Canada's North –
ours to protect, the world's to cherish.

What's Inside …

CURRICULUM LINKS TABLE

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"Were you ever out in the Great Alone,
when the moon was awful clear,
And the icy mountains hemmed you in
with a silence you most could hear …"

Robert Service

CELEBRATE CANADA'S NORTH

What image does "Canada's North" conjure up for you? A stark and silent land sealed in perpetual winter? Ghostly northern lights shimmering against an incredibly cold, dark sky? Perhaps you regard the North as a cold, harsh environment. Or maybe you already know that it is a fascinating world, inhabited by spectacularly resilient plants and animals adapted to some of the most extreme conditions on the planet.

This year's National Wildlife Week theme is important and timely. First, the North, as distant as it may seem to southerners, bears the brunt of human-induced environmental change. Its amazing wildlife and unique ecosystems, established over thousands of years, are feeling the warm embrace of rapid climate change, the toxic taste of accumulating chemical pollution, and the mixed blessing of escalating development of its natural resources. Changes are happening in Canada's North, and there are things we can all do to help conserve the wildlife that lives there.

Secondly, 2007 – 08 is International Polar Year, sponsored by the International Council for Science and the World Meteorological Organization. For the third time since 1882, scientists from all over the world will engage in an extravaganza of research, striving to get a better picture of conditions in the Earth's polar regions and how they influence the Earth's oceans, atmosphere and lands.

Join us during National Wildlife Week, April 8 – 14, 2007, to celebrate and protect the wildlife of Canada's North.

LIFE IN THE NORTH — ECOLOGY OF OUR NORTHERN REGION

Life in Canada's North must adapt to a challenging reality. Weak light conditions, due in large part to the low angle of the summer sun, combine with late spring and early fall frosts to limit the length of the growing season. Growth and reproduction of plants must occur in quick, frantic bursts. The landscape reflects these conditions. As one travels northward, trees become sparse and then so stunted they often look like shrubs. As one approaches the Far North and the Arctic Circle — an imaginary line at 66 degrees 30 minutes north latitude — the landscape becomes a treeless plain of low vegetation called tundra. This plain extends northward until it finally yields to a year-round layer of ice and snow.

Moisture is at a premium in the North. Surprisingly, some parts of the North, such as the Arctic — the land of ice, snow and permafrost (permanently frozen ground) — are so dry they are often referred to as a polar desert. In fact, some areas of the Arctic receive as little as 200 millimetres of precipitation annually, the same amount as the Sahara Desert! Canada's North, however, is far from lifeless and far from uniform. This land mass can be divided into eight terrestrial ecozones — living ecosystems with broad, common characteristics based on climate, landforms, soils, water features, plants and animals. From north to south, they include the Arctic Cordillera, the Northern and Southern Arctic, the Taiga Plains, the Taiga Cordillera, the Taiga Shield, the Boreal Cordillera and the Hudson Plains. While Canada's North may be defined in other ways, such as all land north of the sporadic permafrost line (see **www.nrcan.gc.ca/sd-dd/pubs/norguide/p1_e.htm**), this teacher's guide will focus on Canada's eight northern terrestrial zones.

DRESS LIKE A POLAR BEAR

Grades: K to 6

Subjects: Language arts, mathematics, science, social studies

Skills: Comparing, description, discussion, matching, small group work, inference, brainstorming, problem solving

Duration: Two to three 40-minute periods

Group Size: 20 to 30 students

Setting: Indoors and outdoors

Materials: Scissors; large sheets of craft paper; pencils; crayons; pelt (optional); pictures of polar bear; thermometers; handbooks from St. John's Ambulance, Girl Guides or Scouts for winter gear suggestions (optional)

Summary: Students research and determine appropriate winter clothing.

Learning Outcomes
Students will be able to:

1. List some of the polar bear's adaptations to climate in Canada's northern regions.

2. Create a winter outfit for themselves based on their findings about polar bears.

Method
Students research and determine animal adaptation characteristics.

Background
The polar bear is a sensible dresser for Canada's northern regions, thanks to its three "coats." The first is a layer of oily, water-repellent guard hairs. Though these appear white or creamy yellow in colour, they are actually transparent and hollow. Their colour is the reflection of visible light. These hairs reflect radiant heat from the sun down to the bear's black skin. The next coat is a layer of dense under-fur that snuggles against the animal's skin much like long underwear. Beneath the black skin, the final coat — a thick layer of insulating fat — keeps the bear's vital core warm.

The polar bear has many other adaptations. Its well-furred ears and tail are relatively small, and so less likely to be frostbitten. Its wide and densely furred feet with their webbed toes are ideal for silently stalking prey, keeping warm, walking in snow and swimming. In fact, Arctic summers can be too hot for these well-insulated bears! Summer dens have been found where polar bears dig into the permafrost to cool off. It is thought that some of these dens may have been used for hundreds of years.

Procedure
1. Investigate hair and other physical features that help the polar bear to survive. For instance, explain how guard or outer hairs are long, waterproof, coarse and hollow, and how the under-fur is soft, close and dense (like a cotton ball) to trap air for insulation.

