Project Caribou
Project Caribou
An Educator’s Guide to Wild Caribou of North America

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Using this resource

You, the teacher and learner, are the best judge of how to use this book. In this section we’d like to point out the features and general layout, so that you can best decide how it will be of use in your particular context.

The “All About Caribou” section contains basic, factual background information on caribou in North America, including information on basic biology, ecosystem interactions, and management and protection issues. This is the section to which you and your students may refer for an overview of specific or general topics. Basic research can be done using this section.

The “Activities” section presents 17 activities that cover several different caribou topics and reflect a range of teaching methods and target age/grade levels. The layout is based on the Project WILD model, so you may be familiar with it. If not, note that each activity includes a sidebar identifying the age, subject, skills that are addressed, as well as its setting and duration. If the activity does not directly target your grade level, please make adaptations; in fact, we offer suggestions as to how you might modify the activity for a lower or higher age level.

The “Case Studies” section offers in-depth information about a number of North American caribou herds. You may wish to compare different herds, so each case study is presented in a standard format. Visit the Project Caribou web site (www.projectcaribou.net) for downloadable updates and additions to these case studies.

The “Appendixes” consist of three helpful references: the “Conceptual Framework” that guided the development of Project Caribou and gives a sense of what caribou experts feel is important for all learners to understand; a glossary of terms used in this guide; and a “For further study” section, which lists contact people, books and other references useful for further research or classroom study. Visit the Project Caribou web site for the most recent version of this list. Your submissions are welcome!

Various options in the “Cross-referencing Index” (again, as in Project WILD) allow you to access portions of the text in different ways.

Although we could not include it in this guide, we suggest you visit the Project Caribou web site and refer to the “Curriculum Cross-References” section to find out how Project Caribou fits into the curriculum framework in your province or territory.
Preface

Caribou touch us in many ways, some of which we may not even be aware of. Canadians daily see the image of the caribou on the 25-cent coin. Santa’s reindeer are an indelible part of Christmas for millions of North Americans. Many First Nation groups depend on caribou as a staple food source. Images of the huge northern herds remind us of our last true wilderness areas. Caribou are an inescapable part of our cultural landscape, and somehow we all share a deep-rooted respect for this incredible animal.

Project Caribou was conceived in recognition of the importance of *Rangifer tarandus*. Many biologists now view caribou as an indicator species for ecosystem health in the North. If caribou populations are faltering, it means that we should be on the lookout for changes in other aspects of the environment as well.

Project Caribou is the result of the efforts of a group of dedicated individuals who believe a well-informed populace—beginning with teachers and school-age children—is vital to the long-term survival of caribou and their habitat. These individuals collectively spent a considerable amount of time on this learning resource. The work was carried out in addition to their regular heavy workloads and, in many cases, without pay. They are true champions for the natural environment. Please refer to the Acknowledgments page for a list of contributors.

Our goal was to produce a learning package general enough for use in any context, yet with specific case study information to meet specific regional needs. It is also a dynamic resource to be supplemented, adapted and updated for years to come.

It must be acknowledged that many wonderful learning packages on caribou have preceded this one, most notably those produced by the Beverly and Qamanirjuaq and Porcupine Caribou Management boards. Project Caribou is seen as a way of building and complementing existing resources and making caribou education available to a wider audience.

We hope through the use of Project Caribou that you will pick up some of the infectious enthusiasm for caribou that is shared by those who have put this package together. After all, the caribou’s future is deeply linked with our own.

Remy Rodden
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Yukon Department of Renewable Resources

Most of the activities in this book are the result of a two-day writing workshop held concurrently with the 8th Annual North American Caribou Conference in Whitehorse in 1998. Biologists, teachers, wildlife educators and others came together to learn about caribou and generate activity ideas—a very stimulating creative process. Special thanks to all those who participated!
Areas occupied by Caribou subspecies

- Black = Peary caribou
- Gray = Reindeer, both wild and domestic
- Light gray = Barren-ground caribou
- Dark gray = Wild forest reindeer
- White = Woodland caribou
- Dark gray with stripes = Svalbard reindeer
All About Caribou
Caribou and you

Have you seen any caribou recently? Try looking in your pocket or in your wallet. That’s a caribou, right there on the Canadian quarter. The caribou is an animal that is a part of ecosystems all the way around the northern part of the globe. It is an important part of circumpolar biodiversity.

Caribou mean different things to different people. For many northern aboriginal groups, caribou represent a living part of a cultural heritage that goes back for centuries. What do caribou mean to you? This guide is intended to help you answer that question by learning more about this amazing animal.

What’s in a name?

The most common names for this animal are "caribou" in North America and "reindeer" in Europe. The word caribou originates from the early French explorers who likely converted the Mi’kmaq word xaiibu, which means "pawer" or "shoveller," to describe the species. European arctic explorers never adopted the Inuktitut word for caribou, tuktu, but preferred in their journals to use the term "the deer" as a short form of reindeer. The word reindeer comes from the Lapland language where the word reino means young reindeer. Other terms date back to 1500 A.D. in French as rangier and rangifere.
Origins of caribou

The caribou is an ancient relative of the deer that may have originated in northeastern Asia or northwestern North America. The earliest fossils of caribou date back 1.5 million years and were found at Fort Selkirk, Yukon. During the last ice age, when most of North America was covered by thick sheets of ice, parts of what is now the Yukon and Alaska remained ice-free. This refuge, or refugium, was called Beringia. The animals and plants that lived here escaped the glacial onslaught. Caribou were present at the time of Beringia and ranged the same areas as the woolly mammoth, steppe bison, camel and giant beaver. Many of these exotic animals did not outlast the cold climate, but some of the Beringian animals that did survive include caribou, moose, muskox and grizzly bears.

Caribou and other members of the deer family belong to a group of animals called ungulates. The word “ungulate” comes from the Latin word for hoof. There are two orders of ungulates: Perissodactyls, like elephants and horses, have an odd number of toes; Artiodactyls, including caribou, elk and bison, have an even number of toes. Caribou, moose, elk, mule deer and white-tailed deer all belong to the order Artiodactyla and to the deer family, Cervidae.

All caribou belong to the same genus and species. They share the name Rangifer tarandus. There are five subspecies of caribou in North America and four others in Eurasia. In Eurasia the species are called reindeer, and they may be wild, semi-domestic or domestic. In North America the species are called caribou. In North America these subspecies are:

Rangifer tarandus tarandus: tundra reindeer brought to North America from Eurasia. Although some have escaped into the wild these are primarily semi-domestic in nature.

Rangifer tarandus groenlandicus: barren-ground caribou.

Rangifer tarandus caribou: woodland or mountain caribou.

Rangifer tarandus pearyi: Peary caribou, which live on Arctic Islands.

Rangifer tarandus granti: Grant’s caribou, which live in Alaska and the northern Yukon. The Porcupine Herd belongs to this subspecies.

The wild caribou of North America are generally identified as being either "woodland" or "barren-ground" caribou. Woodland caribou are generally heavier and larger than barren-ground caribou. They are found south of the Arctic Circle. Barren-ground caribou migrate the longest distances between their winter and summer ranges.

Woodland (left) and barren-ground caribou
Adapted for northern living

Caribou were living in North America during the last few ice ages (Wisconsin and Illinoian). Caribou have evolved over a million years of glacial influenced climates. Thus, caribou have developed adaptations allowing them to thrive in landscapes covered in snow and climates of cold temperatures.

Caribou can truly be called “chionophiles,” a word that means snow-loving animals.

Caribou have physical and behavioural characteristics that help them survive cold winter environments. Their shape, for example, plays a role in keeping them warm. Caribou have compact bodies, small tails and short ears. These features reduce surface area and thus the amount of heat that can be lost through the skin. In contrast, snakes have long, skinny bodies to increase their surface area so that they can regulate their body temperature through their skin.

To keep the heat in, caribou have two layers of fur covering their bodies and their ears, noses and muzzles. They have fine, crinkly underfur and a thick coat of guard hairs on top. The guard hairs are hollow. The air cells in this hollow hair act as insulation, keeping in the caribou’s body heat. The hollow, buoyant hair and large flexible feet of the caribou also make them excellent swimmers. Many caribou herds cross wide stretches of open or fast-moving water during their migrations.

Caribou further regulate their body temperature through their short, thick muzzles (the part of the head that includes the nose and mouth). The muzzle acts as a heat exchanger, warming and cooling air to reduce heat and moisture loss as the caribou breathe in and out.

Summer may be the most difficult season of the year for caribou. At this time, they go to alpine snow patches to cool off and to escape the insects that torment them. Barren-ground caribou search out windy areas on the coastal plain for the same reasons.

The hooves of caribou are large and wide. They work in the same way as
people's snowshoes to help the caribou travel over the snow with less effort. Caribou have two small toes called “dew claws” and two large, crescent-shaped toes that support most of their weight. In the winter, the fleshy pads on these toes grow longer and form a tough, hornlike rim. Caribou use these large, sharp-edged hooves to dig through the snow and uncover the lichens that sustain them in winter months. Biologists call this activity “cratering” because of the crater-like cavity the caribou’s hooves leave in the snow.

**An antlered animal**

Caribou are the only members of the deer family whose females as well as males grow antlers. There is so much variation in the way the antlers grow that no two antlers are ever the same, even on the same animal. The antlers of female and young male caribou are smaller and simpler than those of mature bull caribou.

Caribou shed their antlers every year. Antlers reach their maximum size when the caribou are four or five years old. Scientists have separated barren-ground caribou from woodland caribou based on the cross-section of their antlers. When cut crosswise, the woodland caribou antler is round while the barren-ground antler is compressed.

Antlers grow from two permanent bony stumps on the caribou’s head called “pedicles.” A special layer of fuzzy, hairy skin called “velvet” covers antlers when they are growing. This skin contains a network of blood vessels that deposit the minerals necessary to build the antlers. Growing antlers are fragile and sensitive. It takes three to six months to grow antlers.

Antlers have grown to their full size and become hard by the time fall arrives. The blood supply to them is cut off as the bone becomes denser. Bull caribou rub their antlers on trees and shrubs, peeling the velvet off in strips. Bulls use their antlers to challenge and threaten other bulls for mating opportunities with cows during the rut, or breeding season.

Males and females grow antlers at different times. Male barren-ground caribou start growing antlers in March and have a complete set ready for the rut in October. Bull caribou shed their antlers in the fall, after the rut, when hormone levels decrease. Cow caribou keep their antlers until after their calves are born in the spring. They use their antlers to defend their feeding areas (craters in the snow) from the larger but antlerless males. Cows need high-quality food to nourish growing fetuses or young calves.

The hair that covers the body of the caribou is called the “pelage.” The pelage varies in colour throughout the year and is darkest in the summer. Peary caribou are the lightest in colour, nearly white, while woodland caribou are dark brown.

**Antler or horn?**

Caribou, elk and deer have antlers. Goats, sheep and cattle have horns.

Antlers are generally only grown by males, with caribou being the exception to the rule. Antlers are made from bone that grows faster than any other kind of bone. An antler can grow up to one inch a day in the summer! The antlers of older animals are usually more elaborately branched, but the number of points does not signify the age of the animal.

In contrast, horns are permanent and grow slowly larger each year. Horns are not branched like antlers, and they usually grow in yearly ‘rings’ from which the animal’s age can be counted. Horns are made of keratin, which is the same material that your fingernails are made of. Usually both sexes of animals grow horns.
Caribou behaviour

Making ‘sense’ of the world

Like other animals, caribou rely on their senses to help them find food, avoid danger and recognize other animals. Caribou rely mostly on their keen sense of smell. They can use their noses to find food plants located deep under the snow. A cow caribou can recognize her own calf by its individual smell, even in a large herd of jostling caribou.

Sight and sound are less important senses for caribou when assessing danger. Sometimes caribou appear not to be disturbed by people who are standing still. However, caribou are very good at detecting movement, even in poor light. Their eyes are large and are located on the sides of their heads so they can see a wide range of what’s around them.

Caribou are more curious than other North American deer species. If they haven’t been able to verify something as having the scent of danger, they will often move closer to investigate it. People who are downwind of caribou have been able to entice the curious creatures by making odd movements and postures. But if the wind changes, wary caribou will flee to safer ground!

The caribou herd

Caribou need to be able to do two things at once: they need to eat, and they need to keep watch for predators. Like many other animals, caribou fill this need by gathering in herds. When caribou are in a group, several animals will be looking up and around while others are eating. They sniff the air regularly and can recognize predators by scent. They can alert other caribou to danger.
Barren-ground caribou form different kinds of herds at different times of the year. Prior to calving, pregnant cows will band together in small groups called “maternity bands.” After the young are born, the mothers and calves may form “nursery bands.” Larger and larger groups of caribou may move together through the summer as a strategy to reduce harassment by insects. When cool August nights mean fewer insects, these large groups break up and animals wander in smaller groups until fall. By early September larger groups again start to form and continue through fall migration. In winter, bull caribou may avoid groups of cow caribou and their calves, because they know that predators like wolves are drawn to the vulnerable young caribou. Also, they may be challenged for feeding territories by cow caribou, which still have their antlers.

