hop around upon birth.
4. Jumping (up to 3 m in one bound) and running (45 km/h).
5. Seasonally changing colour from brown to white and back again.
6. SNOWSHOE HARE.

Match-Up: Superheroes of the Boreal (page 23)

- | | |
|------|-------|
| 1: O | 9: E |
| 2: J | 10: D |
| 3: K | 11: B |
| 4: I | 12: G |
| 5: C | 13: F |
| 6: P | 14: H |
| 7: A | 15: M |
| 8: N | 16: L |



Tree Superheroes of the Boreal

The boreal forest is no place for wimps! The animals, birds, insects, plants and trees that live in this ecosystem are hardy and strong, able to withstand very cold and usually quite dry conditions. For each question, circle the type of tree, leaf or needle that will do best in the boreal.

1. **Lots of snow falls in the boreal.** Trees here need to be shaped so that the snow slides off easily; otherwise it builds up and breaks branches. Broken branches lead to reduced growth, disease, insect attack, and even tree death. Circle the tree shape below that lets snow slide off most easily.



Maple



Weeping Willow



Spruce



Poplar

2. **The boreal forest is very dry, even though it receives lots of snow.** Trees here need to prevent water loss through their leaves. Which leaves have the least surface area, thus the least loss of water?



Oak



Maple



Pine



Weeping Willow

3. **The boreal forest is very cold for much of the year.** Dark colours absorb maximum heat. Trees here need to have the darkest green leaves possible, because dark foliage absorbs the sun's heat more effectively. Which trees have the darkest leaves?



Maple



Weeping Willow



Spruce



Oak



Pine

4. **The boreal growing season is very short.** Trees that lose their leaves have to grow new ones each spring (deciduous), but trees that keep their leaves can start growing right away (conifers). Circle all the trees below that keep their leaves throughout the year.



Maple



Balsm Fir



Black Spruce



Poplar



Pine

5. **The soils in the boreal are very acidic.** Conifers are able to grow in acidic soils better than broadleaf (deciduous) trees. Which of the following trees are conifers?

PINE

FIR

MAPLE

POPLAR

SPRUCE

LARCH





Animal Superhero of the Boreal

Only the tough survive in the boreal! Animals in these forests and wetlands possess many behaviours and physical features that allow them to survive. Work through the questions below to learn more about a very well adapted boreal animal, one that is extremely successful at surviving in the world's most northern forest!

1. **This animal needs to move easily** over the soft snow of the boreal forest, with feet that can grip into the ground when speed is required. List five words that describe the type of feet and claws that come in handy in the boreal.

- a)
- b)
- c)
- d)
- e)

2. **This animal must be able to eat almost anything.** Name five living things that a small animal can eat in the boreal forest.

- a)
- b)
- c)
- d)
- e)

3. **The young offspring of a prey species must be able to survive on their own soon after birth.** Compared to baby mice, birds and kittens, the newborns of this boreal species are ready to go from birth. Can you think of two ways they are different from the other babies? (Hint: try to picture baby mice and kittens.)

- a)
- b)

4. **To be able to escape a predator, an animal needs certain abilities.** Name two skills that an animal could use to escape danger.

- a)
- b)

5. **This animal needs to be able to hide from predators** in the boreal summer, when the land is green and brown, and in the winter, when the boreal is usually snow-white as far as the eye can see. Describe an ability (regarding fur) that would help an animal become invisible in these changing environments!

- a)

6. Rearrange the letters below to learn the name of this boreal animal superhero!

WSONHSEO AERH





Match-Up: Superheroes of the Boreal

-
1. Maximum number of litters born in a year to a snowshoe hare (litter is a batch of babies).
 2. Common boreal tree species.
 3. Top speed of a snowshoe hare.
 4. Hares will scrape meat off these for protein.
 5. Thin leaves of conifer trees that minimize water loss.
 6. Triggers moult and change in fur colour.
 7. In this weather, cone-shaped conifers avoid broken branches.
 8. Waxy coated needles protects trees from this.
 9. Number of hares in 1 km² if conditions are right.
 10. Colour of needles that maximize absorption of sun's energy.
 11. Predators of the snowshoe hare.
 12. Process by which a tree or plant uses the sun's energy to make its food.
 13. Maximum distance covered in one leap by snowshoe hare.
 14. Forms northern treeline, above which no trees grow.
 15. Conifers are able to thrive on these.
 16. Waste time and energy growing new leaves each spring (unlike conifers).
- A. heavy snowfalls
 - B. eagle, fox, wolf, bear
 - C. needles
 - D. dark green
 - E. 600
 - F. 3 metres
 - G. photosynthesis
 - H. boreal forest
 - I. carcasses
 - J. spruce, tamarack, pine
 - K. 45 km/hour
 - L. maple, oak, poplar
 - M. acidic soils
 - N. dry climate
 - O. four
 - P. amount of daylight





B is for Boreal

Age range: 5 to 8 (Primary)

Time: 45 to 60 minutes

Subjects: Visual Arts, Science,
Language Arts

Resources: scissors and glue, and
Living Things of the Boreal Forest
(page 25), *B-O-R-E-A-L* (page 26),
and *Getting to Know Boreal Plants
and Animals* (page 27) worksheets.

Learning Outcomes

Students will become familiar with some common boreal species by matching up names with images, and then answering questions.



Hook: Who Lives in the Boreal?

Introduce students to a map of the boreal forest (using the coloured poster in the CFA Teaching Kit Volume 6, or from page 5 of this kit). Discuss the uniqueness of the boreal in terms of the amount of intact forest habitat that it provides for so many animals. Habitat includes room to find a mate and raise young, hunt and/or forage, and source water and shelter. Discuss predator-prey relationships among these animals.

Procedure

1 Using the *Living Things of the Boreal Forest* (page 25) worksheet, scissors and glue, have students cut out the plants and animal names and paste them beside the matching images.

2 Ask students to cut their completed worksheets into image-and-word squares. Onto the *B-O-R-E-A-L* (page 26) worksheet, the students should glue the various squares in the row of the chart, that matches the first letter of that plant/animal name (e.g., RAT should be glued in the 'R' row). There are two organisms per letter.



3 Older students can then answer the questions on the worksheet entitled: *Getting to Know Boreal Plants and Animals* (page 27).



Extensions

Ask students to make a list of boreal species and group them under many different categories, such as predator/prey, mammal, bird, insect, reptile, amphibian, plant and tree, or types of habitat preferred (grassland vs. wetland vs. forest).

Using the organisms illustrated on page 25, ask students to categorize the animals as follows: fastest to slowest, heaviest to lightest, loudest to softest. Ask them if they can think of other ways to categorize these animals.

Older students can make a food web of boreal plants and animals.