   Through pictures or pelts, discuss what parts of the polar bear are covered with hair and how that is useful in Arctic conditions. Also discuss how the bear's wide feet help it to walk on snow and why polar bears need layers of fat.

2. Brainstorm about clothing that keeps us cozy in cold weather. Divide students into groups of four and give each group a body part to dress such as the head, feet, body or hands. Next, trace an outline of a volunteer lying down on the large craft paper. Cut out the body outline. Have each group draw and colour their clothing choices on the outline. Discuss the clothing choices. Give groups time to plan what clothes to bring for the following day for an outdoor session.

3. The following day, have students dress appropriately for the outdoors based on what they have learned so far. Once outside, have some students stand still for five minutes and ask them to observe how their bodies react. At the same time, have the rest of the class constantly moving around. After the five minutes are up, have students in both groups measure with a thermometer their skin temperature inside their clothes and also where it is exposed to air. Back in the classroom, discuss the body reactions for each group. Ask students if they would make any modifications to their clothing choices, and why.

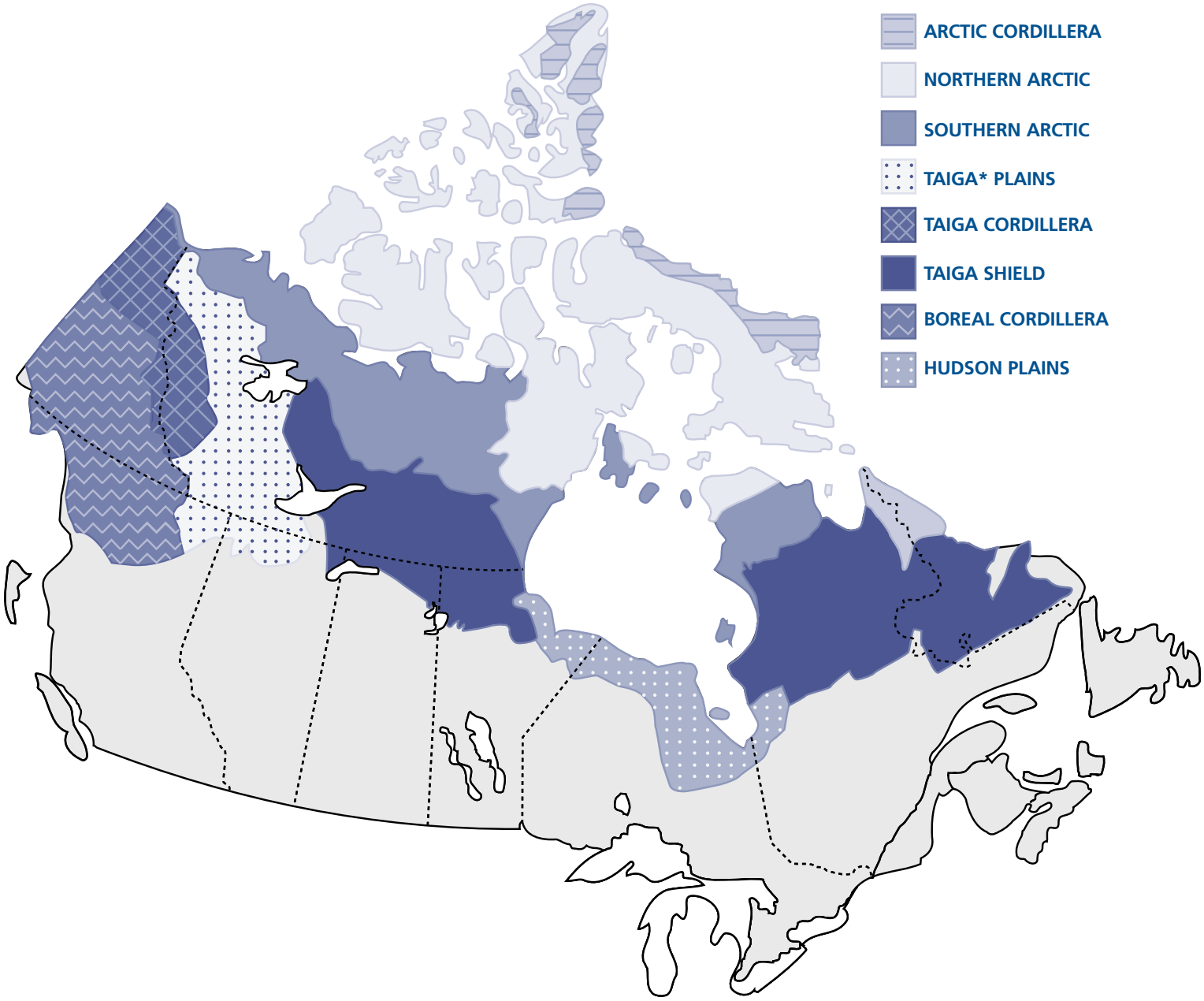
Extensions
1. Invite an Elder, a hunter or a museum staff person to demonstrate traditional winter clothing to students.