There are other advantages to travelling in herds. By travelling together to calving grounds in large groups, pregnant cow caribou in the barren-ground herds reduce the risk of predators killing their calves by sharing the risk with thousands of others. As well, the animals in the centre of the herd are better protected from predators, who may attack unprotected animals or stragglers. In the same way, forming a tightly knit herd may help caribou protect themselves from aggravating clouds of insects.

Woodland caribou are much more solitary. Prior to calving, pregnant cows may separate to give birth and raise their calves in secluded patches of forest. Caribou are most scattered across the range in summer. They do, however, band together in the fall when males are courting females, especially just before winter. Cows, calves and teenage caribou of both sexes travel in small bands throughout the winter, while mature bulls separate until late winter when, for a very brief time, most members of the herd gather together in search of the fresh green plants that appear where the snow has melted.
Caribou communication

While caribou occasionally snort, grunt, pant and bellow, they are generally silent animals. The most common sound associated with caribou is a curious clicking noise. This clicking sound is produced when caribou walk. It is caused by tendons slipping over bones in the feet. Some aboriginal groups imitated in their ceremonial dances the sound of the caribou clicking. They used decorative rattles made of hollowed, dried hooves strung together.

When an unknown entity appears on the horizon, caribou will try to identify it using their sense of smell. If they can’t smell anything, they will circle downwind of the entity to pick up the scent. They move in a trot, keeping their tails up and their heads held high to test the wind for smells. If they become alarmed, caribou will sometimes rear up on their hind legs and bound forward. This is called an “excitation leap.” While doing this, they deposit a scent from a gland (the tarsal gland) between their toes. This scent, left on the ground, will warn other caribou passing over that spot.

Mother caribou communicate with their calves in several ways. A mother will teach her calf to follow her by using a technique called head-bobbing. She lowers her head to the ground and bobs it up and down when danger is near. If she becomes alarmed, she may push and nudge the calf to make it run, and she may encourage it with grunts. Or she may teach the calf to lie down, and then attempt to ‘lead’ the predator away, like mother ducks that feign a broken wing. By watching their mothers, calves learn the proper responses to danger. The calves’ behaviours are reinforced by the rest of the herd.
Caribou habitat

All animals, including humans, have basic needs. They need food, water, shelter and space. An area in which all these needs are met for caribou is called the caribou’s “habitat.” It is the place where the caribou lives.

Some areas are more important than others for the survival of caribou herds; these are called “key habitats.” Caribou need access to winter ranges with good snow conditions where they can find food. They need safe places to give birth to their calves and areas where they can find relief from insects during the summer.

Because caribou are often on the move, they can be versatile in their feeding habits and eat plants from a variety of habitats.

Caribou share their habitats with an astonishing variety of creatures. They are all part of the ecosystem, and support and sustain themselves to mutual benefit. A naturally functioning ecosystem is more than a food chain. Predators chase caribou, and so do tiny insects, whose larvae grow inside a caribou host. Caribou scour the tundra and forest floors to devour lichen, but their travelling hooves help other plants spread and take root elsewhere. Their fecal pellets return nutrients to feed such things as mosquito larvae in wet areas and plants.
What do caribou eat?

Caribou are “herbivores,” or plant-eating animals. The average caribou eats at least three kilograms of vegetation each day—the equivalent of about two garbage bags of food! Caribou eat different types of plants during the year, but their most important food is lichen. “Fruticose” ground lichens are the most significant. Famous among these is “reindeer lichen,” called *Cladina rangiferina*. In winter, when green vegetation is not available, caribou depend on the lichens they find beneath the snow. In boreal forests, caribou will eat lichens growing on the ground or on trees. Caribou will also eat winter green plants like lingonberry (low-cranberry sedges) and horsetails.

In summer there is a wider variety of food available for caribou. They munch on summer greens like grasses, sedges and dwarf willow or birch leaves. Peary caribou, which live on islands in the Arctic Ocean, enjoy the protein-rich flowers of purple saxifrage and lousewort. Caribou continue to eat these plants for as long as they can during the short northern growing season. When fall arrives, they return to eating lichens, as well as mushrooms if they are available.

Caribou are cud-chewing animals, like cows or moose. These animals chew their food, swallow it, regurgitate it and chew it again. Their stomachs are separated into four chambers to help break down food. Food enters the first chamber of the stomach, called the “rumen,” while the caribou is grazing. Bacteria in the rumen break down the plant material until the caribou is at rest in a safe place. Then the caribou “ruminates,” or further grinds the food. The food is regurgitated in small portions, called “cud,” and chewed by the caribou until it is reduced to pulp. The food then goes into the second and third stomachs, the “reticulum” and “omasum,” where most of the water is removed from it. The fourth and final stomach chamber is the “abomasum,” which is most similar to the human stomach. Here, food nutrients begin to be absorbed into the blood.
Liking lichens

Lichens are the colourful, crusty plants that cling to alpine rocks. They are also the wire-like tangles and many-branched clumps covering tundra boulders, rock outcrops and sandy forest floors. They are also the long dry green strings, or "old man's beard," that hang from trees in boreal forests. There are over two thousand kinds of lichens, and while these dry plants may not appear delicious to you they are a primary food source for caribou.

Lichens are made up of two kinds of plants—algae and fungi—that live together in a mutually beneficial, or symbiotic, relationship. Algae contain chlorophyll, which produces sugars and starches through the process of photosynthesis. Fungi are able to store lots of water to support the algae, in return absorbing the sugars and starches produced by the algae.

Lichens come in many shapes and sizes. They do not have roots, stems, leaves or flowers. There are three main groups of lichens. “Crustose” lichens are flat lichens that often attach themselves to rocks. “Foliose” lichens have a leaflike form. “Fruticose” lichens are tufted, or composed of erect stalks.

Lichens need water to grow. They act like sponges, absorbing moisture from the air, rain and snowmelt. When there is no moisture available, lichens dry out and become dormant. In the north, the season when lichens can grow is very short. Thus, even small-sized lichens can be decades or centuries old.

Lichens have been used by humans to dye cloth, ferment beer and set fragrances in perfume. They have also been used in medicated lotions and toothpaste. Lichens can also be used to monitor air pollution. Because they live for many years and absorb particles from air and water, lichens can contain high concentrations of chemicals and even radioactive fallout, carried in pollution from around the world.
Natural threats to caribou

Caribou predators

Predators are animals that kill and feed on other animals. Though these predators are often considered to be harmful to caribou, they benefit the herd by removing the diseased and old individuals, making the caribou population stronger. Caribou are a source of food for several northern predators as well as for humans.

Wolves

Apart from humans, wolves are the major predators of most caribou herds. During the winter wolves hunt in packs, which are usually made up of seven to nine wolves. An average wolf pack will kill a caribou every few days in the winter. They will spend a day or less feeding on the carcass, since what's left of the carcass freezes into solid ice.

The wolf pack may ‘test’ a herd of caribou by chasing them and watching for weaker animals that fall behind or are careless. They will then pursue and kill these animals. Wolves will also ambush caribou on trails between lakes, attempting to cut them off from the rest of the herd or to chase them into deep, soft snow.

Wolves usually attack the caribou's head, neck or shoulders. They will try to push the caribou off its feet, or hang with their teeth clenched in the caribou’s muzzle or throat. A wolf’s jaws can crush the skull of a calf.

Caribou respond to attacks by wolves by trying to outrun them. Where natural cover such as boulder-strewn terrain, ravines and forest occur, caribou will scatter to confuse the wolves. On frozen lakes and in large forest openings they will bunch together to find safety in numbers. If they are cornered, caribou have little means of defence and are usually killed. Bull caribou are especially vulnerable to attacks by wolves and other predators during the rut season, when they are exhausted and distracted.

Grizzly bears

Grizzly bears are major predators of newborn caribou calves on some calving grounds, and they may gather in places where calving activity is concentrated. Grizzlies are “omnivores,” which means they will eat a variety of foods including plants, berries, insects and meat. When caribou migrate through a grizzly’s territory, the opportunistic grizzly may try for some fresh meat, perhaps killing a bull caribou that is exhausted from the rut season. A grizzly may scavenge the carcasses of caribou killed by wolves or other predators.

Golden eagles

The largest of the birds of prey, the golden eagle is an efficient and capable hunter. Where golden eagles are common, they will prey on newborn caribou calves, swooping down with talons outstretched to kill the young animals.
Wolverines

Wolverines are compact animals with strong teeth and jaws and neck muscles that enable them to crush bones and tear at frozen flesh. They will often scavenge caribou that have been killed by bears or wolves but are also capable of killing newborn calves and sick or dying caribou.

Other scavengers

Many other animals in the northern ecosystem take advantage of caribou that have been killed. Lynx and foxes will prey on newborn caribou and also scavenge carcasses, as will birds such as eagles, hawks, ravens, owls, gulls, jaegers, jays, woodpeckers and chickadees. These and other animals are opportunistic predators; they take advantage of circumstances that allow them to overcome prey that would normally escape.

Tiny attackers: insects and parasites

There are other, much smaller members of the caribou’s habitat that can have a big effect on the caribou’s health. Blood-sucking insects like mosquitoes, blackflies, biting midges and bulldog flies are “micro-predators” of caribou. They persistently attack caribou to get the blood they need to hatch their eggs. In summer, these flies often torment caribou, distracting the calves from nursing and the adults from feeding. Caribou will rush wildly about, trying to avoid insect harassment, sometimes injuring themselves in the process.

Tormenting insects keep caribou on the move searching for windy areas like hilltops and mountain ridges, rock reefs, lakeshore and forest openings, or snow patches that offer respite from the buzzing horde. Gathering in large herds is another strategy caribou use to block insects.

Parasites are dependent on the host animals that they live with for all or part of their life cycle. Among the parasites that affect caribou are a variety of worms, insects and microscopic animals called protozoa. Parasites alone are unlikely to kill a caribou, but they may cause the animal to be weak, malnourished, or generally in poor condition. They may also distract them to the point where predators are able to catch them more easily.

Some of the parasites and diseases affecting caribou can be passed along to humans, if they pass through dogs, which act as intermediary hosts. All can be avoided by thoroughly cooking affected caribou organs and meat before eating and/or feeding to dogs.

Tapeworms

Several tapeworms can be found in caribou. The immature forms of the tapeworms hatch from
eggs inside the caribou and form themselves into cysts on the caribou’s organs or muscles. If an infected caribou is killed and eaten by a wolf or dog, the cysts hatch into tapeworms that live in the predator’s gut. Some kinds of tapeworms can be up to five metres long! These adult tapeworms lay eggs that pass out in the wolf’s droppings. The eggs end up on plants that are eaten by caribou, and the cycle continues.

**Warble flies**

Several fly species parasitize caribou year-round. Warble flies, which look like small bumblebees, chase caribou around during the late summer and lay their eggs in the caribou’s hair on the leg and flank. Larvae hatch from these eggs, burrow through the caribou’s skin, and migrate to the animal’s back. Here they form cysts and live through the winter, poking a small hole in the caribou’s skin through which to breathe. The next spring, the larvae pop out through the breathing hole and develop into an adult fly. These flies only live for about a week, during which time they search for another caribou on which to lay their eggs and continue the cycle. It has been estimated that a female warble fly can fly 1,000 km looking for a caribou. Warble fly larvae are edible and considered a delicacy by some Inuit.

**Nose bot flies**

Female nose bot flies deposit larvae near the nose opening of the caribou in the summer. The larvae hatch and attach themselves to the inside walls of passages behind the caribou’s nose. Over 150 nose bot larvae have been found in a single caribou. This many can make breathing difficult, especially if the caribou is running fast. The larvae grow all winter. In the spring, the annoyed caribou sneeze out the bots, and they grow into bumblebee-like flies.

**Protozoa**

Protozoa are primitive, one-celled animals. They can’t be seen by humans except under a microscope. One kind of protozoa, Besnoitia, can cause caribou bones and tendons to become pitted and rough. It is believed to be passed on by biting insects such as black flies. Sarcocystis (see diagram in “Bot fly boogie” activity) has a life cycle similar to that of tapeworms. Giardia (sometimes call “beaver fever” in humans) is contracted through infected drinking water.