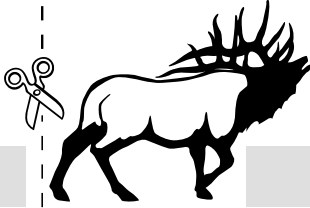





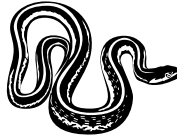




Answers


Getting to Know Boreal Plants and Animals (page 27)

- | | |
|---|---|
| 1. Boreal Owl and Arctic Fox. | 6. Larch, Oak, Ant. |
| 2. Eastern Garter Snake, Norway Rat,
Arctic Hare, Lemming. | 7. Elk. |
| 3. Herring Gull. | 8. Herring Gull, Boreal Owl,
Eastern Garter Snake. |
| 4. Ant. | 9. Ant, Snake. |
| 5. Arctic Hare, Arctic Fox,
Eastern Red Oak. | 10. Herring Gull. |



Living Things of the Boreal Forest

- | | | | | | |
|---|----------------------|-----------------|---------------|----------------------|---------------|
|  Lemming | Boreal Owl | Bufflehead Duck | Elk | Rabbit - Arctic Hare | Carpenter Ant |
| Arctic Fox | Eastern Garter Snake | Larch | Bighorn Sheep | Norway Rat | Oak |





B-O-R-E-A-L

B

O

R

E

A

L



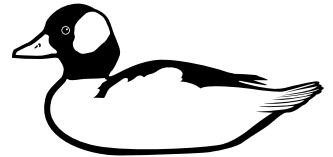


Getting to Know Boreal Plants and Animals



Examine your completed B-O-R-E-A-L worksheet. Use the sheet to answer the questions below.

1. Which two animals are predators? (These animals eat other animals).
 a) b)
2. Which four animals might these predators eat?
 a) c)
 b) e)
3. Which one dives for some of its food?
 a)
4. Which creature has no bones, but a hard outer shell instead?
 a)
5. Which three change colour during the year? (Be careful to think hard about this answer!)
 a) c)
 b)
6. Besides lemmings, hares and rats, which three organisms have the most offspring?
 (Hint: For the others, try to estimate how many offspring each has.)
 a) c)
 b)
7. Which animal is probably the fastest of all those on your sheet?
 a)
8. Which animals lay eggs? (Be careful to think hard about this answer!)
 a) c)
 b)
9. Which two spend the winter underground? (Hint: It's not the Lemming, Arctic Hare or Rat!)
 a) b)
10. Which one eats lots of crayfish, snails, leeches and clams?
 a)



The Canadian Boreal: A World Heritage Site?



Lesson Five

Age range: 16 to 18 (Senior)

Time: 120 minutes

Subjects: World Issues, Civics, Geography

Resources: Internet access; two class sets of *Atikaki/Woodland Caribou/Accord First Nations Area* (page 29) worksheet, one class set photocopied with the sidebar “Parks Canada Responds” BLANKED OUT (see Step 3) and one class set INCLUDING (see Step 6) the sidebar, which contains the answers from Parks Canada.

Learning Outcomes

Students will examine the criteria used to select a World Heritage Site. They will then conduct Internet research to determine how these criteria apply to a proposed section of Canada’s boreal forest.

Backgrounder

One of Canada’s proposed World Heritage Sites (WHS) is located in the boreal, east of Lake Winnipeg. The Atikaki-Woodland Caribou site includes the Woodland Caribou Wilderness Provincial Park in Ontario, the adjoining Atikaki Provincial Park in Manitoba, and five First Nations. The Bloodvein River, a Canadian Heritage River, runs between them. Canada has 13 WHS, four within the boreal:

- Gros Morne (NL)
- Kluane/Tatshenshini-Atsek (YT & BC)
- Nahanni (NT)
- Wood Buffalo (AB and NT)



Hook: World Heritage Sites

Using an overhead or computerized projector, show students a map of World Heritage Sites (see <http://whc.unesco.org/en/map/>). Discuss the origins of the United Nations Educational, Scientific and Cultural Organization’s (UNESCO) World Heritage Site initiative (see <http://whc.unesco.org/en/about/>). Note that seven new sites were chosen on July 15, 2005.

Procedure

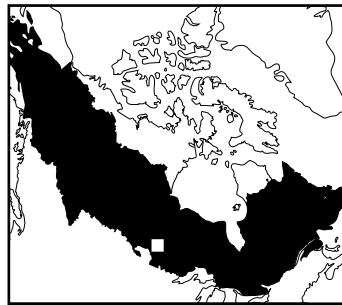
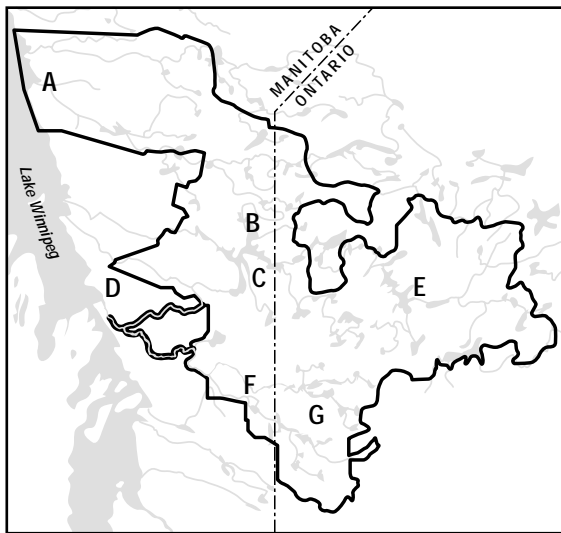
- 1 In pairs or small groups, have students brainstorm** five criteria that UNESCO might use to select World Heritage Sites.
- 2 Have the groups share their ideas** with the rest of the class. On a chalkboard or flip chart, record the criteria they have in common.
- 3 As a class, review the *World Heritage Site Criteria*** (page 29). Be sure the students are viewing the page with the sidebar “Parks Canada Responds” BLANKED OUT. Explain that each confirmed WHS has to meet one or more of the ten criteria.
- 4 Show the class the map** of the Atikaki/Woodland Caribou/Accord First Nations Area on page 29. Explain that this part of the Canadian boreal, bordering Manitoba and Ontario is a proposed WHS.
- 5 Using the following Web sites**, individually or in groups, ask students to use the Internet to research this proposed WHS:
www.poplarriverfirstnation.ca/
www.wildlandsleague.org/bigwild/heritagesite.html
www.borealnet.org/documents/BFN2004b.pdf
www.borealcanada.ca/news_e.cfm?p_id=235 (Within this document, you can also select the PDF link: *Complete Recommendation text*.) Students should gather information to support their claim that this area meets **four** WHS criteria.
- 6 Have students summarize their findings in a report to the WHS Committee.** Once the students have submitted their reports to you, review and discuss *Parks Canada Responds* (page 29). Did they choose these same criteria?
- 7 Discuss the value of a WHS designation.** For example, selection may provide protection against destruction, but not necessarily. Many WHS have been degraded by war and vandalism. Who should care for WHS – government and/or private organizations? What are the possible economic impacts of such designations? What are the possible pros, cons and tradeoffs of receiving a WHS designation?