Evaluation
1. Students will demonstrate what they have learned by dressing appropriately for outdoor conditions.

2. Describe at least four ways that the polar bear has adapted in order to survive winter.

Dress like a Polar Bear is adapted from the *Below Zero Activity Guide*, Canadian Wildlife Federation, 2006. Visit CWF's *WILD Education* website at **www.wildeducation.org** for information about the Below Zero program.

GET TO KNOW CANADA'S NORTHERN ECOZONES



ARCTIC CORDILLERA

Average Temperatures: From -2 C to 6 C in summer and -35 C to -16 C in winter.

Landscape: Mountainous with polar ice fields and deep valleys. Ice and rock cover 75 per cent of this zone. Most of the area is non-vegetated.

Wildlife: Polar bears and seabirds are found along coasts. Sheltered valleys are home to the Arctic fox, Arctic hare, ermine, collared lemming and birds such as the snow bunting.

Points of Interest: Torngat Mountains, Auyuittuq, Sirmilik and Quttinirpaaq National Parks and Nirjutiqavvik (Coburg Island) National Wildlife Area are located in this region.

Human Activities: Hunting, fishing, ecotourism. Total population is about 1,100.

NORTHERN ARCTIC

Average Temperatures: From -1.5 C to 4 C in summer and -31 C to -20 C in winter.

Landscape: Rolling plains and the occasional exposed rock with shallow soils. Permafrost is continuous and may extend to several hundred metres in depth. Plant life is sparse.

Wildlife: Peary and barren ground caribou, muskox, wolf, Arctic fox, polar bear, Arctic hare, and brown and collared lemming. This ecozone is a major breeding habitat for migratory birds (e.g., the Canada goose).

Points of Interest: A number of protected areas are located in this region such as Aulavik and Ukkusiksalik National Parks, Katannilik Territorial Park, Banks Island No. 1 Migratory Bird Sanctuary and Thelon Wildlife Sanctuary, Dewey Soper Migratory Bird Sanctuary, Queen Maud Gulf Migratory Bird Sanctuary, Polar Bear National Wildlife Area, the Rasmussen Lowlands and the Soper Canadian Heritage River.

Human Activities: Hunting, trapping, fishing. Of a total population of 16,000 people, about 80 per cent are Inuit.

SOUTHERN ARCTIC

Average Temperatures: From 4 C to 6 C in summer and -28 C to -17.5 C in winter.

Landscape: Rolling uplands and lowlands with exposures of bedrock. This ecozone is a transition area between the treed taiga to the south and the treeless tundra to the north.

Wildlife: The grizzly, black and polar bear, wolf, moose, Arctic ground squirrel and brown lemming are among the mammals that live here. Birds living in this region include the yellow-billed, Arctic and red-throated loons, old-squaw duck, snowy owl and snow bunting. This area is a major breeding and nesting ground for migratory birds.

Points of Interest: This region includes the major summer range and calving grounds for Canada's largest caribou herds, the barren ground caribou in the west and the woodland caribou in the east. It also contains several protected areas including Tuktut Nogait National Park, Ijiraliq Territorial Park, Thelon Wildlife Sanctuary, Anderson River Migratory Bird Sanctuary and the Thelon Canadian Heritage River.

Human Activities: Hunting, fishing, trapping, tourism, mineral and hydrocarbon exploration, and some extraction. Of the total population of about 10,300, 80 per cent are Inuit.

TAIGA* PLAINS

Average Temperatures: From 6.5 to 14 C in summer and -26 C to -15 C in winter.

Landscape: Mostly slow-growing conifer forests of black spruce with widespread permafrost. Shrubs are well-developed. Upland areas support mixed forests (e.g., white and black spruce, tamarack).

Wildlife: Moose, woodland caribou, wood bison, wolf, black bear, marten, lynx, Arctic ground squirrel, barren ground caribou. Birds include the common redpoll, gray jay, common raven, bald eagle, peregrine falcon and osprey.

Points of Interest: Canada's largest river, the Mackenzie, and its tributaries dominate this ecozone. The Mackenzie Valley is a major migratory corridor for waterfowl breeding along the Arctic coast. Nahanni National Park Reserve, a United Nations Educational, Scientific and Cultural Organization World Heritage Site, and the South Nahanni Canadian Heritage River are located in this ecozone.

Human Activities: Hunting, trapping, fishing, forestry, tourism, mining, oil and gas extraction. About 60 per cent of the total population of 21,400 is Aboriginal.

TAIGA CORDILLERA

Average Temperatures: From 6.5 C to 10 C in summer and -25 C to -19.5 C in winter.

Landscape: Mountainous wilderness with foothills and narrow valleys. Permafrost underlies most of this area, including most wetlands. Arctic tundra occurs in the north with taiga or open woodland in the south.