**Other threats**

Caribou calves are barely larger than snowshoe hares when they are born. They are very vulnerable at this time. If the weather is poor on the calving grounds, strong winds may keep a calf from standing up to feed. Exposure to cold, wet conditions may also cause calves to weaken and die. Though calving grounds are chosen in areas where few predators roam, many caribou calves are killed by wolves, golden eagles, gulls or grizzlies.

Migratory caribou move over a treacherous landscape of melting or falling snow, icy cold rivers and rocky terrain. An accident can occur at any time
of the year, but particularly during migrations. River crossings are especially dangerous. During spring migration, rivers are flooding and choked with broken ice. Even very young calves attempt to cross, swimming beside their mothers’ sheltering bodies. Strong currents can carry calves away, or they may be hit by floating ice chunks and injured or killed.

Other caribou are killed during the large herd migrations. Insect hordes or predators may cause the herd tostampede wildly, trampling calves and injuring adults. If calves lose or are deserted by their mothers during these stampedes, they will die. Another cow will not accept a calf that is not her own.

Caribou are susceptible to some bacterial diseases. One of these is called “brucellosis.” It causes female caribou to abort or give birth to weakened calves. Sometimes the cow will retain the afterbirth, which may cause an infection. Abortion and sterility caused by brucellosis reduce the productivity of a caribou herd.

Humans also kill caribou, through hunting for food or trophies and also through the direct and indirect effects of their activities. Habitat encroachment, resource development and long-term processes such as global warming and pollution may all have great impact on the survival of wild caribou herds.

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**Caribou tragedy**

Human actions can have a profound impact on caribou. In 1984 10,000 caribou were drowned as they attempted to cross the Caniapiscau River in northern Quebec. A hydro dam had changed the flow rate and quantity of water in the river. The caribou were swept over Limestone Falls to their death.

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*Barren-ground caribou crossing the Porcupine River*
DON'T BUZZ WILDLIFE

It stresses them and causes injuries

At any time of year — even summer — wildlife survival depends on conserving as much energy as possible. Harassment by aircraft causes huge energy expenditures that reduce wildlife's ability to cope with the stresses of their environment. Such harassment can even result in injuries, abandonment and death of young animals.

Each jurisdiction in Alaska and Canada has laws pertaining to wildlife harassment with fines up to $250,000 U.S. for an individual felony. The north may look empty from the air but there are people on the land all year round. They will report the registration of any aircraft that is harassing wildlife.
Seasonal movements of caribou

Some caribou are migratory, moving great distances from winter to summer grazing ranges and calving areas. The barren-ground caribou are well known for their incredible long-distance migrations. The largest herd in North America, the 700,000-strong George River Herd of the Ungava Peninsula, covers over 500,000 square kilometres in its annual migratory cycle.

Some herds of mountain and woodland caribou also make seasonal movements from summer to winter range and have distinct calving areas. Woodland caribou in other parts of the continent are not truly migratory, but sedentary, occupying summer and winter ranges that overlap to a large extent. They may move within a range of only a few hundred square kilometres over the seasons.

Winter

Caribou live with snow, cold weather and short days during the long winter. Caribou do not travel great distances in the winter. Their winter ranges are usually in areas where snow can be dug easily. Caribou make “craters” in the snow with their hooves, searching for ground lichens.

Spring

When the snow begins to melt and the days grow longer, caribou begin to feel the migration urge. Pregnant cow caribou are the first to move towards calving grounds. Bulls, young caribou and cows that have not bred begin to migrate to summer ranges a few weeks later.

Caribou calves are born in the spring, from mid-May to mid-June, depending on the herd. Introduced reindeer (see sidebar on next page) can even calve at the end of April. The timing of caribou births appears to match the times when new, nutrient-rich vegetation is at maximum growth.

In the large barren-ground herds calves are born in special areas called “calving grounds,” which can vary from year to year but are often in traditional locations. Caribou calving grounds are areas where new spring vegetation appears first. They may also be areas that offer better protection from predators and insects. In smaller woodland herds, individual cows choose specific calving sites that they return to year after year rather than congregating in calving grounds. Among the forest-dwelling woodland caribou, cows separate to search out secluded locations for calving on treed islands in lakes and muskegs.

Caribou calves grow up fast. They are able to stand shakily and walk a few steps within an hour of being born. After a day, they may be running and trotting. Only a couple of days after being born, calves are able to keep up a running pace and even swim across streams!

Because they are born at about the same time, calves grow up together and develop at similar rates, learning to keep up with the herd by the time it begins to move. Calves that are born early in spring, during migration on
the barren lands, or after the calving season are not very strong. They are more likely to be killed by predators or abandoned by their mothers when they cannot keep up with the rest of the herd.

Calves remain close by their mothers throughout the summer. They learn behavioural responses from their mothers and from the rest of the herd, such as how to recognize and react to danger. By the fall, they are weaned and no longer dependent on their mothers for milk.

Summer

Caribou herds continue to move about in their summer ranges. For barren-ground caribou these are north of tree line. Mountain caribou move to moist alpine tundra and open mountain meadows, while woodland caribou move to open spruce and pine forests close to wetlands and lakeshore. By being continually on the move, caribou can avoid overgrazing and also take advantage of a wide variety of habitats. With the new growth of grasses, herbs and shrubs, caribou can diversify their diet. During the long summer days they eat steadily, building up fat reserves for the fall rut and the winter. This good life in summer is often disturbed by hordes of parasitic flies and mosquitoes. These insects drive the caribou to seek relief areas in mountains, on snow banks and even in lakes and oceans.

Fall

As cold weather approaches, the summer movements of the caribou within the herd blend together and become a fall migration. Barren-ground caribou move south from the northern tundra towards the boreal forest or other more sheltered areas where snow and weather conditions are better. Similarly, mountain caribou move from exposed locations into valley bottoms, and woodland caribou move to sandy forest openings and muskeg wetlands to feed on lichens growing on trees and on the forest floor.
**Caribou mating season: in a ‘rut’**

The mating season of certain ungulates like caribou, elk and moose is called the “rut.” During this time, bull caribou grow thick white manes, and their necks swell to twice their normal size. Bulls thrash against trees, rubbing the velvet off their antlers. They become restless and aggressive. They eat very little and begin to emit strong odours. (At this time, hunters avoid killing them, because their meat is tough and strong-tasting.)

During the rut, caribou challenge other bulls to ritualized sparring matches in an attempt to prove dominance. They face each other in a “threat position,” with heads low to the ground and antlers thrust forward. If a challenge is accepted, the bulls clash together and push and twist their heads from side to side. The bull that manages to push the other backwards has established dominance. These battles can sometimes become violent, resulting in injuries and even deaths. Occasionally, the antlers of two sparring bulls become locked together, and both may be killed by predators or die of starvation.

Some woodland caribou bulls herd groups of females into “harems” and attempt to prevent other bulls from mating with them. Barren-ground caribou are constantly mingling and breaking into new groups.

During the rut, bulls approach cows from behind with outstretched necks. These usually silent creatures make a hoarse, coughing sound. If a cow is not ready to mate she will run away. But if she has come into “heat” she will allow the bull to move closer, mount and mate with her. The bull then moves on to other cows. By the end of the rut season, bull caribou are exhausted and depleted of the energy fat reserves they have built up over the summer. They are in rough shape and susceptible to predation as they face another long, cold winter.

Attempts to introduce reindeer herds to the Canadian north have met with varying degrees of success. Reindeer were brought over from Alaska in the 1930s, in one case taking five years to move across the Arctic to the Mackenzie Delta. The plan was to establish a herd of reindeer owned by the government, from which interested Inuit could borrow to start their own small herds. Several family-owned herds were established, but the experiment was not a success. Only one commercial reindeer venture is still operating, at Reindeer Station, near Tuktoyaktuk. This herd, today numbering about 8,000 animals, has operated as a private business since the mid 1970s.

Reindeer were introduced to another Arctic community, Sanikiluaq, on the Northwest Territories Belcher Islands, in 1978. Native caribou had disappeared from these Hudson Bay islands because of severe weather conditions. The government introduced the reindeer to the islands, hoping to supplement the Inuits’ traditional diet of marine foods. The reindeer are now free-roaming on the islands, managed and hunted by the local Inuit.

Herding of reindeer did not catch on in a significant way with native peoples in Arctic North America, who continue to prefer to hunt wild caribou. Today about 50,000 reindeer remain, most of which are in Alaska. Reindeer provide profit to today’s herders through the sale of meat and antler velvet, which is valued in Asia as a health aid.
Humans and caribou

Caribou have always formed a basic part of the cultures of people living in the Arctic and subarctic. Caribou have provided people and their dogs with meat for eating; fat for light and cooking; hides for clothing and shelter; and bones for needles, fish hooks and ornaments.

People also formed mythologies and legends and structured their cultures around the caribou. They travelled to known migration routes to intercept herds for hunting. They told stories about caribou. They taught their children to respect these animals. Traditional hunters believed that if they had the right thoughts about animals and treated the carcasses properly, they would always have enough to eat.

They also created taboos that showed their respect. For example, in both Inuit and Dene cultures it was taboo to mix foods from the water with foods from the land. Therefore, caribou and fish could not be eaten on the same day. Inuit did not even cook caribou over driftwood fires because the wood came from the sea.

Using every part of the caribou

Resourceful northern peoples know not to let anything go to waste. Their respect for the caribou they hunt and their many survival needs lead them to find innovative uses for all parts of the animal.

(The discussion below uses the past tense. Please be aware, however, that caribou is still an integral part of many northern cultures, and much of what is described is still in practice today).

The caribou’s meat was eaten fresh or dried. It could also be pounded and added to berries and grease to make “pemmican,” which lasted a long time. Sections of the caribou’s head such as the tongue, nose and chin were considered delicacies. The brains were eaten or used to cure hides. The velvet on the antlers was singed and eaten. The rest of the antler bone was used to make a variety of carved items including buttons, fishing jigs, knife handles and the ribs of kayaks.

Many organs were also used. The heart, liver and kidneys were roasted and eaten. The stomach was cleaned and washed and then used to store fat, blood, or water. The intestines were washed and cut up and added to stews. The blood was collected and used to add flavour to soups. Lungs were not eaten by people, but were fed to dogs.

Bones were scraped clean of meat and used to make tools like scrapers, knives, needles and fish hooks. They could also be ground into bonemeal for cooking. Boiled bones provided grease. Bone marrow was eaten raw or cooked. Hooves were boiled until tender, eaten raw or dried. Hollowed hooves were made into decorative rattles.

Caribou hides were also used in various ways. Dried or untanned hide, also called rawhide, was used to make drums, rattles and buckets, or was

Clothing from caribou

You may have heard of Hollofil and other types of modern outdoor clothing made from synthetic fabrics. This clothing can be a good insulator, but the original ‘hollow-fill’ came courtesy of the caribou. Northern native peoples have been using caribou skins to make clothing for centuries, knowing that such clothing provides excellent insulation and durability in a harsh winter environment.

Each caribou hair consists of a network of large cells arranged like a honeycomb to trap air. Air is also trapped between each of the densely matted hairs. This air acts as an excellent insulator. Ice and snow collecting between the hairs can easily be beaten off with a wooden or bone beater, a drying technique that doesn’t work as well with modern fabrics. Traditional clothing made from caribou skins can be a lifesaver for an Inuit hunter caught in a fierce storm.

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stretched over boats. When rawhide is stretched in strips and dried, it forms “babiche,” a tough thong used in the webbing of snowshoes, dog harnesses, snares and bowstrings.

Tanned hides were used to make clothing: moccasins, mitts, mukluks, pants, shirts and dresses. Tanned hides were also cut and sewn to make many other things, from pouches and packsacks to bow strings and baby belts. They were also sewn together and draped over frames to make skin houses.

Hides tanned with the hair on were used to make warm winter clothing: parkas, mittens and pants. They could be used as robes or sleeping mats. Sewn together and draped over willow poles, they made winter dwellings.

**Traditional hunting methods**

Caribou was the staple around which many northern communities were organized, and the hunting of the caribou was often a community activity in which everyone participated.

One common hunting method was to build an enclosure to entrap migrating caribou. These corrals or impoundments were constructed in clearings or on frozen lakes. They were built of brush and consisted of an exterior fence that could be over a kilometre long, surrounding a maze of shorter brush fences with babiche snares in the openings. The caribou were driven into the corral. Women and children surrounded it, shouting to keep the caribou from breaking out. The hunters then attacked the snared caribou with spears and the loose caribou with bows and arrows.

Out on the tundra, where there was no brush from which to construct corrals, hunters placed sticks topped by fluttering strips of hide. These sticks were arranged in rows to lead caribou towards blinds constructed of stones. Women and children again took part, chasing the caribou towards hunters hiding behind the blinds.