Extensions

Ask students to research and justify WHS designation for each of the ten other proposed areas. See Canada’s Tentative List for World Heritage Sites, at http://www.pc.gc.ca/progs/spm-whs/itm3-/index_e.asp

Atikaki/Woodland Caribou/Accord First Nations Area



- A Poplar River First Nation
- B Pauingassi First Nation
- C Little Grand Rapids First Nation
- D Bloodvein First Nation
- E Pikangikum First Nation
- F Atikaki Provincial Park
- G Woodland Caribou Provincial Park

World Heritage Site Criteria

Any property that is nominated as a World Heritage Site will be considered to be of outstanding universal value when the WHS Committee finds that it meets one or more of the following criteria. It must:

1. Represent a masterpiece of human creative genius;
2. Exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town planning or landscape design;
3. Bear a unique or at least exceptional testimony to a cultural tradition or civilization that is living or has disappeared;
4. Represent an outstanding example of a type of building, architectural or technological ensemble, or landscape illustrating a significant (or stages) in human history;
5. Represent an outstanding example of a traditional human settlement, land-use, or sea-use representative of a culture (or cultures) or human interaction with the environment, especially when it has become vulnerable under the impact of irreversible change;
6. Be directly or tangibly associated with events or living traditions, ideas, beliefs, or artistic and literary works of outstanding universal significance. The Committee prefers that this criterion be used in conjunction with other criteria;
7. Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
8. Contain outstanding examples representing major stages of Earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features;
9. Represent outstanding examples of significant ongoing ecological and biological processes in the evolution and development of terrestrial, freshwater, coastal and marine ecosystems, and communities of plants and animals; and
10. Contain the most important and significant natural habitats for in situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

PARKS CANADA RESPONDS

The Atikaki/Woodland Caribou/Accord First Nations land meets the following four of ten World Heritage Site criteria:

► CRITERIA 5:

The site, which represents an outstanding example of traditional lifeways by Aboriginal people in the boreal ecozone, exemplifies a land-use representative of a culture and human interaction with the environment.

► CRITERIA 7:

It has exceptional natural scenic values, with wild rivers and extensive undisturbed boreal forests, lakes and wetlands.

► CRITERIA 9:

It is an intact boreal landscape demonstrating a range of ecological processes relating to glacial history and fire ecology.

► CRITERIA 10:

It contains a good variety of species typical of the region as well as one threatened species (woodland caribou) and one species of special concern (chestnut lamprey).



Boreal 101



Lesson Six

Age range: 8 to 12 (Junior)

Time: 60 minutes

Subjects: Visual Arts, Geography,
Social Studies, Science

Resources: scissors, glue, *The Boreal Forest* (page 32 and 33) and *Introducing the Boreal Forest* (page 34 and 35) worksheets.

Learning Outcomes

Students will learn about biological, geographical, cultural, economic and global aspects of Canada's boreal.



Hook: Variety in the Boreal

Show the 18-minute film *Canada's Forest* (see *Video Resources*, page 9).

If students have not seen a map of the boreal, make handouts or an overhead of page 5, or show the poster from CFA Teaching Kit Volume 6. Students will realize just how much of Canada this forest covers.

Procedure

1 As a class, define whether or not your community is located in the boreal. Have a classroom discussion about what the boreal forest means to us as Canadian citizens.

They may focus on trees, wood and paper products, camping and fishing.

Ask them to list other resources and activities not normally associated with a forest, such as:

- metals and minerals,
- oil and gas,
- farming,
- bird watching,
- ceremonies and events,
- plants and herbs used for food, cultural and spiritual purposes (by Aboriginal and non-Aboriginal people alike).

Explain that they are going to discover that there is much more to the boreal forest than they would ever have thought!

2 Put students in pairs; each pair should have glue, scissors, *The Boreal Forest* (page 32 and 33) and *Introduction to the Boreal* (page 34 and 35) worksheets.

3 Ask students to cut out the blocks of information on *Introduction to the Boreal*, and paste them under the correct headings on *The Boreal Forest* worksheet.

4 Afterwards, discuss the variety of boreal facts and activities that they just learned about and the ways in which this forest is valued. Were students surprised by any of the information? Remind students that, as is the case everywhere, the industries, cultures and individuals involved with the boreal adapt over time to address new technologies, developments and concerns.



Extensions

Review what the class has learned about the boreal region. Across the top of a chalkboard or flip chart, write the word BOREAL. Have the students refer to their *Boreal Forest* worksheets to find things that correspond to each letter.

For example, under B, they could call out: birds, bear, blueberries, Bald Eagle, British Columbia, birch, better mining, balsam, burn, benefits (such as?),

The Boreal Forest (page 32 and 33)

B	O	R	E	A	L	F	O	R	E	S	T
BOREAL PROVINCES AND TERRITORIES	OIL AND GAS INDUSTRY	RESOURCES FOR MINING	EATING AND HEALING	ANIMALS, BIRDS AND TREES	LIGHTNING BRINGS WILDFIRE	FOREST FACTS	OTHER BOREAL COUNTRIES	RECREATIONAL OPPORTUNITIES	ELECTRICITY (HYDRO DAMS)	SPIRITUALITY AND CULTURE	TIMBER HARVEST AND REGENERATION
British Columbia	Oil and gas wells are found mostly in Alberta	80% of Canada's mining takes place in the boreal	Sap from the paper birch is a medicinal tonic	Coniferous trees include spruce, balsam and fir	Jack pine cones open when this occurs	Global boreal absorbs vast amounts of CO ₂ , a greenhouse gas	United States (Alaska)	Bird-watching	Canada is world's largest producer of this power	People of all cultures find spiritual value in the boreal	Boreal forestry provides hundreds of thousands of jobs
Quebec	This industry's roads, pipelines and wells impact the boreal	Mining provides us with precious metals like gold and nickel	Russians eat the nuts of dwarf Siberian pine	Over three million song birds and waterfowl breed here	On average, fire strikes any given boreal area every 150 years	Global boreal filters millions of litres of water daily	Russia (holds 50% of global boreal forest)	Cross-country skiing	Hydro is a clean, pollution-free source of electricity	Aboriginal culture is closely tied to the land	60% of Canadian forestry occurs in the boreal
Saskatchewan, Manitoba and Ontario	The Alberta oil sands lie within the boreal	Mining provides us with minerals like uranium and potash	Sphagnum peat moss is good for cuts and rashes	Predators such as Bald Eagle, wolf, bear and fox	Causes plants like fireweed to appear afterwards	Global boreal includes the world's northern forests	Finland, Norway, Sweden (Scandinavia)	Fishing	Harnessing the power of falling water	Cree culture is known for its birch-bark-biting art	Timber provides wood, pulp and paper products
Alberta	Oil companies are starting to minimize disturbances such as roads	Diamond mining occurs in several boreal locations	People pick blueberries and bearberries in the boreal	Deciduous trees like aspen, balsam, poplar and white birch	The biggest boreal disturbance, exceeding pests and forestry	Canada's boreal covers 58% of its land mass	Latvia and Estonia	Camping	There are drawbacks and benefits to hydro power	Boreal forest is important in Native culture and livelihood	By law, timber harvesters must replant
Yukon and Northwest Territories and Nunavut	Another name is petroleum products	Mining, drainage and roads have an impact on the boreal	Labrador tea plant is a good source of vitamin C	Herbivores like moose, beaver, muskrat, deer and caribou	Lightning fires often start in dry, rocky places	World's three forest types: tropical, temperate and boreal	Lithuania	Hunting	Most dams in Canada are in the boreal	One Native spiritual custom is the Vision Quest	Boreal forestry supports 7000 businesses in Canada
Newfoundland and Labrador	Thousands of Canadians work in the oil and gas sector	Mining in Canada is changing for the better	Mushrooms are gathered in the boreal	Small mammals include the snowshoe hare and lemming	Fire consumes only 1/3 of living material in a burn area	Global boreal covers 11% of Earth's surface	Scotland	Hiking	Dams, reservoirs and transmission lines impact the boreal	Boreal plants and animals are part of native cultural practices	All forestry activity requires long-term planning and management