Wildlife: Diverse forms of wildlife include the Dall sheep, woodland and barren ground caribou, moose, mountain goat, black and grizzly bear, wolf, lynx, Arctic ground squirrel, American pika, hoary marmot and wolverine. Birds include the gyrfalcon, willow and rock ptarmigans and waterfowl.

Points of Interest: Thousands of swans, Canada geese and other waterfowl nest or stage in the Yukon's Old Crow Flats, a Wetland of International Importance. Ivvavik and Vuntut National Parks, Fishing Branch Ni'iinlii'njik Park and the Arctic Red Canadian Heritage River are also located in this ecozone.

Human Activities: Hunting, trapping, ecotourism, outdoor recreation and mineral exploration. About eighty per cent of the population (about 300 people) resides in Old Crow, Yukon's northernmost settlement.

TAIGA SHIELD

Average Temperatures: From 6 C to 11 C in summer and -11 C to -24.5 C in winter.

Landscape: Rolling terrain with widespread permafrost. Thousands of lakes and wetlands and open forests are interwoven with shrublands and meadows typical of the Arctic tundra.

Wildlife: About 50 species of mammal live here, including the barren ground and woodland caribou, moose, wolf, snowshoe hare, Arctic fox, beaver, black and grizzly bears, and lynx. The Arctic and red-throated loons and gray-cheeked thrush live in this zone. Thousands of birds rest and feed here on their way to Arctic breeding grounds.

Points of Interest: The northern edge of this ecozone is the latitudinal limit of tree growth. The East Arm of Great Slave Lake is a proposed National Park.

Human Activities: Mineral exploration, petroleum exploration and hydroelectric developments, forestry, hunting, fishing and trapping. Total population is about 33,600.

BOREAL CORDILLERA

Average Temperatures: From 9.5 C to 11.5 C in summer and -1 C to -23 C in winter.

Landscape: Mountainous ranges, extensive plateaus, wide valleys and lowlands with widespread permafrost. Tree species include alpine fir, trembling aspen, balsam poplar and white birch.

Wildlife: The woodland caribou, moose, Dall sheep, mountain goat, black and grizzly bear, marten, lynx, American pika, hoary marmot and Arctic ground squirrel. Birds include the willow, rock and white-tailed ptarmigans, and migratory songbirds and waterfowl.

Points of Interest: Several important protected areas are located in this ecozone, including Kluane National Park and Reserve, a UNESCO World Heritage Site, Nisutlin River Delta National Wildlife Area, Coal River Springs Territorial Park and the Alsek Canadian Heritage River.

Human Activities: Mining, forestry, tourism, hydroelectric development. Total population is about 30,800.

HUDSON PLAINS

Average Temperatures: From 10.5 C to 11.5 C in summer and -19 C and -16 C in winter.

Landscape: This lowland plain slopes toward Hudson and James Bays with extensive wetlands and marshes and tidal flats along coastlines. Better-drained areas support open woodlands of black spruce and tamarack.

Wildlife: The woodland caribou, moose, black and polar bears, marten and Arctic fox.

Points of Interest: The Hayes Canadian Heritage River, Wapusk National Park and the Moose River, Hannah Bay, Boatswain Bay and McConnell River Migratory Bird Sanctuaries are located in this area. The latter is also a Wetland of International Importance, as is Polar Bear Provincial Park. This ecozone is an important habitat for breeding waterfowl, especially the Canada goose.

Human Activities: Hunting, fishing and trapping with some sport fishing and tourism. Total population is approximately 9,900.

***** Taiga is a Russian word that refers to the northern edge of the boreal forest — "land of little sticks."

BE COOL ... STAY COOL
Grades: 4 to 12

Subjects: Science, geography

Skills: Evaluation, problem solving, critical thinking

Duration: One hour

Group size: Six and up

Setting: Indoors

Materials: Pens and paper for notes, name cards or materials for hats, photocopies of "Inhabitants of the North Profiles" (see below and page 7) and, for reading, "Canada's Changing North" (see pages 8 and 9), appropriate electronic equipment (optional)

Summary: A role-playing activity about the effect of the changing environment on people and wildlife in Canada's North.

Learning Outcomes
Students will be able to:

1. Describe a selected species of wildlife and its needs.
2. Suggest effects of climate change on people and wildlife in Canada's North.

Method
Students adopt identities of inhabitants of Canada's North and predict how climate change might affect them and their descendants in 50 years.

Background
Life in Canada's North is a complex web of relationships between people, animals, plants and the land itself. As this delicate balance is disturbed by changing conditions, such as warmer temperatures, pollution and natural resource extraction, every living thing is affected. Some of the changes expected for Canada's North are described in the section "Canada's Changing North" located on pages 8 and 9.

Procedure
1. Create individual "profile" cards by photocopying and cutting out the templates provided in this activity. Then, divide your class to form discussion circles (with six to eight students in each circle). Give each student a "profile" card so that each may play the role of an inhabitant of Canada's North in his or her circle. Students can make paper hats or name cards to identify their role.
2. Have students read their profiles and describe their habitat needs to members within their circle. (Habitat includes water, food, shelter and space arranged just right for each species.) Ask students to compare their needs with the needs of other members in their circle.
3. Next, have students read the section "Canada's Changing North." Let students brainstorm and then predict what might happen to their habitat by the year 2050. Have them identify positive and negative effects. Finally, have students brainstorm about actions that could help reduce negative effects arising from the anticipated changes.