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**Caribou tragedy**

Human actions can have a profound impact on caribou. In 1984 10,000 caribou were drowned as they attempted to cross the Caniapiscau River in northern Quebec. A hydro dam had changed the flow rate and quantity of water in the river. The caribou were swept over Limestone Falls to their death.
In similar fashion, Inuit built long rows of stone cairns they called “inukshuks,” meaning “resembling a person.” Migrating caribou were thought to perceive these stone men as hunters and avoided passing through them. In this way, the hunters were able to lead caribou to areas where they could ambush them.

During migration periods, many hunting groups waited at traditional river and lake crossings, and speared caribou as they swam. From a kayak or canoe the hunters could lean over with a short lance and pierce the animals’ backs. The floating carcasses of caribou could be retrieved later.

Several solitary hunting methods were also used. Caribou inhabiting forest areas in winter could be chased through deep snow by a hunter until they were tired enough to allow the hunter within bow and arrow range. Hunters also tried to trick caribou, draping themselves with caribou skins and holding antlers over their heads and moving towards unwary caribou until they came within arrow range.

Caribou snares were made with babiche. The snares were set at antler level and tied to sturdy trees or poles that would get entangled in brush when dragged about by the harried animal.

During the rut period, bull caribou were sometimes lured towards the sounds of other bulls fighting over a female. The unfortunate animals actually encountered hunters rattling pieces of antler together!

It is still possible today to see the remains of caribou fences and hunting camps on the tundra. The small, squat, stone men—inukshuks—built by hunting communities of the past are still present on the windswept northern coastal plains.

Barren-ground caribou crossing the Porcupine River
Changing relationships

The arrival of Europeans changed the northern people’s relationship with the caribou. The nature of the caribou harvest was dramatically altered by the needs of whalers who travelled the arctic seas in the 1800s. They needed caribou for provisions. So did later waves of fur traders and trappers, prospectors and miners, who all added their needs to the caribou harvest. Between 1890 and 1910, professional meat hunters worked to feed all the people on the land. In the 1930s, a great deal of caribou meat was needed to feed the animals of the many people who used dogs and sleds for travel. The introduction of the rifle made it easier to kill the caribou and lessened the amount of skill needed in the hunt.

In less than a generation, mechanized transportation and high-powered rifles have again revolutionized hunting. The fleet-footed caribou must out-race high-speed human predators.

Present day use of caribou

The dietary and cultural aspects of the caribou remain important to northern aboriginal groups. Caribou is a nutritional food source, high in protein and low in fat. Hides and antlers are still used to make clothing and artwork; crafts and art are now an important aspect of the northern tourism industry.

The hunt has a cultural importance to the community as well. Being able to procure one’s own food and enjoy sharing it with others is a source of satisfaction, self-worth and dignity. Hunting is an integral part of northern society and culture, and it offers a lifestyle alternative to buying imported foods from retail stores.

Caribou are hunted every month of the year and consumed every day by the aboriginal people of Alaska, Yukon, NWT, Nunavut, Manitoba and the Ungava Peninsula. Non-aboriginal northerners also hunt caribou on a seasonal basis as dictated by wildlife regulations. Other people can come from southern parts of Canada or foreign countries to hunt caribou. Caribou thus have both recreational and subsistence value.

Tourists also enjoy caribou for sightseeing and photography. People camping, hiking or canoeing are thrilled at the sight of wild caribou. The sight of these wild herds gives people a strong feeling of wilderness.

Want to find caribou?

Start by learning more about caribou. Think about their needs. Where would caribou find food, water and shelter in this season? Study caribou migration routes and the kinds of habitat they might choose at various times of the year. In the summer, caribou are more likely to be spotted on breezy ridges or seen as brown specks on remnant snow patches, where they seek relief from insects. Remember to think about whether your presence might be a disturbance to caribou.

I like you from afar!

Please keep your distance.
Human-related threats to caribou

Whereas before northern people were dependent on caribou populations for survival, now the caribou’s fate is often held in the hands of people.

Oil and gas development on calving grounds

Concentrated human activity in caribou calving grounds—such as oil and gas exploration or development—could interfere with instinctive maternal behaviours or cause cows to abandon traditional calving areas for less favourable ones where food may be scarce or calves more at risk of predation. At birthing times, cows are wary and will flee if disturbed. Calves that are not yet steady on their feet may have a difficult time keeping up with their mothers.

There are several theories about why barren-ground caribou return to traditional calving grounds year after year. One is that caribou are avoiding insects and predators present in greater numbers at this time of the year on the southern parts of their range. Another is that cow caribou need the new, nitrogen-rich vegetation that occurs on the calving grounds. For whatever reason, traditional northern calving grounds are critical habitat for many barren-ground caribou herds.

Logging on caribou ranges

Woodland caribou depend on lichens from the forest floor for winter food. Cows seek out the mature forested islands in muskegs for raising calves. Caribou need the shelter of forest for cover. Caribou ranges are typically large, harbouring small herds of animals. Caribou must travel constantly to avoid overgrazing in habitat where the food source is thinly scattered, grows slowly and is sensitive to disturbance. Intensive logging activity on woodland caribou ranges could destroy important feeding grounds,
calving areas and forest cover. This destruction might occur at too rapid a rate for caribou to adapt. It could mean that in the long run, fewer and fewer caribou will be able to survive in forests subjected to logging.

**Roads**

Ancient northern hunters knew that caribou were wary of unusual linear structures. They were able to guide the caribou for hunting using flimsy antler fences or rows of stone piles. In a similar way, reindeer herders in Scandinavia sometimes guided their animals by laying dark strips of cloth on the ground. In a modern society where roads, power lines and oil pipelines cut across the landscape, the caribou’s wariness may have many implications for their survival.

There are several major effects roads have on caribou. One major problem with roads is the increased access they offer hunters. Herds that once were available only to small groups of subsistence hunters travelling over the land are made accessible to many people. Roads also provide a hunting corridor for wolves, which use the plowed surface to travel and survey their prey from the road.

Another consideration is whether the vehicles and people travelling along roads will disrupt the movements of caribou herds. If caribou avoid crossing roads, their range on the other side of the road is lost to them. Roads also attract tourists, and the more traffic the more chances that caribou will be hit and killed by vehicles. Tourists may also start forest fires.

Roads, once in place, tend to encourage further industrial expansion and development. The compounding effects of development on fragile northern ecosystems are not fully understood. Logging, increased air travel and hydroelectric dams could all pose threats to caribou herds.

**Disturbance**

Activities associated with hunting and northern travel can pose problems for caribou. Snow machines, automobiles and aircraft that chase caribou or frighten them into running long distances can cause a problem called "stress syndrome." Violent exertion causes chemicals to build up in muscles faster than blood can remove them. The changes this causes in the muscle can bring death to the caribou, hours, days or even weeks after the harassment occurred. Panicked caribou can also injure themselves in other ways. Hunters must be aware that the survivors of a hunted caribou group may suffer as much as their quarry.

**Lichen pollution**

Pollution caused by people living far from the territory of the caribou may still have an effect on the caribou and those that depend on them. One example of this effect is that of the radioactive element cesium.

Caribou depend on lichens as a primary source of food in the winter months. Lichens take nutrition from moisture. Lichens grow very slowly and live a very long time; because of this nutrients are more concentrated...
in lichens than in other plants. Unfortunately, heavy metals such as cadmium and cesium accumulate and become concentrated in the same way. Cesium is passed along to caribou that eat the lichens. Radioactive elements like cesium may be cancer causing.

In northern Canada, tests have shown the levels of contamination to be low enough that Health and Welfare Canada has not recommended against the human consumption of caribou meat. However, contamination levels were so high in northern Europe after the Chernobyl nuclear disaster that reindeer meat had to be destroyed. Even in Canada, levels of contamination increased by up to 25% in some caribou herds after the disaster.

Cesium does not persist in the body tissues of caribou. This means that the level of it found in the meat will be higher in winter, when the animals are on a lichen diet, than in summer, when caribou eat a wider variety of plants. However, other forms of pollution, like heavy metal fallout, do accumulate in body tissues such as the liver and kidneys. The caribou of the far north are a powerful symbol of the potentially devastating effects of human activity, even on the other side of the world. Perhaps this example will encourage people to understand that every action has a consequence.
Studying caribou in the wild

Traditional knowledge of caribou was gathered through centuries of observing the behaviour of the animals. Traditional knowledge led to values and hunting practices that promoted respect and complete use of the animal, rather than wasteful or unwise killing. Traditional knowledge of the caribou is centred in northern aboriginal communities and cultures, passed on through an enduring oral tradition. Aboriginal people use the knowledge that has been passed down to them in their interactions with caribou in the present.

Governments and biologists gather scientific knowledge about caribou. It is based on repeatable observations, experiments and data gathering. Scientific knowledge is based on a written record.

Both scientific and traditional knowledge about caribou can be used together in wildlife management to ensure the survival of healthy caribou populations despite hunting and resource development.

Biologists study animals to learn the best ways of managing them for the survival of ecosystems. Caribou and other large mammals can be considered "indicator species": that is, if they survive in healthy populations then so do many other members of the ecosystem.

Biologists gather information about caribou in several ways. They may do aerial or ground surveys to count caribou herds and study their composition (the numbers of various sex and age classes). Biologists can also get information about caribou from native and non-native hunters by doing harvest studies. They can tag caribou and find out where the caribou are killed by collecting tags from hunters. Another kind of study involves putting radio collars on caribou. These collars transmit a signal that can be picked up from an airplane or by satellite. Radio-collaring allows scientists to track the movements of individual caribou through the seasons.

Caribou viewing tips

Always observe caribou from a distance. If a caribou becomes alert or nervous and begins to move away, you are too close.

Use binoculars or spotting scopes to get a better view.

Try to minimize the noise you make: talk in whispers and limit the clicking of cameras.

Never come between a cow caribou and her calf.

Avoid bull caribou during the rut season when they may be aggressive.

Behave like a guest in their wild habitat: do not bother them.

If you can't find any caribou, keep in mind that people have been baffled by the movements of caribou for centuries. Some, like the men of Sir John Franklin's expedition in 1821, have starved to death because they miscalculated the behaviour of caribou. Hopefully, your caribou mission doesn't have such high stakes!
Working to protect caribou

The more we learn about the effects humans have on animals, the more we realize that we need to foresee the consequences of our actions and plan accordingly. This can be called wildlife management.

In the past, humans did not have the means to seriously alter the natural environment and the abundance of wildlife that depends on it. New developments in technology and the explosive growth of human populations have given us the power to wipe out entire species. We have learned that wildlife needs protection, or stewardship, to survive in the world of today.

Wildlife management can take many forms. It can include licensing hunters and setting hunting seasons and quotas. It can also mean allocating resources to certain users, like aboriginal groups or resident hunters. Another important way wildlife management works is by protecting habitat or setting guidelines for its use.

Another management tool is to make efforts to reduce caribou mortality. Predator control programs are one way governments have tried to protect caribou populations. Hunting of caribou can also be restricted. The government restricts non-native hunters by imposing seasons, quotas and licensing requirements. Aboriginal hunters are generally assured access to caribou and other game animals for food.

The management of caribou is made more complicated by the fact that these animals migrate great distances. Caribou pay little attention to political boundaries, crossing through adjacent provinces, territories and even countries. Wildlife managers are learning to balance traditional and scientific knowledge about caribou when making decisions.

Successful management of the caribou is challenging because different people may have different ideas about how many animals should be harvested every year and how many caribou each person should get. Other people may have different ideas about how the land should be used and what the best ways are to protect caribou and their habitat.

Many jurisdictions are focusing on "integrated management" of wildlife. In Manitoba, for example, department wildlife biologists review logging plans with respect to wildlife habitat and have the ability to change operations to accommodate wildlife requirements. The new discipline of conservation biology guides this process.

Another way that management of caribou has improved in recent years is through a process called "co-management." Co-management is a partnership where all people who rely on the caribou in an area are involved in making decisions about how they are managed. This often involves biologists, government representatives, aboriginal people and other stakeholders.
How can you help protect caribou?

One way you can help protect caribou is by learning more about caribou, their habitat and the threats to their survival. Without public support, wildlife management programs have limited success. Students can become involved in caribou and other wildlife issues by participating in public consultations regarding issues that affect caribou. Issues may be local or national, such as when land use regulations are being established or changed.

Students can also contact local government, nonprofit and private wildlife agencies for ideas on how to help caribou and their habitat. People face important choices now and in the future about how we use and affect the natural world. These choices can affect caribou and other living things.