The Boreal Forest

B BOREAL PROVINCES AND TERRITORIES	O OIL AND GAS INDUSTRY	R RESOURCES FOR MINING	E EATING AND HEALING	A ANIMALS, BIRDS AND TREES	L LIGHTNING BRINGS WILDFIRE





F FOREST FACTS	O OTHER BOREAL COUNTRIES	R RECREATIONAL OPPORTUNITIES	E ELECTRICITY (HYDRO DAMS)	S SPRITUALITY AND CULTURE	T TIMBER HARVEST AND REGENERATION



Introducing the Boreal Forest

Predators such as Bald Eagle, wolf, bear and fox	Newfoundland and Labrador	Small mammals include the snowshoe hare and lemming	Another name is petroleum products	Timber provides wood, pulp and paper products	Mining in Canada is changing for the better
Cree culture is known for its birch-bark-biting art	Harnessing the power of falling water	Mining, drainage and roads have an impact on the boreal	There are drawbacks and benefits to hydro power	British Columbia	By law, timber harvesters must replant
This industry's roads, pipelines and wells impact the boreal	Mushrooms are gathered in the boreal	Camping	Lightning fires often start in dry, rocky places	Mining provides us with precious metals like gold and nickel	Over three million song birds and waterfowl breed here
Sphagnum peat moss is good for cuts and rashes	On average, fire strikes any given boreal area every 150 years	Herbivores like moose, beaver, muskrat, deer and caribou	Boreal plants and animals are part of native cultural practices	Global boreal includes the world's northern forests	Boreal forestry provides hundreds of thousands of jobs
Scotland	People of all cultures find spiritual value in the boreal	Fishing	Jack pine cones open when this occurs	Latvia and Estonia	Yukon and Northwest Territories and Nunavut
Saskatchewan, Manitoba and Ontario	Sap from the paper birch is a medicinal tonic	80% of Canada's mining takes place in the boreal	Bird-watching	Oil and gas wells are found mostly in Alberta	Global boreal filters millions of litres of water daily



Finland, Norway, Sweden (Scandinavia)	All forestry activity requires long-term planning and management	Boreal forest is important in Native culture and livelihood	Hunting	Hydro is a clean, pollution-free source of electricity	Oil companies are starting to minimize disturbances such as roads
The Alberta oil sands lie within the boreal	Global boreal covers 11% of Earth's surface	Quebec	Fire consumes only 1/3 of living material in a burn area	60% of Canadian forestry occurs in the boreal	Coniferous trees include spruce, balsam and fir
People pick blueberries and bearberries in the boreal	Lithuania	Diamond mining occurs in several boreal locations	Alberta	Mining provides us with minerals like uranium and potash	Most dams in Canada are in the boreal
Causes plants like fireweed to appear afterwards	Aboriginal culture is closely tied to the land	Dams, reservoirs and transmission lines impact the boreal	Labrador tea plant is a good source of vitamin C	Boreal forestry supports 7000 businesses in Canada	The biggest boreal disturbance, exceeding pests and forestry
Russians eat the nuts of dwarf Siberian pine	World's three forest types: tropical, temperate and boreal	Thousands of Canadians work in the oil and gas sector	Cross-country skiing	Hiking	One Native spiritual custom is the Vision Quest
Canada is world's largest producer of this power	Global boreal absorbs vast amounts of CO ₂ , a greenhouse gas	Russia (holds 50% of global boreal forest)	United States (Alaska)	Canada's boreal covers 58% of it's land mass	Deciduous trees like aspen, balsam, poplar and white birch





Fire: Agent of Change

Age range: 16 to 18 (Senior)

Time: two 75-minute classes on computer, one in class

Subjects: Science, Geography

Resources: Internet access,

Understanding Fire Ecology and Prescribed Burns (page 38), *Planning a Prescribed Boreal Burn* (page 39) and *Mapping a Prescribed Burn* (page 40) worksheets.

Learning Outcomes

Students will analyze the role of natural fires and prescribed burns in the life and management of the boreal forest.



Hook: The Power of Fire

To introduce students to fire and fire management in Canada's boreal forest, gather some statistics, then facilitate a question-and-answer session for the class. To access statistics and facts about fire and the boreal, visit:

Ontario

<http://affm.mnr.gov.on.ca/spectrasites/internet/affm/fire.cfm>
In *Fire Information*, select *Fire Statistics* and/or *Current Fires*.
In *About Forest Fires*, select *Fire Management Facts*.

Alberta

http://www3.gov.ab.ca/srd/wildfires/fpd/mfp/mfp_pub.cfm
Select *Wildfire Information*.

Manitoba

<http://www.gov.mb.ca/conservation/fire/>
Select *Current* or *Archived Information*.

Saskatchewan

<http://www.se.gov.sk.ca/fire/>
Select *Wildfire Information*.

Canada

http://nfdp.cfm.org/compendium/fires/tables_index_e.php

Natural Resources Canada

Report: *The State of Canada's Forests 2003-2004* available at
http://www.nrcan-rncan.gc.ca/cfs-scf/national/what-quoi/sof/latest_e.html

Procedure

- 1** During the first two class periods, give students the worksheets *Understanding Fire Ecology and Prescribed Burns* (page 38) and have them complete the questions by consulting with the provincial Web sites it lists.
- 2** During the third class, review what they have learned and ask them to share their answers.
- 3** Individually or in groups, ask students to plan a prescribed burn using the handout *Planning a Prescribed Boreal Burn* (page 39) and *Mapping a Prescribed Burn* (page 40).
- 4** After the students are finished, have them discuss their answers.