Extensions
1. For older students: Let students research their "profiles" in more detail and have the class develop electronic presentations of a plan of positive actions that could minimize harmful effects of changes in Canada's North. Ask students to present their suggestions at a school event such as one for National Wildlife Week.
2. For younger students: Have students draw a diagram of a food web formed by the organisms in the discussion circle. Let them modify the web without their organism and discuss the results.

Evaluation
1. List three effects climate change will have on your organism.
2. Suggest three things you can do to slow down climate change.

INHABITANTS OF THE NORTH PROFILES

Exploration geologist: As an exploration geologist, I look for oil for a large oil company. My job is to find oil resources that can be developed. I need help finding my way around in Canada's North. The local ecotourism operator and a local Inuit hunter are very knowledgeable about the land and how to travel across it. When I am out on the tundra I live off the land as much as possible.

Diamond miner: I spend two weeks at a time away from my family working in a diamond mine. I once lived off the land, but it was getting more and more difficult to make a living to support my family. Now, with a steady pay cheque, I can give my children lots of store-bought food, heat and toys. I go out on the land whenever I can because I like to stay connected to the old way of life. If the oil company finds deposits close to my community, the new development might mean a job closer to home.

Ecotourism operator: I am an entrepreneur. I make a living by taking tourists out on the tundra. My business was built on taking sportsmen on a hunt. Today, my clients are also interested in learning about Canada's North and experiencing it in different ways, such as by photographing the landscape and animals. I have adjusted the services I offer to accommodate their interests. Sometimes I hire a local Inuit hunter to talk about the traditional Inuit way of life and how climate change is affecting his relationship with the land. My business depends on having access to unspoiled wilderness.

Arctic willow (or rock willow): I live on the tundra and am between 15 and 20 centimetres in height. I am one of the most northern woody plants in the world. I am a shrub. I can live very long — up to 85 years. To protect me from the wind, my leaves are covered in long silky hairs. I can take on many shapes, but I generally trail across the ground keeping low and out of the wind. Permafrost keeps my roots shallow. I like dry habitat. My leaves and catkins (flowers) unfurl at the same time in the spring and allow me to take advantage of the short growing season. I produce either male or female flowers so I need the right neighbour for pollination to occur. Just about all herbivores of the Arctic like to eat me, including caribou, muskox, Arctic hare and lemmings. Visit **www.blueplanetbiomes.org/arctic_willow.htm** for more information about me.

Collared lemming: I am a mouse-like rodent with small ears and a short tail. I am the only small mammal to venture into the Northern Arctic ecozone. In summer, I am brownish with a chestnut collar and a black stripe down my back. In winter, I turn white and grow an extra-long, tough nail on each front foot to help me dig through snow and ice. I am active under the snow and ice all winter; I feed on willow and I find shelter in my globular nest of grass. I can have up to three litters of young per year. Many predators, such as the ermine, Arctic fox, gyrfalcon and snowy owl, rely on me as a source of food. Even people suffer when my numbers are low because they lose income when there are no foxes to trap. There is no question that I am a key organism in the balance of life in Canada's North. Visit **www.hww.ca** for more information about me.

Barren ground caribou: In spring, I migrate with my herd hundreds of kilometres north from the taiga onto the tundra to the traditional calving (birthing) grounds. I feed on willow and other plants all summer. Biting insects drive me crazy; sometimes I run frantically for many kilometres to get away from them. In the fall, I return to the taiga in the south for the mating season known as the rut. My fall and winter food is almost entirely lichen, a plant that I get by digging food pits through the snow. The antlers of males and non-pregnant females fall off in late fall or early winter, leaving pregnant females the dominant animals in my herd. Many of my kind are killed and eaten by wolves, people and sometimes bears. Other carnivores on the tundra will often feed at the leftovers from a wolf kill. Get to know me by visiting **www.hww.ca** and **www.projectcaribou.net**.

Canada goose: Each spring, I return to the place where I hatched. For me, it happens to be in Canada's North. I spend my first year with my parents, learning migration routes by following them south to southern Canada or as far as Mexico in the fall, and then back north in the spring. I mate for life. My mate and I raise our goslings. Mom incubates the eggs while Dad stands guard. He's good at it, too; an agitated goose can deliver severe blows. Ask any Arctic fox about the hazards of taking eggs for dinner. Like all geese, I have to moult and replace my worn-out feathers. That means I cannot fly for four to five weeks each summer. I am very vulnerable to predation from foxes, wolves and people during this time. Learn about me at **www.hww.ca**.