Students can explore questions about caribou in the following activities and in discussions with their friends, families and communities. By turning education into action, students can make a difference to caribou. Their concern and activism can ensure that caribou continue to be an important part of northern ecosystems and communities, and a connection to the wild.
Activities
Barren-ground caribou migration
(Adapted from Below Zero, Saskatchewan Environment and Resource Management and the Canadian Wildlife Federation)

Objectives
Students will:
1. Understand the annual migration cycle of barren-ground caribou herds.
2. Understand how hunting and predation affect caribou populations.
3. Play an active game that demonstrates the above concepts.

Method
Students learn about the migration cycle of barren-ground caribou by playing an active outdoor game that represents the annual movements of a caribou herd.

Background
Barren-ground caribou are well known for their incredible long-distance migrations. Caribou live with snow, cold weather and short days during the long winter. Caribou do not travel great distances in the winter. Their winter ranges are usually in areas where snow can be dug easily. When the snow begins to melt and the days grow longer, caribou begin to feel the migration urge. Pregnant cow caribou are the first to move towards calving grounds. Bulls, young caribou and cows that have not bred begin to migrate to summer ranges a few weeks later. In the large barren-ground herds calves are born in special areas called "calving grounds," which can vary from year to year but are often in traditional locations.

Caribou herds continue to move about in their summer ranges. For barren-ground caribou these are north of tree line. By being continually on the move, caribou can avoid overgrazing and also take advantage of a wide variety of habitats. With the new growth of grasses, herbs and shrubs, caribou can diversify their diet. During the long summer days, they eat steadily, building up fat reserves for the fall rut and the winter. As cold weather approaches, the summer movements of the caribou within the herd blend together and become a fall migration. Barren-ground caribou move south from the northern tundra towards the boreal forest or other more sheltered areas where snow and weather conditions are better.

Apart from humans, wolves are the major predator of most caribou herds. During the winter wolves hunt in packs, which are usually made up of seven to nine wolves. An average wolf pack will kill a caribou every few days in the winter. The wolf pack may ‘test’ a herd of caribou by chasing them and watching for weaker animals that fall behind or are careless. They will then pursue and kill these animals.

Wolves will also ambush caribou on trails between lakes, attempting to cut them off from the rest of the herd or to chase them into deep, soft snow.
Caribou respond to attacks by wolves by trying to outrun them. Where natural cover such as boulder-strewn terrain, ravines and forest occur, caribou will scatter to confuse the wolves. On frozen lakes and in large forest openings they will bunch together to find safety in numbers.

**Set-up**

1. Refer to the "Caribou migration diagram" included on page 35. Use four pylons or flags to mark the corners of the summer range. Similarly mark the corners of the winter range at the other end of the playing field. Use four more pylons or flags to mark the corners of the calving grounds. If possible, orient the playing field so that the summer range is in the north and the winter range is in the south. If your outdoor area has trees, it is appropriate to mark the winter range in that area. Place token collection pails in the circle "T" locations indicated in the "Caribou migration diagram."

2. Scatter most of the food tokens in the summer range, reserving one food token per caribou for the winter range.

3. Use the ropes to represent the river and choose two participants to wriggle the ropes. (This is a good role for mobility challenged participants.) The two participants who represent the river will also be the persons who empty the token pails each round.

**Procedure**

1. Choose two fast runners as wolves. Choose another as the hunter. The hunter represents the traditional First Nation people who are allowed to take caribou for subsistence (food) any time the caribou migrate near the community.

2. Briefly explain the life cycle of the caribou. It helps to walk the participants through the playing field, explaining what happens at each point in the cycle, showing them where to collect and drop tokens, and demonstrating how to move in each phase.

3. The activity begins in summer. The caribou move constantly back and forth across the tundra picking up one food token at a time. Summer is a time of plenty when caribou replenish fat reserves and improve their health. The caribou are preparing for the rigours of the fall migration, the period of rut and winter severity.

4. The wolves try to catch caribou. When a wolf tags a caribou, he or she takes the caribou's food tokens and escorts the caribou to the calving grounds. The caribou that are caught become unborn calves waiting for the herd to reach the calving grounds in the spring, when they can reenter the game.

5. When the activity leader calls "fall," the caribou begin their southern migration. To represent the energy expenditures during the migration, each caribou deposits one food token in the first pail, then another in the next pail when he or she jumps across the river. They deposit another food token on their journey from the river to the winter range.
Caribou migration diagram

SUMMER RANGE

Return to summer range with calves

CALVING GROUNDS (no wolves)

at least 30m apart

RIVER

hunter

WINTER RANGE

pregnant running
6. During the migration, the wolves follow the caribou, taking as many caribou as possible, but only one at a time. Wolves must stay two metres away from the caribou at the token deposit pails. Each wolf must get at least 25 food tokens to avoid starvation and thus survive each round (yearly cycle). (Wolves need more food tokens than the hunter because of their higher energy expenditure following the caribou.)

7. The hunter moves back and forth along the river and hunts caribou as they migrate past his community. (We are not aware of any women participating in the actual taking of game in this traditional society. However, women play an essential role in the processing of the meat.) The hunter takes the food tokens of the caribou he catches and takes his kill(s) to the calving grounds. He may then return to the river area and hunt for more caribou. The hunter must get at least 12 tokens per yearly cycle to feed himself and his family and relatives.

8. The leader calls "winter" and the caribou proceed to the winter range in the transitional forest. Each caribou must collect at least one food token to sustain life. The caribou have to keep moving to avoid predators.

9. The leader calls "spring" and the caribou begin the migration north toward the calving grounds. The caribou must deposit one food token each on the journey to the river, jump across the river, deposit another token after crossing the river and proceed to the calving grounds. Caribou who do not successfully jump across the river are dead of exhaustion and must go to the calving grounds where they can rejoin the game.

10. Caribou who successfully crossed the river must now run with their hands on their knees to represent the extra energy it takes to travel while pregnant with an unborn calf.

11. When the caribou arrive at the calving grounds, they must each deposit one food token. Any caribou who has at least two food tokens left may choose a calf and give one token to the calf. The wolves do not follow the caribou into the calving grounds. This represents the time wolves spend raising their families.

12. The river participants empty the token pails, allocating five per caribou to the summer range and one per caribou to the winter range in preparation for round two (year two). The leader or recorder records the population of surviving caribou and newborn calves by having the caribou show their food tokens. These are then collected and redistributed to the summer range. Caribou who have no remaining food tokens die and stay in the calving grounds until the next round. Caribou who only have one food token remaining survive but do not reproduce.
13. Wolves compare food tokens. The wolf who has the most food tokens is able to reproduce and goes to the calving ground to select a wolf pup who will join the hunt in the next round. Any wolf who does not have at least 25 tokens starves, deposits all food tokens into one of the pails and goes to the calving grounds to await the next round.

14. The hunter must have at least 12 tokens to survive. If he has more, he can go to the calving grounds to select a participant to join him in the hunt for the next round. All his food tokens must be deposited into one of the pails before the next round.

15. Round two and succeeding rounds begin with summer on the tundra and with the caribou collecting food tokens in preparation for the migration. The recorder should also record the number of wolves and hunter each round.

16. After about four rounds, stop the play and discuss what the participants observed about the life cycle of the barren-ground caribou.

Extensions

Play the game with an increased number of hunters and allow the hunters to travel throughout the caribou range. This represents the recent increasing population of First Nation hunters and their changes in technology such as automatic rifles, snowmobiles and use of aircraft to travel to the herds’ locations.

What effect does this have on the caribou population? Can participants predict what would happen to the caribou herd if the size of the annual hunt were not controlled?

In Saskatchewan, Manitoba, Nunavut and the Northwest Territories, the food replacement value of the meat from the Beverly and Qamanirjuaq barren-ground caribou herd is estimated at $13.5 million annually.

The population statistics for the caribou, wolves and hunters can be transferred to a graph in different colours. Wildlife biologists estimate an acceptable loss to the herd is about 5% in any one year, or about one participant in 20.

Evaluation

1. Ask the participants to describe the stages in the annual barren-ground caribou migration.

2. Ask the participants to list the hazards caribou face throughout the year from their physical environment and from predators (including hunters).

3. Discuss how recruitment to the herd helped to offset losses due to hunting and predators.

4. Discuss what hunters might do if the wolves are predating too heavily on the caribou herd.
Biomagnification

As time passes and the organisms get older, more contaminants can build up in their bodies, depending on what they are eating.

Bioaccumulation
Bioaccumulation: the story of time

(Adapted from Contaminants Found Me by the Yukon Contaminants Committee)

Objectives
Students should be able to:
1. Understand that contaminants occur naturally and will accumulate in organisms over time.
2. Play an active game that allows them to understand how contaminants build up in caribou over time.

Background
Naturally occurring substances are found in the soils of the earth. These substances originate from the rock under the soil. Rock contains a variety of elements. The roots of the willow or any plant might absorb these elements. Some plants absorb some elements more easily than other plants. Willow, for example, absorbs cadmium more readily than does dogwood. Elements absorbed from some soils may be in amounts that can cause environmental or human health concerns.

Caribou eat great quantities of lichens. Lichens do not have a root system that can absorb contaminants from the soil. However, lichens are sensitive to airborne contaminants, either naturally occurring (such as volcanic activity or forest fires) or human made (such as pollution or radio-nuclides).

It is useful for people to know at what amounts essential elements become harmful, and where in an organism these elements will concentrate. Cadmium tends to concentrate in an animal's liver or kidneys. Mercury concentrates in the brain. Aluminum concentrates in bones. These metals are water soluble, but may be difficult to eliminate. "Organochlorines" (PCBs, toxaphene or DDT) concentrate in fatty tissue and are more difficult for an organism to eliminate.

"Biomagnification" is a process whereby an animal eats a plant or another animal, consuming the contaminants stored in that organism. Contaminant values increase, or magnify, with each "trophic level." Trophic levels are successive levels of nourishment in a food chain.

"Bioaccumulation" is a normal and essential process for the growth and nurturing of organisms. All animals bioaccumulate vital nutrients daily. Bioaccumulation also refers to the building up of contaminants in the body over time, as animals eat food or drink water containing the contaminants. Contaminants are either water soluble or fat soluble. Contaminants such as organochlorines are fat soluble. They are not easily eliminated from organisms. Contaminants such as metals are water soluble and are more readily eliminated through normal bodily functions.

Method
1. Select four students to represent caribou and assign them letters A through D.
Adaptations for different ages

**Primary:** Play a simplified version of the game.

**Senior:** Make the game more complicated. Introduce various kinds of shrubs and their different abilities to absorb different elements. Have several caribou play at once. To show the effects of contaminants, place a limit. When caribou have gathered enough tokens to reach the limit, they die and become hunters who are allowed to tag other caribou. Watch and record the results.

2. Ask other students to be willows. Each willow holds a few tokens with a value of 5. Each of these tokens represents contaminants in the environment.

3. Set the playing area boundaries. This activity can be done in a classroom or on an outdoor playing field.

4. Play one caribou at a time. Caribou A goes first and is allowed three minutes to gather willow. Since it is the oldest, it gets the most time. Caribou B is not as old, so it is allowed two minutes to gather willow. Caribou C is younger still, and is allowed one minute. Caribou D is a calf and is allowed only 30 seconds.

   The object of the game is for each caribou to tag as many willows as possible. When a willow is tagged, it must give the caribou one token only, then scatter. Encourage willows to keep moving, refraining from standing still and handing tokens to caribou. A willow can be tagged a number of times, handing out as many tokens as required.

5. Count and record tokens on chart paper after each caribou has had its turn.

**Results**

The oldest caribou usually gathers the most tokens, and the youngest caribou gathers the least. An extremely fast caribou will collect more tokens, therefore simulating the accumulation of more toxins. In discussion with the group, point out that individual caribou in nature may indeed gather more food and contaminants due to access to better food sources. Regardless of the actual amounts, bioaccumulation takes place to lesser or greater degree.

**Variations**

1. Mark some of the tokens with a "C" to signify contaminants and others with an "N" to signify nutrients. Discuss 'acceptable' and 'unacceptable' levels of contaminants. When the caribou have gathered an unacceptable number of contaminant tokens, have them become willows.

2. Experiment with times and numbers of contaminant tokens.

**Extensions**

1. Do a classroom case study on contaminants and caribou.

2. Study the effects of an industrial accident such as a nuclear meltdown or an oil spill. Map the way that contaminants move through the environment.

**Evaluation**

1. Discuss what contaminants are.

2. Ask students to define biomagnification and explain how it works.

3. Ask students to define bioaccumulation and explain how it works.
**Bot fly boogie**

**Objectives**
Students should be able to:

1. Recognize caribou parasites.
2. Illustrate and describe the life cycles of:
   - Bot flies
   - Warble flies
   - Tapeworms
   - Protozoa (e.g., sarcocystis)
3. Discuss the broader ecological significance of caribou parasites on caribou and the predators that prey on them.
4. Understand how to prevent parasites from spreading from caribou to humans.