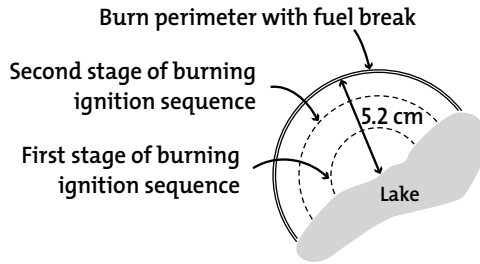
Extensions

Watch the video *Wildfire: A Force of Nature* [King Motion Picture Corporation, 29 minutes 1995, English only; www.thislivingworld.com or (800) 630-7840]. Visit www.learnforestry.com, the Web site of the British Columbia network of forest educators. In *Lesson Plans*, you will find a *National Forest Week* teaching package entitled *Force of Fire*.

✓ Answers

Planning a Prescribed Burn (page 39)

1. The prescribed burn should be located along the northwestern shore of the lake.



2.
$$\begin{aligned} \text{Area of burn} &= 40 \text{ hectares} = \frac{1}{2}\pi r^2 \\ 40 &= 0.5 (3.14) r^2 \\ 40 &= 1.57 r^2 \\ 26.1 &= r^2 \\ \text{square root of } 26.1 &= r \end{aligned}$$
Therefore r (radius of semicircle) = 5.2 cm (see #1).

3. To create a fuel break you must:
 - cut down the trees in a two or three-metre swath (the width of one bulldozer blade) along the burn perimeter
 - use heavy equipment to displace leaf litter so that only soil and some stumps remain.

Note that a soil barrier does not guarantee the fire will be contained within the burn area. Weather and wind conditions are the deciding factors.

The tree-cutting crew requires chainsaws, hard hats, chainsaw pants, eye protection and steel-toed boots.

The heavy equipment operators need hard hats, eye protection and steel-toed boots. Of course, everyone needs training in the proper use of the equipment and first-aid certification.

4. See #1.
5. One crew must be responsible for complete implementation of ignition. Most other crews should be placed along the various ignition lines, with an emphasis near any hazards (e.g. clear-cut) just outside the burn. A couple of crews should be on stand-by in trucks, ready to go where needed.
6. Possibly. It depends on wind direction and whether the smoke is at ground level or high above the ground. Sometimes ground-level smouldering is evident the morning after the burn, so traffic assistance may then be needed.

Understanding Fire Ecology and Prescribed Burns

On a separate piece of paper, answer the following questions.

1. The Role of a Forest Fire

- What are three common effects of a forest fire on plants and trees?
- Describe five specific effects of a forest fire on various wildlife species.

For information, visit:

- ▶ Ontario – <http://affm.mnr.gov.on.ca/spectrasites/internet/affm/fire.cfm>
In *About Forest Fires*, select *Science of Fire*, then *Fire Ecology*.
- ▶ British Columbia – <http://www.for.gov.bc.ca/protect/burning/prescribedfire.htm>
Read *Fire in Nature*.
- ▶ Manitoba – http://www.gov.mb.ca/conservation/parks/popular_parks/fire83/
Consult *Introduction* and *Section 1: Reborn of Fire*.
- ▶ Saskatchewan – <http://www.se.gov.sk.ca/fire/insect-disease>
Select *Fact Sheet 7: Fire Ecology*.

2. Prescribed Burning

- Describe eight situations in which prescribed burns are conducted; provide specific examples for each.
- List and explain five factors that are considered when planning the location, size and ignition of a prescribed burn.

For information, visit:

- ▶ Ontario (as above) –
In *Managing Fire*, select *Prescribed Fire*.
In *Issues in Fire Management*, select *Prescribed Burns*.
- ▶ Alberta – www3.gov.ab.ca/srd/wildfires/fpd/mfp/mfp_pub_wm_prescribed.cfm
- ▶ Manitoba – www.gov.mb.ca/conservation/forestry/
In *Forest Renewal*, select *Site Preparation*; scroll down to *Prescribed Burning*.
- ▶ Saskatchewan – www.se.gov.sk.ca/fire/insect-disease
Select *Fact Sheet 5: Prescribed Burning*.

3. Introduction to Planning a Prescribed Burn

You will now participate in an interactive exercise introducing the decision-making process for planning a burn. It takes about 60 to 75 minutes to complete, and can be done in pairs.

- ▶ Go to <http://www.tallgrassontario.org>
- ▶ Select and read *Fire and the Prairie*.
- ▶ Select and read *Prescribed Burns*.
- ▶ Select and read *Prescribed Fire Decision Support System*. At the bottom of this Web page, click to begin.
- ▶ Follow the instructions, agree to the software licensing agreement and answer the questions.

Upon completion, examine the output data based on your input variables.

- What is the significance of having deer on-site?
- What is the significance of site visibility?
- What is the cost and time commitment to conduct the burn?
- Describe some of the factors that need to be considered with regard to internal and external communications.



Planning a Prescribed Boreal Burn

You are the Burn Boss. The planning and safe execution of this prescribed boreal burn is your responsibility. Wildlife, your crews, and people in the surrounding area are counting on you to do your job correctly. This section of boreal jack pine forest will be burned mainly to help prevent and/or contain future forest fires.

As part of the necessary paperwork for a prescribed burn (all 10 cm of it!), you must draw a map and outline the steps the burn crew will follow. Before the burn, you must also contact the public, alert emergency services, arrange for traffic assistance on nearby roads due to smoke, receive approval to proceed, monitor weather forecasts and conduct a final weather check on burn day.

On a separate sheet of paper, answer the following questions.

STEP 1: The small lake in this area provides an ideal moisture break that you will use to contain the fire. The wind usually blows from the northwest. On the *Mapping a Prescribed Burn* worksheet on page 40, draw a semicircular area where the burn should be placed.

STEP 2: Based on the number of people and heavy equipment available to you, this burn will be about 40 hectares in a semi-circular shape (1 hectare on the map = 1 cm²). Using the equation for area of a semi-circle, solve for radius and draw the burn perimeter (a line enclosing the semi-circular burn area).

$$\text{Area of burn} = 40 \text{ hectares} = \frac{1}{2}\pi r^2$$

$$\text{Therefore } r \text{ (radius of semicircle)} = \underline{\hspace{2cm}}$$

STEP 3: All along the burn perimeter, your crews must create a fuel break.

a) What are the two tasks involved in this?

b) List the equipment that is required to do this work; include safety equipment.

STEP 4: The prescribed burn ignition sequence will occur in three stages. Draw a line inside the burn area along which you will start the fire, and then another line along which you will introduce the second-stage burning. The third stage will occur along the perimeter.