Arctic fox: I am the smallest member of the dog family in Canada (and am about the size of a large domestic cat). I am white in winter and two-toned brown in summer. My favourite foods are lemmings and Canada goose goslings and eggs. In years when lemmings are plentiful, my numbers swell. In years when the lemming population is low, my numbers dwindle. I really suffer following a bad lemming year if the weather also prevents geese from nesting successfully. During these years I may travel for hundreds of kilometres looking for food. I have more babies per litter than any other mammal in the world with an average litter size of 11. Once my brood starts eating solid food, my mate and I have to hunt 30 lemmings a day. This number increases to 100 per day by the time the pups are ready to leave the den. That adds up to 3,500 to 4,000 lemmings per litter. Get to know me by visiting **www.hww.ca**.

Traditional Inuit hunter: I live off the land, hunting and trapping just as my ancestors did for 13,000 years. Though my ancestors used dog sleds to travel, I use snow machines and all-terrain vehicles. I also use firearms and the latest in technology. I hunt caribou in the fall and trap Arctic fox in the fall and winter. I also harvest fish, seal and the odd polar bear. My last bear pelt sold for $2,000. I sometimes can earn extra cash by guiding people or by giving talks to ecotourism groups about the traditional Inuit. This extra cash comes in handy, especially following years when the lemming population is low and there are few or no foxes to trap. The last time I went hunting I noticed the weather is not as predictable as it used to be!

THE IMPORTANCE OF CANADA'S NORTH!

- Our northern regions provide Canada with natural resources, such as natural gas, oil and minerals (e.g., lead, zinc and silver). Canada has recently become one of the world's largest producers of diamonds thanks to recent discoveries and new mines in the Southern Arctic.
- Vast areas of wilderness in Canada's North provide irreplaceable habitat for unique animals, such as the polar bear, muskox and the endangered Peary caribou.
- Millions of migrating birds, such as geese, ducks and shorebirds, spend parts of their lives feeding, nesting and raising young in our northern regions.
- Acting as a global climate regulator, ecological systems in Canada's North cool the air and play a role in the circulation of warm and cold waters between northern and southern parts of the globe.
- In its current state, Canada's Arctic region acts as a carbon sink. This means its plants take carbon dioxide from the air, use it to build their roots, stems and leaves, and hold it there for years. The Arctic is especially good at this because the cold conditions slow down the decay of plant matter. Even when a plant dies, it holds onto that carbon for a long time. Since carbon dioxide is a main cause of climate change, this simple service helps keep our entire planet healthier.

People who spend their lives in Canada's northern regions also depend on its healthy ecosystems.

- Aboriginal Peoples have a rich heritage that revolves around their relationships with the land, its plants and its animals. Although this relationship continues to change, many people, including non-Aboriginals, depend on the land for food and employment.
- Tourists flock to Canada's North for a taste of its remote scenery and the chance to see its unique wildlife. They spend money in local communities for tour guides, food, accommodation and other services. That adds up to local jobs and prosperity.

While our North is truly a national treasure, its remoteness does not protect it from harmful changes.

CANADA'S CHANGING NORTH

Canada's northern environment, wildlife and people are facing major changes. Global climate change, caused mainly by our urbanized activities in the south, is predicted to have its greatest impact in this region. Pollution, carried by air and water currents, is accumulating to dangerous levels in distant northern ecosystems and wildlife. Development, related to resource extraction, is gathering momentum and drastically changing the traditional Aboriginal way of life.

Climate Change

Scientists predict that the greatest warming due to global climate change will occur in some northern regions, especially in winter. The western Arctic, for example, is expected to warm by 5 C by the year 2050 and the eastern Arctic is expected to cool slightly. There will be numerous effects, some of which will be felt around the world.

- Sea levels are rising as polar ice melts. If predictions are correct, all summer ice will disappear from the Arctic by the year 2100. The ice sheet of Greenland, alone, contains enough water to raise global sea levels by six to seven metres. Any land near sea level today will be flooded if this occurs.
- Landscapes, ecosystems and wildlife will change. As the land warms and the permafrost melts, the treeline will creep northward. With the new forests will come species (including diseases and parasites) not historically found here. Many northern species may become extinct as they are replaced by southern species better adapted to the new conditions.
- Tundra ecosystems could be reduced by two-thirds, with the Southern Arctic ecozone entirely disappearing from mainland Canada. There is already 18 per cent less tundra now than 20 years ago, most of it converted to wetlands as the permafrost melted. If this continues, we can expect a loss of soil stability resulting in erosion, sinking buildings and collapsed roads.
- Barren ground caribou herds are expected to suffer major losses, and the Peary caribou will likely become extinct. As ice disappears, caribou migration routes will be disrupted. The predicted 25-per cent increase in precipitation means deeper snow. Caribou and muskoxen will have to use more of their precious energy to travel and to dig up food. Traditional Inuit families who depend on these animals for survival will, in turn, be affected.

- We are currently seeing a loss of pack ice off the coastal regions. Without these key winter feeding areas, the polar bear may become extinct.
- All wildlife — and people — will suffer with an increase in mosquitoes and other biting insects.
- Traditional knowledge of ice and snow is becoming unreliable because conditions are no longer predictable. The way of life that has allowed the Inuit to survive for thousands of years in one of the harshest environments in the world is being undermined and lost.