**Method**
Students will develop and present a dramatic presentation to illustrate the life cycles of caribou parasites.

**Background**
Parasites are dependent on the host animals that they live with for all or part of their life cycle. Among the parasites that affect caribou are a variety of worms, insects and microscopic animals called protozoa. Parasites alone are unlikely to kill a caribou, but they may cause the animal to be weak, malnourished, or generally in poor condition. They may also distract them to the point where predators are able to catch them more easily.

Some of the parasites and diseases affecting caribou can be passed along to humans, if they pass through the intermediary host: dogs. All can be avoided by thoroughly cooking affected caribou organs and meat before eating and/or feeding to dogs.

**Tapeworms**
Several tapeworms can be found in caribou. The immature forms of the tapeworms hatch from eggs inside the caribou and form themselves into cysts on the caribou's organs or muscles. If an infected caribou is killed and eaten by a wolf or dog, the cysts hatch into tapeworms that live in the predator's gut. Some kinds of tapeworms can be up to five metres long! These adult tapeworms lay eggs that pass out in the wolf's droppings. The eggs end up on plants that are eaten by caribou, and the cycle continues.

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**Age**
Grades 5 – 10

**Subjects**
Drama, Biology

**Skills**
Comparison, identification, physical mobility, visualization, research

**Duration**
Two 45-minute periods

**Group size**
25

**Setting**
Indoor/outdoor

**Materials**
- Cartoon caricatures of parasite life cycles are on pages 45 to 48
- Costumes and props, elaborate or simple
- Warbles: branches
- Caribou: blanket, straws
- Bot flies: straws, rice, blanket, extended tube, fake dog doo
- Tapeworm: suction cups, tape measure

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**Roundworms**

Thread lungworms, also known as roundworms, live in the lungs of caribou, where they lay their eggs. The eggs hatch into tiny, immature worms. These worms migrate up a caribou's windpipe and are eventually swallowed, passing through the digestive system and ending up in the caribou's feces. They continue growing on vegetation and, if eaten by another caribou, travel through that caribou's bloodstream to reach the lungs, beginning the cycle again. Thread lungworms can cause pneumonia in caribou.

**Warble flies**

Several fly species parasitize caribou year-round. Warble flies, which look like small bumblebees, chase caribou around during the late summer and lay their eggs in the caribou's hair on the leg and flank. Larvae hatch from these eggs, burrow through the caribou's skin, and migrate to the animal's back. Here they form cysts and live through the winter, poking a small hole in the caribou's skin through which to breathe. The next spring, the larvae pop out through the breathing hole and develop into an adult fly. These flies only live for about a week, during which time they search for another caribou on which to lay their eggs and continue the cycle. Warble fly larvae are edible and considered a delicacy by some Inuit.

**Nose bot flies**

Female nose bot flies deposit larvae near the nose opening of the caribou in the summer. The larvae hatch and attach themselves to the inside walls of passages behind the caribou's nose. Over 150 nose bot larvae have been found in a single caribou. This many can make breathing difficult, especially if the caribou is running fast. The larvae grow all winter. In the spring, the annoyed caribou sneeze out the bots, and they grow into bumblebee-like flies.

**Protozoa**

Protozoa are primitive, one-celled animals. They can't be seen by humans except under a microscope. One kind of protozoa, Besnoitia, can cause caribou bones and tendons to become pitted and rough. It is believed to be passed on by biting insects such as black flies. Sarcocystis (see diagram in "Bot fly boogie" activity) has a life cycle similar to that of tapeworms. Giardia (sometimes call "beaver fever" in humans) is contracted through infected drinking water.
**Procedure**

1. Introduce students to the concept of parasites and provide them with background information.

2. Divide students into groups and assign each group a parasite. Provide them with the appropriate life cycle illustration.

3. Have each group research their specific parasite using available materials.

4. Ask each group to prepare a dramatic presentation enacting its parasite's life cycle.

5. Have each group make its presentation to the other students without disclosing which parasite they are depicting.

6. As the other students are viewing the presentations, ask them to try to guess which parasite is being portrayed, writing its name on a secret ballot.

**Variations**

1. Have the students portray the event first from the parasite's perspective and then from the caribou's perspective.

2. Have the students make their own drawings of parasites and their life cycles.

**Extensions**

1. Have students research some parasites that live on humans.

2. Look at some actual parasites, using a microscope if available.

**Adaptations for different ages**

**Primary:** Working with the entire class, study one parasite and how it uses its host during its life cycle. Then divide the class into several groups and have them act out the parasite's life cycle.

**Evaluation**

1. Discuss what parasites are.

2. Ask students to name three parasites that live on caribou.

3. Discuss whether humans act as hosts for parasites.

4. Discuss whether some parasites may be useful to their host animals.
The tapeworms lay tiny eggs that pass out in the wolf’s droppings. The eggs go onto plants that are eaten by caribou or moose.

After the eggs are eaten by the caribou or moose, the eggs hatch and form large cysts in the lungs.

Cysts may be found in the lungs of caribou, moose, or muskox.

Wolves or dogs eat the lungs containing cysts. These hatch into tapeworms in the wolf’s gut.

Hydatid Disease can infect people.
Be careful when handling droppings from wolves, foxes or bears.

Don’t feed infected organs from wild game to your dogs.
Tiny larvae hatch and migrate under the skin to the caribou's back.

Life Cycle of the Warble Fly (Oedemagen a tarandi)

Up to 1000 larvae can overwinter under the hide of one caribou.

Warbles can be found in barren-ground caribou.

During the summer, female warble flies lay eggs on the leg hairs of caribou.

The larvae drop out in early summer, and an adult fly develops. The adult warble fly has no mouth parts, and lives only 6-8 days.

Warbles do not affect people.
Small larvae hatch and attach to the inside walls of the air passages behind the nose. The larvae (or bots) grow all winter.

Nose bots can be found in woodland and barren-ground caribou.

During the summer, the female bot flies deposit eggs into the nostrils of caribou.

Life Cycle of Nose Bots
(Cephenemyia trompe)

In spring, the bots are sneezed out, and develop into bumblebee-like flies.

Nose bots do not affect people.
Life Cycle of Protozoan (Sarcocystis)

The parasite produces tiny eggs that pass out in the wolf's droppings. The eggs go onto plants that are eaten by the caribou.

Wolves or dogs eat the meat containing cysts. These hatch into mature parasites that reproduce in the wolf's gut.

After the eggs are eaten by the caribou, the eggs develop into microscopic cysts in the meat. Sometimes, the cysts are larger and look like tiny rice grains.

Cysts may be found in the muscle of caribou, moose or muskox.

Sarcocystis is killed by cooking, and will not affect people.

Dogs can be infected if fed uncooked meat.
Build-a-caribou

(Adapted from a concept developed by Doug Urquhart)

Objectives
Students should be able to:
1. Describe adaptations of caribou to their environment.
2. Describe how adaptations can help caribou survive in their habitat.
3. Build a model caribou with exaggerated body parts, symbolizing the caribou's adaptations.

Method
Students learn about caribou adaptations by building models of caribou, highlighting these adaptations.

Background
Animals are the products of countless adaptations over long periods of time. Adaptations increase the animals' likelihood of surviving in their habitat. When a habitat changes, either slowly or catastrophically, the species of animals with adaptations that allow them many options are the ones most likely to survive. Species that have adapted to a very narrow range of habitat conditions are extremely vulnerable to change and may be more susceptible than other animals to death or extinction. Some animals from Beringia still survive today, for example, yet others have become extinct.

Caribou were living in North America during the last few ice ages (Wisconsin and Illinoian). Caribou have evolved over a million years of glacial influenced climates. Thus, caribou have developed adaptations allowing them to thrive in landscapes covered in snow and climates of cold temperatures.

Caribou can truly be called "chionophiles," a word that means snow-loving animals. Caribou have physical and behavioural characteristics that help them survive cold winter environments. Their shape, for example, plays a role in keeping them warm. Caribou have compact bodies, small tails and short ears. These features reduce surface area and thus the amount of heat that can be lost through the skin. In contrast, snakes have long, skinny bodies to increase their surface area so that they can regulate their body temperature through their skin.

To keep the heat in, caribou have two layers of fur covering their bodies and their ears, noses and muzzles. They have fine, crinkly underfur and a thick coat of guard hairs on top. The guard hairs are hollow. The air cells in this hollow hair act as insulation, keeping in the caribou's body heat. The hollow, buoyant hair and large flexible feet of the caribou also make them excellent swimmers. Many caribou herds cross wide stretches of open or fast-moving water during their migrations.
Caribou further regulate their body temperature through their short, thick muzzles (the part of the head that includes the nose and mouth). This muzzle acts as a heat exchanger, warming and cooling air to reduce heat and moisture loss as the caribou breathe in and out.

Summer may be the most difficult season of the year for caribou. At this time, they go to alpine snow patches to cool off and to escape the insects that torment them. Barren-ground caribou search out windy areas on the coastal plain for the same reasons.

The hooves of caribou are large and wide. They work in the same way as people's snowshoes to help the caribou travel over the snow with less effort. Caribou have two small toes called "dew claws" and two large, crescent-shaped toes that support most of their weight. In the winter, the fleshy pads on these toes grow longer and form a tough, hornlike rim. Caribou use these large, sharp-edged hooves to dig through the snow and uncover the lichens that sustain them in winter months.

**Procedure**

1. Discuss animal adaptations. Use examples such as long necks on giraffes to allow them to reach high vegetation, or large eyes and deep facial disks on owls, allowing them to gather light for hunting in the dark. Have students brainstorm some other animal adaptations and how they help the animal survive in its habitat.

2. Discuss and research caribou adaptations with the class, using the material given above as well as other sources.

3. Break the class into small groups. Have each group brainstorm ways to build their own caribou, using materials that symbolize caribou body parts.

4. Using available materials, have students build their own model caribou. They might use, for example, a pop can or other cylindrical object to symbolize the caribou's round body, adapted to minimize heat loss. They might use branches for antlers. They might use straw to symbolize the caribou's hollow hair. Remind the students to keep caribou adaptations in mind while they are building their caribou.

5. Have each group display their creation and explain it to the class.

**Extensions**

1. Discuss some other animal adaptations and how they help animals survive in their habitat.

2. Imagine that caribou were suddenly transported to a very different habitat?for example, the desert or the ocean. Draw a picture of what the caribou might look like if it had 'adapted' to its new environment.

3. Invent an animal that would be adapted to live in your neighbourhood. Consider mouth, shape, coloration, food, shelter, reproduction and other characteristics. Draw and describe your animal.
Evaluation
1. Ask students to identify different kinds of adaptations in humans.
2. Ask students to name four ways in which caribou have adapted to their environment.

Adaptations for different ages
Primary: Have students dress each other as though they were caribou, using objects to signify caribou body parts and their adaptations.
Caribou bingo

(Adapted from a game developed by Margeurite Kuiack for the Yukon Southern Lakes Caribou School Program)

Objectives
Students should be able to:

1. Demonstrate their general knowledge of caribou.
2. Play a simple bingo-style game.

Note: This activity would be best used at the end of the unit as it ties everything together.

Method
Students play a variation of the bingo game that will help them demonstrate their general knowledge of caribou.

Background
This is a fun game that is intended as a simple review of the information included in this educational kit.

Procedure

1. First make up the bingo cards for your class. You can download these at the Project Caribou web site (projectcaribou.net) or create them manually as follows: Photocopy a number of Card Sheets on page 54 equivalent to your class size. Photocopy the Card Answer Sheets (one-half as many as your class size) on pages 55 and 56. Cut up the answers so that they can be pasted onto the bingo cards randomly under the appropriate columns. (You may wish to get a student to do this).

2. Distribute prepared bingo cards to the students.

3. Cut out the bingo questions and put them into a bowl or bag. Stir them up. You may wish to give one student the task of selecting and/or reading the questions.

4. Instruct the students in the game rules: There are five categories. For each round, a question from one category will be read. The answers to the questions can be found on selected bingo boards. If your board contains the correct answer to the question read, place a marker (bean or other token) on that square. Questions will be read until someone calls "bingo!" You may call "bingo!" when five squares in a row (straight across or diagonal) are covered with markers.

5. It is up the teacher to decide whether to have students give the correct response after each question or to wait until the end of the game.

6. The game is over when a student calls "bingo!" You may wish to play several times.
Variations
1. Make up your own questions and answers which reflect caribou characteristics in your area.
2. Have the students make up their own caribou bingo game.
3. Play “blackout bingo”: students cannot call “bingo!” until every square on their game cards is covered.

Extensions
Think of some other simple games that may be adapted to the caribou theme.

Evaluation
This game is intended as an evaluative tool. The students can switch game boards and play the game several times so all have the chance to be ‘winners.’