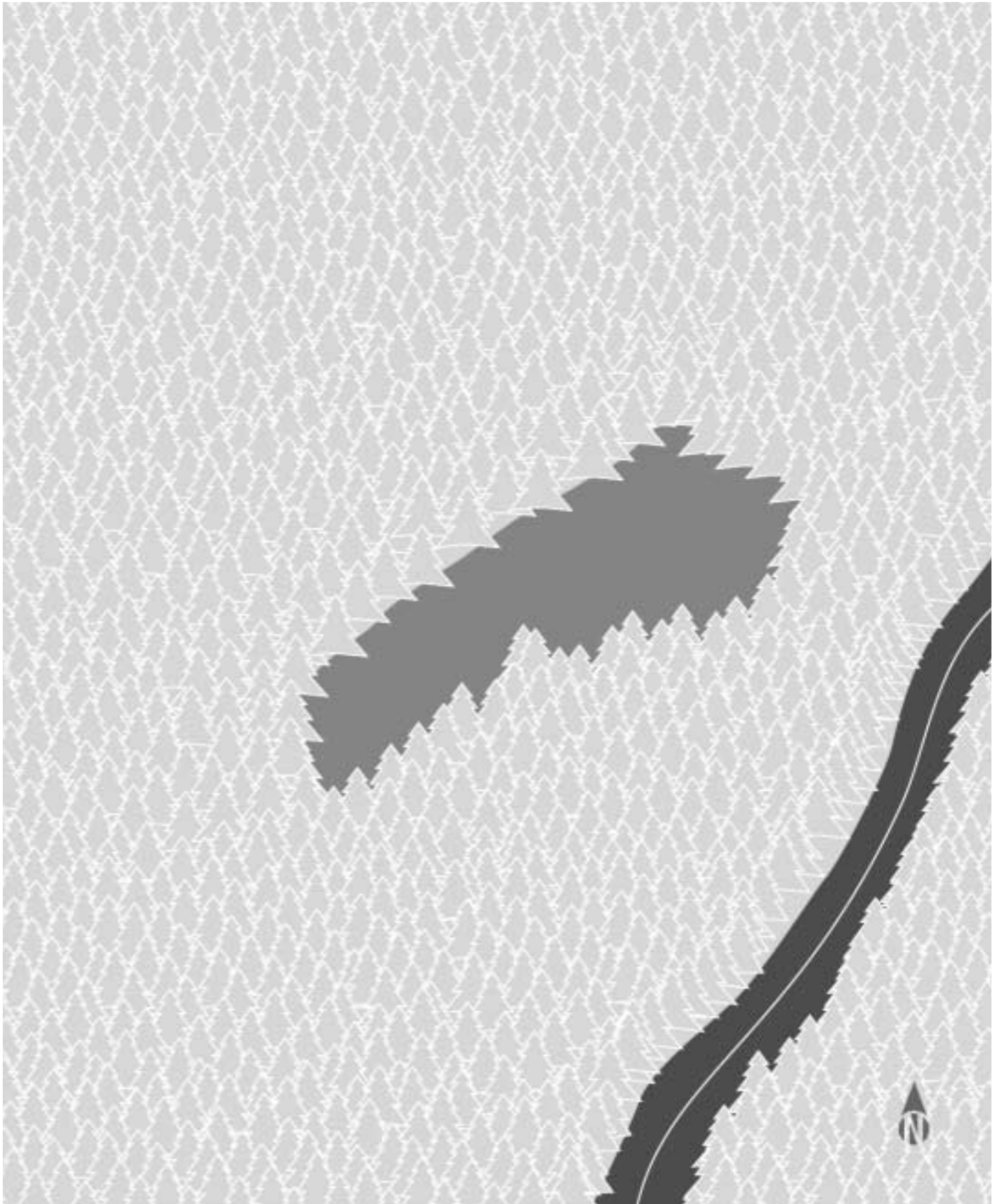
STEP 5: You have seven fire control crews at your disposal. Describe where you will place your crews during each stage of burning.

STEP 6: Explain the conditions under which you will need to direct traffic on the road due to smoke from the prescribed burn.





Mapping a Prescribed Burn





Boreal Footprints

Age range: 5 to 9 (Primary to Junior)

Time: 60 minutes

Subject: Visual Arts, Language Arts, Science

Resources: paint and large sheets of paper, potatoes or dense styrofoam pieces for making stamps (brought from home), butter knives or peelers, paint brushes, markers for labelling, *Boreal Footprints* (page 42) handout.

Learning Outcomes

Students will create paint stamps for the footprints of various boreal animals, use the stamps to create a painted boreal scene, and write a sentence to describe the action in the painting. To simplify the activity, students could cut and paste the footprints on paper.

Hook: The Story in Pictures

Have students look at several suitable pictures – posters, photographs or paintings – that illustrate a story using images. Ask various students to tell the class what is happening in the picture, what happened before this point, and what might happen next. Alternatively, you could have everyone write a sentence describing what's happening in the picture.

Explain that they are going to make their own pictures, to tell the story of what's happening in the boreal forest.

Procedure

1 Give each student a copy of the handout: *Boreal Footprints* (page 42). Ask each student to choose the two animal footprints they would like to work with, or assign footprints so all are used. (Alternatively, use a photocopier to enlarge the footprints and ask the students to cut and paste them onto paper. Skip to Step 3.)

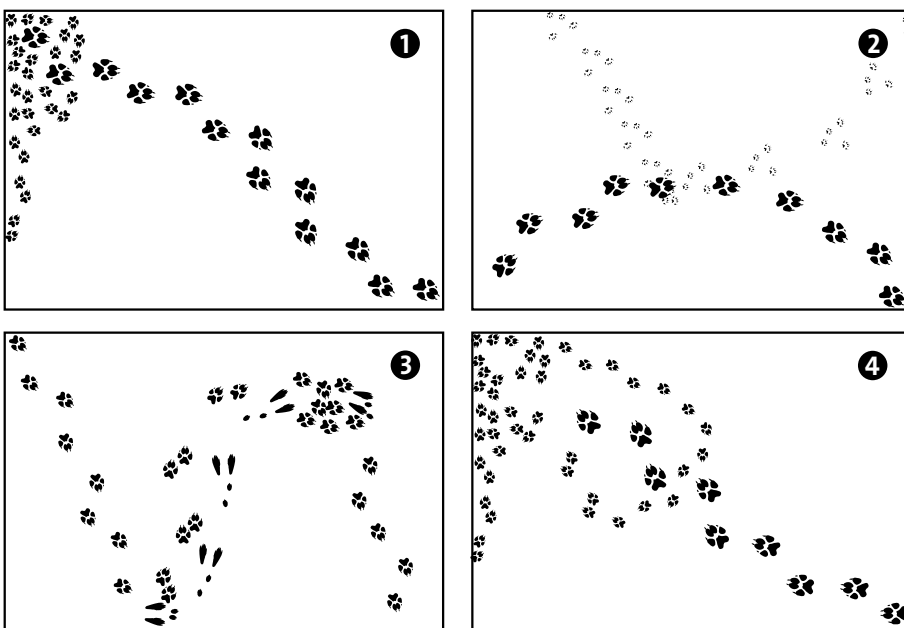
2 Have students transfer the footprint outline to the flat face of a potato (which has been cut in half) or a block of styrofoam. They should then use butter knives and peelers to carve away the negative space around the outline.

3 Using the two stamps, each student should create a scene illustrating how their two boreal animals interact. For example, what happens if a bear meets a deer, a lemming meets a fox, or a wolf meets a hare. See *Extensions* below.