Development

- Industry brings increased employment opportunities and higher wages to the people living in Canada's North, but development also has its costs.
- Traditional ways of life are being abandoned, and thousands of years of knowledge about the land are being lost.
- As global demand for fossil fuels rise, oil and gas exploration and extraction is increasing. More activity leads to more possibility of damaging this sensitive environment through oil spills and more roads, pipelines and human communities that break up or take over key wildlife habitats.
- Shipping is increasing as previously ice-packed passages open up. If the melting continues, the Northwest Passage through the Canadian Arctic may replace the Panama Canal as a preferred route for shipped goods in the northern hemisphere. The shorter route may reduce global energy needs but it will also bring increased pollution, garbage and disruption of marine mammals in critical habitat areas.
- Tourism, though it brings money into local communities, can have a downside in this ultra-sensitive environment. Waste that is left behind decomposes very slowly in the cold climate. Wildlife encounters, though thrilling for humans, can disrupt animal reproduction and feeding or even be fatal for the animals. Even a simple walk on the tundra can leave a footprint that may last for centuries.

Pollution

- Comparatively speaking, the people living in Northern Canada do not produce much total pollution. Most of it is transported to the North on air and water currents. Traces of pesticides from as far away as Southeast Asia have been found in the tissues of wildlife living in the North. Northern ecosystems and wildlife are particularly susceptible to pollution because:
  - The low sunlight and cold temperatures slow down decomposition of chemical pollutants and spilled oil so they last longer in the environment.
  - Food chains in Canada's North are good at accumulating and storing contaminants. As plants and animals are eaten, the concentration of toxins builds with each step up the food chain. The many people who still get their food from the land have landed on the top rung of this poisonous ladder.
  - The remoteness of Canada's North makes detection, monitoring and clean-up of pollution difficult.

MIGHTY MIGRATORS
Grades: Grades 4 to 6

Subjects: Science, social studies

Skills: Drawing, evaluation, problem solving, small group work, critical thinking

Duration: One or two 45-minute periods

Group Size: Any; smaller groups for making murals

Setting: Indoors and outdoors

Materials: Drawing materials; large sheets of butcher or poster paper

Summary: Students draw murals showing caribou migration routes and the possible consequences of a pipeline being laid across the route.

Learning Outcomes
Students will be able to:

1. Understand that caribou, like many species of wildlife, migrate to survive winter.
2. Describe possible impacts of human activities on wildlife migration patterns.

Background
The purpose of this activity is to help students recognize some of the problems that human activities can produce for wildlife and the environment. In this case, a pipeline laid through a caribou migration route is used as an example.

Barren ground caribou are famous for their enormous herds and long treks. They move in herds of thousands between their winter and summer ranges. Some migrations can be close to 800 kilometres long, one-way. Around March, the herds head north to the tundra where pregnant females calve. The caribou are thin when they reach the tundra in spring but nutritious plants there (lichens, grasses, sedges, mosses and flower buds) are just what the females need to help them produce rich milk for their calves. When winter approaches, the caribou travel back to the protection of southern forests. While caribou are migrating, just about nothing will stop them. They trot through ice fields, ford wide rivers and climb up mountains.

Caribou are well equipped for life in Canada's North. Their feet are wide. They have toe-like dew claws that help support them in deep snow. They use the edges of their front hooves to dig holes in the snow to reach lichens, their main winter food. Their hooves can even adjust to different walking conditions! Their foot pads harden in winter. The dense, stiff hair that grows between their toes prevents slippage on ice and protects their pads from cuts by ice and snow crusts.

Procedure
1. Divide students into small groups. Provide each group with drawing materials and a large piece of butcher or poster paper. Ask each group to draw a mural of caribou habitat. Have them research caribou (see **www.hww.ca**) and include a variety of environments such as tundra, ice fields, rivers and mountains in their murals. Use "winter" as the time frame and ask students to draw their caribou herd in their winter range. Ask them to draw arrows to show the path that they think the caribou would take each year to move from their summer to winter ranges and back again.
2. Once the murals are complete, ask students to describe the features in their murals. Now tell students that a major pipeline is being planned for the area. It is to be built somewhere directly across the caribou migration path. An Environmental Impact Statement has been done, which explains it is possible to build the pipeline in a way that will minimize any negative effects on wildlife and the environment. At this point, the Environmental Impact Statement is being contested in court; therefore it is not clear whether the pipeline will actually be built.
3. Have each group discuss how to draw a pipeline on their mural in a way that is least harmful to wildlife and the environment. As each group reaches a consensus, they can add the pipeline to their murals. (Some points students could consider include the impact on herds during construction of the pipeline through creation of construction camps, development of access roads, hydroelectric development and increased air traffic, as well as ways to minimize erosion and impacts on permafrost. Visit **www.eenorth.com/eenorth/documents/teacher_on_the_tundra.pdf** for more information. Ask students to pay special attention to how the caribou can travel back and forth to their summer and winter ranges; for instance, it may be possible to bury or elevate the pipeline at critical spots, or to lay the pipeline so as to avoid the migration path.)
4. Have each group report on what plans it made. What were the consequences to the caribou, as well as to other wildlife, vegetation, soil and permafrost?