Adaptations for different ages
Primary: This game can be simplified, using questions and answers geared to the students’ age level.
Senior: Play the game with more complex questions geared to the students’ age level.
## Card sheet

### Caribou Bingo

<table>
<thead>
<tr>
<th>People and Caribou</th>
<th>Habitat</th>
<th>Adaptations and Behaviour</th>
<th>Conservation and management</th>
<th>Hazards</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>
### Card Answer sheet 1

<table>
<thead>
<tr>
<th>People and caribou</th>
<th>Habitat</th>
<th>Adaptations and behaviour</th>
<th>Hazards</th>
<th>Conservation and management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulation</td>
<td>Calving grounds</td>
<td>Chionophile</td>
<td>Wolves</td>
<td>Traditional knowledge</td>
</tr>
<tr>
<td>Hollowed caribou hooves</td>
<td>Beringia</td>
<td>Ungulates</td>
<td>Golden Eagle</td>
<td>Indicator species</td>
</tr>
<tr>
<td>Warble flies</td>
<td>Barren-ground</td>
<td>Velvet</td>
<td>Black flies</td>
<td>Satellite and radio-collaring</td>
</tr>
<tr>
<td>Fish hooks</td>
<td>Crustose</td>
<td>Pelage</td>
<td>Nose bot flies</td>
<td>Co-management</td>
</tr>
<tr>
<td>Fish</td>
<td>Fungi</td>
<td>Cratering</td>
<td>Brucellosis</td>
<td>Licences and quotas</td>
</tr>
</tbody>
</table>
# Card Answer sheet 2

<table>
<thead>
<tr>
<th>People and caribou</th>
<th>Habitat</th>
<th>Adaptations and behaviour</th>
<th>Hazards</th>
<th>Conservation and management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pemmican</td>
<td>Low snowfall</td>
<td>Dew claws</td>
<td>Habitat encroachment</td>
<td>Aerial surveys</td>
</tr>
<tr>
<td>Babiche</td>
<td>Fall migration</td>
<td>Lichen</td>
<td>Oil and gas</td>
<td>Analyze their droppings</td>
</tr>
<tr>
<td>Inukshuks</td>
<td>Key habitats</td>
<td>Rut</td>
<td>Roads</td>
<td>Poaching</td>
</tr>
<tr>
<td>Gold Rush</td>
<td>Ecosystem</td>
<td>Tendons</td>
<td>Stress syndrome</td>
<td>Harvest study</td>
</tr>
<tr>
<td>Trophy hunters</td>
<td>Tundra</td>
<td>Females have antlers</td>
<td>Bioaccumulation</td>
<td>Composition count</td>
</tr>
</tbody>
</table>
Categories, questions and answers

People and caribou
Q. Northern native people used caribou skins to make clothing because it provides excellent what? A. Insulation
Q. Some native groups imitated the sound of the caribou's clicking using decorative rattles made out of what? A. Hollowed caribou hooves
Q. Which caribou parasite is considered a delicacy by some Inuit? A. Warble flies
Q. Caribou bones were used by arctic peoples to make ornaments, needles and what else? A. Fish hooks
Q. In some Inuit and Dene cultures it was bad luck to eat caribou and what on the same day? A. Fish
Q. Caribou meat that is pounded and mixed with berries and grease is called what? A. Pemmican
Q. Rawhide that is stretched into strips and dried is called what? A. Babiche
Q. What is the name of the stone figures built by Inuit that resemble human figures? A. Inukshuks
Q. In the late 1800s/early 1900s, caribou were harvested by professional meat hunters to feed people participating in what? A. Gold Rush
Q. People who hunt for recreation and not subsistence are sometimes called what? A. Trophy hunters

Habitat
Q. Barren-ground caribou give birth in special areas called what? A. Calving grounds
Q. What is the name of the area of Yukon and Alaska that remained ice-free during the last ice age? A. Beringia
Q. The family of caribou that travel long distances to calving grounds north of tree line are called what? A. Barren-ground
Q. Lichens that are flat and attach themselves to rocks are called what? A. Crustose
Q. Lichens are made up of two kinds of plants, algae and what? A. Fungi
Q. Caribou need winter habitat that has what characteristic? A. Low snowfall
Q. As cold weather approaches, caribou band together and begin their annual what? A. Fall migration
Q. Areas that are of prime importance to the survival of caribou herds are called what? A. Key habitats
Q. Caribou share their habitat with a large variety of creatures. All together they make up a what? A. Ecosystem

Q. The treeless area in the far north of Canada is known as what? A. Tundra

**Adaptations and behaviour**

Q. What is the word that means "snow-loving animal?" A. Chionophile

Q. Caribou and other members of the deer family belong to a group of animals called what? A. Ungulates

Q. The layer of fuzzy skin covering the caribou's antlers is called what? A. Velvet

Q. The hair that covers the body of the caribou is called what? A. Pelage

Q. When caribou dig through the snow with their wide hooves in search of lichens it is called what? A. Cratering

Q. The caribou's two small toes are called what? A. Dew claws

Q. What is the caribou's main winter food? A. Lichen

Q. The mating season of caribou and other ungulates is called the what? A. Rut

Q. The 'clicking' sound made by the caribou's feet is caused by bones and what? A. Tendons

Q. What makes caribou different from other members of the deer family? A. Females have antlers

**Hazards**

Q. Which animals are the major predators of most caribou herds? A. Wolves

Q. Which bird of prey will hunt for newborn caribou calves? A. Golden Eagle

Q. What is a bloodsucker that persistently torments caribou during the summer? A. Black flies

Q. The larvae of which parasite is sneezed out of caribou's noses? A. Nose bot flies

Q. Which bacterial disease causes caribou to abort or give birth to weakened calves? A. Brucellosis

Q. A large housing subdivision built in an area that is used during the winter by a caribou herd might be called what? A. Habitat encroachment

Q. What kind of development is proposed for the calving grounds of the Porcupine caribou herd? A. Oil and gas

Q. Which linear constructs may affect the movements of migrating caribou herds? A. Roads
Q. If caribou are chased by snow machines or aircraft, the resulting violent exertion may cause what? A. *Stress syndrome*

Q. What is it called when contaminants such as metals like cadmium, aluminum and mercury build up in animals? A. *Bioaccumulation*

**Conservation and management**

Q. What is one name for values and practices gathered by northern people through centuries of observing caribou behaviour? A. *Traditional knowledge*

Q. Large mammals like caribou that can give information about the health of other members of their ecosystem are called what? A. *Indicator species*

Q. What kind of research method allows scientists to track the movements of individual caribou year-round? A. *Satellite and radio-collaring*

Q. What is it called when several agencies, organizations or governments work together to manage wildlife? A. *Co-management*

Q. What are some ways that wildlife managers can restrict the number of caribou being hunted? A. *Licences and quotas*

Q. What is one way that biologists count the number of caribou in a herd? A. *Aerial surveys*

Q. What is one way that biologists can study caribou food habits? A. *Analyze their droppings*

Q. What is it called when an animal like caribou is hunted illegally? A. *Poaching*

Q. What is it called when biologists use questionnaires and do interviews with hunters? A. *Harvest study*

Q. What is it called when biologists try to estimate the numbers of bulls, cows and calves in a herd? A. *Composition count*
Caribou and mammoth together?

Objectives
Students should be able to:

1. Recognize that caribou are an ancient deer that have been in existence for millions of years.

2. Describe how a good portion of northern Canada and Alaska, known as Beringia, was never glaciated.

3. Identify some of the animals that lived during the time of Beringia.

Method
Students will learn about Beringia and the animals, including caribou, that lived at the time. They will use their knowledge to create a diorama of animals at the time of Beringia and today.

Background
During the last ice age, when most of North America was covered by thick sheets of ice, parts of what is now the Yukon and Alaska remained ice-free. This refuge, or refugium, was called Beringia. The animals and plants that lived there escaped the glacial onslaught. Caribou were present at the time of Beringia and ranged the same areas as the woolly mammoth, steppe bison, camel and giant beaver. Many of these exotic animals did not outlast the cold climate, but some of the Beringian animals that did survive include caribou, moose, muskox and grizzly bears.

The caribou is an ancient relative of the deer that may have originated in northeastern Asia or northwestern North America. The earliest fossils of caribou date back 1.5 million years and were found at Fort Selkirk, Yukon. Caribou were living in North America during the last few ice ages (Wisconsin and Illinoian). They have evolved over a million years of glacial influenced climates. Because of this, caribou have developed adaptations that allow them to thrive in landscapes covered in snow and in cold climates.

Procedure
1. Share information about Beringia with the students.

2. Have students do independent research on Beringia, studying the climate, environment and the variety of animals that lived during that time.

3. Divide the students into two groups. Ask one group to create a mural of a Beringian landscape as it may have looked in the past, using a large piece of paper or poster board. Ask the students not to add any animals to the dioramas. Tape the paper to a wall so that all the students can work at once on different parts of the diagram.
4. On a second large piece of paper, have the second group of students create a mural of the environment of an area of the northern Yukon as it looks today. Again, ask the students not to add any animals to the dioramas.

5. When the landscape posters are complete, ask the students to draw some pictures of Beringian animals on cardboard or sturdy paper. Some examples are mammoth, giant beaver, hyena, large camel, giant moose, giant pica, short-faced skunk, giant beaver and ground sloth. Other, more familiar examples are caribou, muskox and grizzly bear. Have the students cut out the pictures they have drawn.

6. Attach double-sided tape or other fastener material to the back of the animal cutouts.

7. Place the cutouts on the Beringia mural. Experiment with which animals can also be placed on the present-day mural. As you move the animals back and forth, have students think about the following questions: Which animals from Beringia, besides caribou, are still found in the Yukon and Alaska today? Which animals have relatives that survive today? Are they all in Canada? Animals such as the camel are no longer found here. Why not? How have animals adapted to the changing temperatures? Which Beringian animals are now extinct?

**Variations**

Have each student do an individual research project on a Beringian animal.

**Extensions**

Take the class on a field trip to the Yukon Beringia Centre, if in the Yukon, or to another museum of prehistory.

**Evaluation**

1. Ask students to name two kinds of animals that lived in the time of Beringia and are now extinct.

2. Ask students to name two kinds of animals that lived in the time of Beringia and still exist today.

3. Ask students to explain what a refugium is.
Caribou and the Internet

Objectives
Students will:

1. Use the Internet to learn more about caribou.
2. Share information, ideas and resources across the Internet.
3. Use the Internet to carry out a number of caribou-related activities.

Method
Students will use computers to access caribou resources and undertake various projects over the Internet.

Background
The Internet has revolutionized the way we learn and share what we have learned with others. Information about wildlife species such as caribou is readily available on the Internet, and Internet users have the option of adding their own information and comments to the growing body of 'web knowledge.' The Internet has been used to further caribou research and increase people's understanding of caribou in several ways. It allows researchers to communicate with one another and with the public, and it gives the public access to caribou materials and tracking capabilities. The Internet also provides a means for individuals, schools and organizations to exchange comments and ideas about caribou quickly and inexpensively.

There are many web sites on the Internet that contain caribou information or resources. Rather than list them here, we suggest you go to the Project Caribou site (www.projectcaribou.net) and access a current list of links.

Procedure
Get the students started with their web searches by accessing the Project Caribou web site. Allow the students some time to surf around and get a feel for the breadth of resources available, then choose from among the following possible activities:

1. Have the students track a radio-collared caribou by following the link on the Project Caribou site. Post a map on a wall in the classroom and put pins marking the changing caribou positions.
2. Create an e-mail exchange with a school in a community that relies upon caribou for food, or with another school that is interested in a caribou project.
3. Post a poem, story, essay or drawing on our web site.
4. Host an on-line chat about caribou, with several schools participating. You may wish to invite a caribou biologist to answer questions over the Internet.
5. Have the students visit several caribou-related sites, choose three that they feel are especially interesting, and create an annotated bibliography that includes the site name, who created it, and what information and resources are available on the site.

**Extensions**
Create your own caribou-related site at your school or server. Link up with some other sites.

**Evaluation**
Have students demonstrate a working knowledge of a given caribou site (e.g., Project Caribou site).

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**Adaptations for different ages**

**Primary:** Have students access a web site and do primary-level activities. Visit the Project Caribou web site for suggestions.

**Senior:** Have students critically examine the caribou-related resources on the web. You may wish to have them do an in-depth project and use the Internet for their research or create an annotated bibliography of information about caribou available on the web.
Caribou need a home, too!

Objectives
Students should become aware that human activities can have an impact on caribou.

Method
Students draw floor plans for houses and then consider the effects on their activities of removing some of the space from use. The process is repeated for caribou ranges.