4 Once their picture is complete, have each student write a sentence to describe what has happened in their scene. Then have each student come to the front of the class and tell the story they have illustrated.

Extensions

Working in small groups, have older students create a story that spans four or five scenes (like a comic strip). For example:



Scene 1: Mother fox leaves the den (small fox footprints around the den and mother fox prints leaving the scene).

Scene 2: Mother fox meets a lemming; she attacks lemming but lemming runs away.

Scene 3: Mother fox comes upon rabbit in hiding; rabbit runs and fox chases after it.

Scene 4: Mother fox returns to den dragging dead hare.

Boreal Footprints

BLACK BEAR



Front

Hind



WHITETAIL DEER



FOX



Front

Hind



LEMMING



Front

Hind

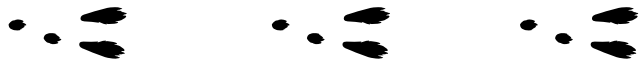


SNOWSHOE HARE



Front

Hind



WOLF



Front

Hind



Glossary

biome: a particular regional or global biotic community, such as a grassland, desert or specific type of forest, that is characterized mainly by the dominant plant species and prevailing climate.

carbon sink: a place where carbon is accumulating – such as a forest – where carbon dioxide from the air is converted into carbon-containing sugars and plant fibre.

climate change: an on-going process of large-scale and long-term weather changes due to planetary warming or cooling that may involve many unpredictable and extreme effects.

conservation: the study, protection, sustainable utilization, restoration and enhancement of natural resources with a long-term perspective.

COSEWIC: the Committee on the Status of Endangered Wildlife in Canada, an independent volunteer group of experts funded by the Canadian government, which conducts research and provides recommendations about at-risk species for the government to use when updating the Species at Risk Act (SARA).

deforestation: clearing an area of forest for another long-term use, such as golf courses, parking lots, buildings and roads.

forest fragmentation: the process of breaking up a once-intact forest into fragments, usually as a result of agriculture, mining, pipelines, roads and other developments.

habitat: the arrangement of food, water, shelter and space.

intact forest: forest that does not contain roads or other developments.

invasive species: a non-native species that has arrived in an area due to migration or to direct/indirect effects of human activity; and can cause problems for native species.

management: careful planning and decision-making that goes into the wise use and conservation of natural resources such as forests, fresh water and fisheries. This could include harvest levels, protected areas, and use policies.

native species: a species normally found in an area.

non-renewable resources: naturally occurring assets such as oil, gas and minerals that exist in finite amounts.

organism: a living thing.

prescribed burn: a deliberate and carefully planned fire in a controlled area, set to prevent wildfire, promote regeneration and control invasive species.

refugium: an area that has escaped ecological changes occurring elsewhere and so provides a suitable habitat for species in need.

renewable resources: naturally recurring assets including wood, water, fish, plants and wildlife.

riparian zone: a distinct area between land and water (excluding ocean) featuring specific types of vegetation. Trees and plants here are important for wildlife habitat and food, sediment control and erosion prevention.

SARA: Canada's Species at Risk Act

species-at-risk: a species identified by COSEWIC that is of special concern, threatened, endangered (facing imminent extinction) or extirpated (extinct in certain areas of previous inhabitation).

stakeholder: a person or organization that has an investment and concern in a particular item or endeavour; stakeholders wish to be included in the sharing of information and contribute to decision making.

sustainable: describes practices that allow for controlled consumption so that a renewable resource remains at basically the same level.

taiga: the term used in Russia to define the boreal forest

wetland: a distinct wet area of habitat featuring varying degrees of water and specific types of vegetation and soil; includes swamps, bogs, fens and marshes. Spruce bogs are very common in the boreal.

CFA Programs

Forest Capital of Canada – Celebrating Forest Communities

Established in 1979, the Forest Capital of Canada program highlights the valuable role forests play in the socio-economic and environmental health of our communities – past, present and future.

Each year the CFA designates a community or region to host a celebration of its forest resources. Traditionally, provincial forestry associations or other forest agencies invite and relay proposals from communities or regions in their province/territory that demonstrate the capacity to mount a successful 12 to 24-month celebration. Interested communities may also submit proposals directly to the CFA.

National Forest Week

National Forest Week is sponsored across Canada by the CFA and regionally by various provincial forestry associations, corporations, agencies and individuals.

Established circa 1920 as Forest Fire Prevention Week, the intention was to encourage greater public awareness towards Canada's forests. At the time, there was no apparent shortage of trees for industrial expansion – the greatest threat came from forest fires, due mainly to human causes.

Since then National Forest Week, as it was renamed in 1967, has evolved to encompass the many and varied human and environmental aspects of Canada's forest resources.

Although special activities are promoted across Canada, National Forest Week remains first and foremost a challenge to individual Canadians to learn more about their forest heritage and support greater recognition of this valuable resource.

National Forest Week is observed annually during the last week of September, Sunday through Saturday.

How to Participate

- Arrange a tree planting activity at your school; contact: www.treecanada.ca
- Take a walk in a forested area near the school; learn about a forest, close up!
- Identify all the things in your classroom that come from the forest.
- Learn about forest related organizations that demonstrate excellence in sustainable forest land management.
- Have students adopt a tree: care for a newly planted or a neglected tree, and learn about the species.
- Contact your provincial forestry association for more teaching activities and ideas.

2006 Canon Envirothon

2006 Theme: Water Stewardship in a Changing Climate

Water is a fundamental element of all life on Earth. The availability of clean, abundant and accessible water is a central need of human societies and both terrestrial and coastal ecosystems. It is also one of the key resources most at risk from short-term climate variability and long-term climate change. Water crosses all political boundaries providing benefits and sometimes generating negative impacts such as floods or droughts. Changes in climate will influence both the quantity and quality of water available to communities and ecosystems. Climate changes will also affect the timing and size of stream flow events with consequent impacts on aquatic systems, infrastructure and community welfare.

Changes in climate, whether part of natural cycles or exacerbated by global warming attributed to an enhanced anthropogenic greenhouse effect, will have significant impacts on water resources. Water resources have multiple uses, and will therefore experience multiple impacts in a changing climate. Both positive (e.g., longer growing seasons) and negative (e.g., increased frequency of extreme weather conditions) effects will be experienced by agriculture, forest, aquatic, wildlife and municipal sectors.

Water Stewardship in a Changing Climate, the environmental theme for the 2006 Canon Envirothon will not only bring a focus on water issues, but will encourage examination of broader, global climate.

Students will gain knowledge of both climate change science and policy with introductions to climate change modeling and the United Nations Intergovernmental Panel on Climate Change (IPCC). Students will also examine water stewardship in their own jurisdictions, identify possible positive and negative impacts of climate change, explore adaptation and mitigation activities and consider implications of cross boundary (municipal, state, provincial/territorial and international) jurisdictional issues. Finally, the interconnectivity of water, forests, soils and wildlife with climate change will be explored.