Extensions
1. Use clay or papier mâché to make a three-dimensional mural.

Evaluation
1. Name three animals that live in Canada's North and that migrate. For each, list a human activity that might interfere with their migration.

2. Explain why planning before undertaking any industrial development is crucial to an area.

PROTECT CANADA'S NORTH

What Governments Do

There are a number of ways that governments protect areas in Canada's North:

- Federal and territorial governments protect special natural features and important wildlife habitat through national parks, provincial and territorial parks, national wildlife areas and migratory bird sanctuaries. Canada is currently recommending that sites in the North, including Quttinirpaaq National Park, be designated World Heritage Sites by UNESCO because of their natural and cultural significance.
- Environmental monitoring is carried out by a number of government agencies and their partners such as universities and non-governmental organizations. They gather information on different aspects of the northern environment, such as ecosystems, wildlife species, ice, climate conditions and chemical pollution. This information helps us understand Canada's North and see what changes are going on so we can try to head off future problems.
- Pollution control is an ongoing challenge because so much of the contamination comes from outside Canada's northern region. Environment Canada, for example, enforces laws and promotes actions countrywide that help reduce pollution that might otherwise find its way to the North. Territorial governments also regulate activities that cause pollution locally.
- Sustainable development is an approach to activities (such as mining, oil exploration, forestry, manufacturing and hunting) that considers long-term environmental values as well as economic benefits. Canadian and territorial governments hold public meetings to allow people to have input into developments that might affect them, and often require developers to prove that their activities won't damage the environment.

What You Can Do

You can make a difference for Canada's North regardless of where you live. Here are everyday things you can do to help conserve our northern ecosystems and the wildlife they support.

- **Go wild!** Plant and encourage wild, green places at school and at home. That will help local wildlife, and the green plants will absorb carbon dioxide from the air to reduce climate change. Visit **www.wildaboutgardening.org**.
- **Skip it!** Energy and natural resources go into making everything you use, not to mention transporting it to your local store. That means more pollution, more development and more climate change. If you do buy something:
  - Look for reusable alternatives with minimum packaging.
  - When you're done, recycle whatever you can.
- **Park it!** For every litre of gas you use driving or being driven somewhere, you produce 2.5 kilograms of climate-changing carbon dioxide. The more gas we use, the more oil companies increase efforts to find and develop northern oil resources, putting natural spaces and species at risk.
- **Turn it off!** Cars that are parked and running (idling) waste gas and pollute. Remind your parents to turn off the car if they're waiting for more than 10 seconds.
- **Shut it off!** Turn off lights and appliances when not in use — including the TV! Electricity creates pollution too.
- **Time it!** If you have a choice, use appliances at times when electricity is less in demand.
- **Set it!** Air conditioners that are set too cold waste electricity and contribute to global climate change.
- **Watch it!** There are lots of volunteer programs for ecological monitoring. When you help scientists gather this type of information, you help us all to understand our changing conditions.
- **Tell it!** Spread the word on changes in Canada's North and the part we all play through presentations, projects, fairs and newsletters. The more people we have working on solutions, the fewer we have creating problems.
- **Get involved!** Discover how to get involved in International Polar Year activities. See **www.ipy.org**.
- **Visit it!** For more information, go to Students on Ice at **www.studentsonice.com** for more information.
- **Discover northern ecozones!** Explore Canada's northern ecozones at **www.ec.gc.ca/soer-ree/English/Framework/NarDesc/canada_e.cfm**.
- **Learn more!** Visit CWF's *WILD Education* website at **www.wildeducation.org** for a list of resources that offer general information, teaching resources about Canada's North, photos, diagrams, posters and maps.

PARTNERS AND SPONSORS

CWF gratefully acknowledges the following partners and sponsors for their help in preparing and financing National Wildlife Week educational materials. Please visit their websites for additional resources.

Provincial and Territorial Governments

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Victoria, BC V9W 9M1
Tel.: 250-356-7111
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E-mail: wild@gov.bc.ca
Website: www.hctf.ca/wild.htm

Manitoba Conservation
Wildlife and Ecosystem
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Nova Scotia Department of Natural Resources
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Website: www.gov.ns.ca/natr/wildlife/index.htm

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Iqaluit, NU X0A 0H0
Tel.: 1-866-222-9063 or 867-975-7700
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E-mail: environment@gov.nu.ca
Website: www.gov.nu.ca/Nunavut/environment/home

Ontario Ministry of Natural Resources
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Education Page: www.swa.ca/WatershedEducation/index.asp

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For more information about wildlife and protected areas in your region, contact our National Wildlife Week partners.

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Fax: 613-364-4022
E-mail: abreau@mus-nature.ca
Website: www.nature.ca

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National Wildlife Week website: www.wildlifeweek.org

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