Envirothon Canada



Canon The CFA is the national agency for Envirothon Canada, which works in partnership with conservation groups, forestry associations, educators and cooperating natural resource agencies to organize and conduct competitions at the local, regional and provincial levels. Winning teams at the provincial level compete at the Canon Envirothon.

The Canon Envirothon is North America's largest secondary school environmental education competition. Reaching more than 500 000 students across North America annually, Envirothon succeeds in its mission to develop knowledgeable, skilled and dedicated citizens who are willing and prepared to work towards achieving a balance between quality of life and quality of the environment.

Program

- promotes environmental education based on teamwork, collaboration and competition
- school-based learning guided by a set of expectations and key references
- combines in-class curriculum and hands-on field experiences
- supplements environmental education inside and outside the traditional classroom

Benefits

- secondary students explore environmental issues with peers, natural resource professionals and community leaders
- students gain valuable knowledge and training in ecology and natural resource management principles and practices
- students get excited about pursuing careers in environmental studies, environmental law, natural sciences and natural resource management
- communities benefit from the involvement of young people in local environmental issues
- society benefits from a citizenry educated in the principles of environmental stewardship.

**For more information about these and other CFA Programs visit:
www.canadianforestry.com**

CFA Sponsors in Forest Education

Canadian Boreal Initiative

The Canadian Boreal Initiative was created in response to both opportunities and threats facing Canada's boreal region. Based in Ottawa, the CBI brings together a wide range of conservation organizations, First Nations, industry leaders and others to create new solutions for boreal conservation and sustainable development. It supports scientific research to advance thinking on conservation-based planning for the boreal region, and acts as a catalyst by supporting a variety of on-the-ground efforts across the boreal by conservation groups, First Nations and others.

In 2003, the CBI convened the Boreal Leadership Council, an extraordinary group of conservation organizations, First Nations and resource companies. In concert with members of the Council, the CBI created and launched the Boreal Forest Conservation Framework – a vision for the protection and sustainable development of Canada's entire boreal ecosystem.

Canadian Forest Service

The Canadian Forest Service, one of five sectors of Natural Resources Canada, works to ensure that Canada's forest resources are used wisely by advancing the science and policy that assists forest managers in practising sustainable development. Canada is steward of more than one-third of the world's boreal forest, one-fifth of the world's temperate rainforest, and one-tenth of the total global forest cover. This is a responsibility the Canadian Forest Service takes to heart. Its innovative programs, policies, science and technology are key to Canada's global leadership and critical to safeguarding the environmental, economic, and social values that Canadians place on their forests – now and for the future.

Ducks Unlimited Canada

Ducks Unlimited Canada (DUC) is a national, private, non-profit organization and is known as Canada's Conservation Company. DUC has been committed to wetland conservation for more than 67 years and has positively influenced nearly 25 million hectares of habitat in 7139 locations across Canada. Despite this, wetland loss continues across Canada. As much as 70% of Canada's original wetlands have been lost in some areas of the country. DUC's conservation efforts take many forms. On-the-ground work

is guided by the wetland and environmental research of DUC's scientists. DUC works to change policy in favour of wetland and habitat conservation. DUC also delivers wetland and environmental education programs to teach Canadians about wetlands and the need to conserve them. As a non-profit organization, DUC relies on the support of over 150 000 Canadians from across the country. DUC's 8200 dedicated volunteers work very hard to help DUC in achieving its conservation mission and vision.

Forest Products Association of Canada

The Forest Products Association of Canada (FPAC) is the voice of Canada's wood, pulp, and paper producers nationally and internationally in government, trade, and environmental affairs. Canada's forest industry represents 3% of Canada's gross domestic product (GDP) and exports \$45 billion annually. The industry is one of Canada's largest employers, operating in hundreds of Canadian communities and providing over 900 000 direct and indirect jobs across the country. With the help of member companies, FPAC designs programs to promote Canada's leadership in trade and economic matters, sustainable forest management and environmental stewardship.

Louisiana Pacific

Louisiana Pacific is a premiere supplier of building products, delivering innovative, high quality commodity and specialty products to retail, wholesale, homebuilding and industrial customers. LP operates 31 mills (20 in the United States, 10 in Canada and one in Chile) and has more than 6000 employees.

LP was founded in 1972 as a spin-off of Georgia-Pacific Corporation and became an independent corporation on January 5, 1973. Building on a strong presence in lumber and plywood, LP pioneered the U.S. production of oriented strand board (OSB) panels in 1982. Today, LP is the world's largest producer of OSB, which continues to replace plywood in residential building. Other products manufactured by LP include LP WeatherBest composite decking, LP SmartSide composite siding and Engineered Wood Products, including LVL and LP I-joists.

LP's centralized Technology Center in Franklin, TN is designed to rapidly turn new concepts into new products.

The facility also focuses on improving product quality and raw material utilization in the manufacturing process.

LP is traded publicly on the New York Stock Exchange under the LPX ticker symbol. Net sales in 2004 reached \$2.8 billion.

LP is dedicated to investing in communities where our employees live and work. The company provides funding, product and volunteers to support public schools and non-profit organizations. Contributions are focused in areas of shelter, education, social services and the environment.

Ontario Ministry of Natural Resources (OMNR) - Forests Division

Ontario is a recognized world leader in its forest and forest fire management programs and practices. The OMNR Forests Division is committed to sustainable forest management – healthy forests providing balanced environmental, social and economic benefits now and for the future. Sustainable forest management is critical to a dynamic provincial economy. Our mission is to ensure excellence in the management and protection of Ontario's forests and the provision of specialty resource management services.

Weyerhaeuser

Weyerhaeuser's business starts with the forests. By growing and managing this precious renewable resource, they manufacture products that meet basic human needs for shelter, communications and a host of other uses. Their goal is to be the industry leader in stewardship of public and private forest lands in Canada, while holding themselves to the highest standards of ethical conduct and environmental responsibility, and communicating openly with their employees, customers, communities and shareholders. That's their commitment now and for future generations.

Weyerhaeuser Company is one of the world's largest integrated forest products companies; incorporated in 1900. In 2003, sales were \$27.8 billion (US\$19.9 billion). They have offices or operations in 18 countries, with customers worldwide. Weyerhaeuser is principally engaged in the growing and harvesting of timber; the manufacture, distribution and sale of forest products; and real estate construction, development and related activities.

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The Canadian Forest Service has, for many years, been a strong supporter of the Canadian Forestry Association, working with it on projects of mutual interest and benefit. In addition to providing a substantial share of the CFA's annual core funding, CFS provides scientific expertise and guidance to products such as the Canada's Forests teaching kit series. While the CFA remains an independent arms-length organization, its mission dovetails with the objective of the CFS to develop and showcase Canada's world-leading advances in forest science and forestry practices.

CFA Partner Agencies

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PEI Forest Improvement Association

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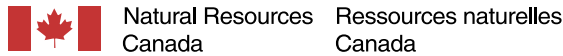
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Supporting Forest Education



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Canadian Forestry Association
Association forestière canadienne

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