Background
Caribou require large ranges that meet their habitat requirements for food, water and shelter from predators, insects and weather. Caribou ranges include calving grounds, summer range, migration routes, winter range and other seasonally important areas. Human disturbance may prevent caribou from accessing critical habitat, destroy habitat or disrupt the movement of caribou herds.

Procedure
1. Have students brainstorm their daily living needs and the kinds of rooms they have in their homes to meet those needs.
2. Have each student or pair of students draw a floor plan of a house including rooms, hallways, doors, etc.
3. Give each student one or more playing cards to place anywhere on their floor plans. Then explain that these portions of their houses have been blocked off and can no longer be used. Discuss how the loss of these spaces affects the way they use their houses. Discuss where they can place the cards to have the least effect on their activities.
4. Brainstorm with the students on the habitat needs of caribou.
5. Have each student (or pair) design on paper a caribou range that incorporates all of the caribou's habitat needs.
6. Brainstorm the kinds of human activity that may occur in a caribou range. Have students place one or more playing cards over their caribou ranges. (The cards represent areas of human disturbance that may exclude caribou or alter their behaviour. String may be used to represent linear developments such as roads and pipelines.) Discuss how the disturbance could affect the activity of caribou in their ranges.

Variations
Have the students include on their range maps other animals who share their habitat with caribou. Examine with the class how other animals might be affected by changes to their habitat, and how this, too, affects caribou.
Extensions

1. Formulate research questions to test the effects of human disturbance on caribou.

2. Have the students consider both the direct and indirect effects of development. For example, a factory placed near the caribou range might remove some space from the range. This is a direct impact. However, the people who move to the town to work in the factory present an indirect impact associated with the factory. The influx of people might mean an increase in the number and type of recreational activities taking place on the caribou range. Another indirect impact would be any pollution produced by the factory that might harm plants the caribou eat.

3. Do this activity in conjunction with the "Barren-ground caribou migration" activity for a physical demonstration of habitat disruption.

Evaluation

Discuss with students:

1. The basic habitat needs of caribou.

2. Ways that human activity can disrupt caribou's use of habitat.

3. Ways that these effects can be mitigated.
Checks and balances

(Adapted from Project WILD Activity Guide)

Objectives

Students will be able to:

1. Evaluate hypothetical wildlife management decisions.
2. Identify at least four factors that can affect the size of a wildlife population.

Method

Students become managers of a herd of animals in a paper-and-pencil and discussion-based game.

Background

Wildlife managers attempt to maintain healthy populations of wild animals, while factors?both avoidable and unavoidable?affect the populations. Some of these factors are loss of habitat, weather conditions, pollution of food and water sources, development of other natural resources, poaching and recreation pressures. Many people are unaware of how such pressures can affect wildlife.

In Canada, provincial and territorial wildlife agencies manage wildlife populations within their respective boundaries. The Canadian Wildlife Service, under Environment Canada, is responsible for some policies and programs affecting migratory species of animals (principally birds), as well as the import and export of animals and animal products, inter-provincial transportation of all species, and additional wildlife-related responsibilities.

Wildlife management is based on the best scientific and technical knowledge available. Such knowledge is growing; however, it is still limited and is continually affected by changes in the complex relationships between wildlife, human beings, and their shared environments.

In a sense, everyone shares responsibility for wildlife management. Although there are legally responsible agencies, their work requires the thoughtful and informed co-operation of citizens. There are frequently differences of opinion about the most appropriate policies and programs affecting wildlife. Individual citizens, private conservation groups, private industry, community groups and others all make important contributions to the overall conservation and protection of wildlife and its habitat.

In the Yukon, caribou are managed by the Yukon Department of Renewable Resources. There are 24 caribou herds in the Yukon. Three of the herds (Porcupine, Nelchina/Mentasta and 40 Mile) are barren-land caribou; the rest are woodland caribou. Barren-land caribou are smaller than their woodland cousins and engage in long-distance migrations between their calving and wintering grounds.
Two herds that have received a lot of attention are the Porcupine and Aishihik herds. The Porcupine is a barren-ground herd, and the Aishihik is a woodland caribou herd. U.S. interest in oil and gas development in the heart of the calving area for the Porcupine Caribou Herd, has spawned a public outcry. Predator control has been used as a management strategy to offset the rapid decline of the Aishihik herd.

The major purpose of this activity is for students hypothetically to assume the role of wildlife managers in a game situation and thus gain insight into some of the complex variables that influence stewardship of the wildlife resource.

**Procedure**

1. Each student is the manager of a caribou population. The carrying capacity of the habitat is 100 animals. The point of the activity is to end up with a viable population after nine rounds, representing nine years. If at any time the student's population of caribou reaches less than 10 or more than 200 individual animals, that student no longer has a viable herd and observes the other students until the conclusion of the activity.

2. Each student has a starting population of 100 animals. The cards are separated into three decks totalling 36 cards: a condition deck (18 cards), a reproduction deck (9 cards), and a management deck (9 cards). Shuffle the cards within each deck. Explain that cards will be drawn in the following sequence: condition card, reproduction card, condition card, management card. This sequence of draw will be repeated, each repetition representing an annual cycle. (The students may think of each draw as representing a different season, e.g., autumn, winter, spring, summer.) As each card is drawn, it is read aloud to the entire class. Each student then rolls his or her die and follows the instructions on the card to determine his or her herd population's new size. Some computations will result in fractions; numbers may be rounded to the nearest whole.

Note: Students may object to the use of dice to determine the impact of decisions made for wildlife management purposes. Their concerns are appropriate; wildlife management is based on more than the chance elements reflected in the use of dice. However, chance has an impact on caribou as well, as in the case of weather conditions in a given year. Encourage the students to discuss and consider what is realistic and what is unrealistic about the impact of dice in this activity, and to recognize that wildlife management is far more complex than can be represented through this activity.

3. Wrap up the activity with a class discussion. Include topics such as:
   - The apparent impacts of the condition, reproduction and management cards.
   - The benefits and disadvantages of the management decisions made.
• Outcomes of the different management strategies used by different students. (Ask students to discuss how they might manage their herds differently given a second chance.)

• Realistic and unrealistic aspects of the activity.

• Examples of ways in which habitat can be improved in the short and long term.

• The necessity, benefits and disadvantages of human management of wildlife populations for both people and animals.

Variations
1. Add a monetary aspect to the activity. For example, students allowing hunting might have more revenue available for projects like habitat enhancement based on income from sale of hunting licences. Expenses might include salaries of wildlife managers, funds for research, feeding animals in severe conditions, relocation, etc.

2. After using the given cards once, students may want to experiment with changing some of the parameters on the supplied cards or making additional cards. Students may also want to make additional complete sets of cards for use by small groups or individual students.

Extensions
1. Have the students do a research project on the management of a specific caribou herd, such as the Porcupine or Southern Lakes herds.

2. Invite a wildlife manager from a local government to talk to the class about wildlife management.

Evaluation
Discuss with students:

1. Four factors that can affect the size of a wildlife population.

2. The idea that wildlife management may involve more management of people than of wildlife.
### Reproduction Cards

#### Reproduction card: excellent year
- This has been an excellent reproduction year.
- Increase your herd by \((\frac{100}{your \ current \ population \ size}) \times 5 \times \text{your roll}\), if your population is over 50 individuals. If your population is between 50 and 10, increase your population by the number equal to three times your roll. If your population is under 10, you may not reproduce.

#### Reproduction card: average year
- This has been an average reproduction year.
- Increase your herd by \((\frac{100}{your \ current \ population \ size}) \times 3 \times \text{your roll}\), if your current population is over 50 individuals. If your population is between 50 and 10, increase your population by the number equal to two times your roll. If your population is under 10, you may not reproduce.
**Condition cards**

<table>
<thead>
<tr>
<th>WEATHER CARD</th>
<th>HABITAT LOSS CARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A cold, wet calving season has had a serious negative impact on the survival of the herd. Decrease your herd by the percentage equal to five times your roll.</td>
<td>The building of a new mining town has occurred, destroying critical habitat. Decrease herd size by the number five times your roll.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WEATHER CARD</th>
<th>HABITAT DEGRADATION CARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Swollen rivers caused by torrential rain have had a negative impact on the survival of the herd. Decrease your herd by the percentage equal to five times your roll.</td>
<td>An increase in logging roads has occurred, damaging critical habitat. Decrease herd by the number equal to three times your roll.</td>
</tr>
</tbody>
</table>

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<tr>
<th>WEATHER CARD</th>
<th>HABITAT DEGRADATION CARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A mild winter with little snow has had a dramatic positive impact on the survival of the herd. Increase your herd by the percentage equal to five times your roll.</td>
<td>Aircraft have begun flying over the herd's calving grounds. Decrease herd by the number equal to three times your roll.</td>
</tr>
</tbody>
</table>

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<tr>
<th>WEATHER CARD</th>
<th>HABITAT DEGRADATION CARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A dry summer has lessened insect harassment and had a positive impact on the herd. Increase your herd by the percentage equal to five times your roll.</td>
<td>Construction of a pipeline has occurred, damaging critical habitat. Decrease herd by the number equal to three times your roll.</td>
</tr>
</tbody>
</table>
HABITAT DEGRADATION CARD
Mineral exploration has occurred, damaging critical habitat. Decrease herd by the number equal to three times your roll.

HABITAT LOSS CARD
Oil and gas exploration has occurred, resulting in a loss of critical habitat. Decrease herd by the number equal to three times your roll.

HABITAT LOSS CARD
A forest fire has resulted in a loss of critical habitat. Decrease herd by the number equal to three times your roll.

PREDATOR CARD
An increase in the wolf population has occurred, affecting the herd size. Decrease herd size by the percentage equal to your roll.

HABITAT LOSS CARD
A hydroelectric power development has resulted in a loss of critical habitat. Decrease herd by the number equal to three times your roll.

DISEASE CARD
Disease has struck the herd. Decrease herd by the percentage equal to your roll.

HABITAT LOSS CARD
Increased traffic along a traditional migration route has resulted in a loss of critical habitat. Decrease herd by the number equal to three times your roll.

POACHING CARD
Poaching, illegal killing of animals, has reduced the size of the herd. Decrease herd by the number equal to two times your roll.

HABITAT LOSS CARD
Clearcut logging has resulted in a loss of critical habitat. Decrease herd by the number equal to three times your roll.
**Management Cards**

**HABITAT IMPROVEMENT CARD**
Oil and gas exploration have been stopped in the herd’s calving grounds, improving critical habitat. Increase herd by five times your roll.

**HABITAT RESTORATION CARD**
A national park has been created in the herd’s calving grounds. Increase herd by the percentage equal to five times your roll.

**HABITAT ALTERATION CARD**
A small forest fire has occurred, altering critical habitat. Increase or decrease herd (students decide which before rolling the die) by the percentage equal to two times your roll.

**RESEARCH CARD**
A long-term study in vegetation mapping has been successfully accomplished. Increase or decrease herd (students decide which before rolling the die) by two times your roll.

**EDUCATION CARD**
Project Wild and other education activities have led to increased understanding of wildlife and habitat. Increase or decrease herd (students decide which before rolling the die) by the percentage equal to two times your roll.

**LAW ENFORCEMENT CARD**
More conservation officers and law enforcement activities have protected the herd against illegal actions like poaching. Increase herd by the percentage equal to two times your roll.

**HABITAT ACQUISITION CARD**
Habitat acquisition has increased the area of available and suitable habitat. Increase the herd by five times your roll.

**HUNTING CARD**
A request for a hunting season has been made. Do you wish to allow hunting in your area? If yes, decrease your herd by the percentage equal to five times your roll. If no, record no change in the size of your herd.

**PREDATOR CONTROL**
An aerial wolf kill has been requested to combat the recent and rapid decline of the caribou herd population. Do you wish to allow predator control in your area? If yes, increase your herd by the percentage equal to five times your roll. If no, record no change in the size of your herd.
Co-management role play

Objectives

Students should be able to:

1. Understand that North America's largest caribou herds are managed cooperatively by governments and local residents who use the caribou.

2. Understand some of the different viewpoints and perspectives held by different members of co-management boards.

3. Identify social and ecological considerations where human land-use conflicts with wildlife habitat needs.

4. Understand the importance of rational land-use decisions.

Method

Students play roles of different members of a caribou management board and make a decision about a key management issue.

Background

Co-management is a process that brings local resource users and government representatives together to share the management responsibility for local or regional resources. It is an alternative approach to managing local resources that has been gaining increasing support throughout Canada. The cooperative approach to management can involve government wildlife and fisheries staff, wildlife boards, First Nations, community hunters and trappers associations, and others. These groups work together, using both scientific and traditional knowledge to manage resources.

Co-management has been used particularly with respect to aboriginal land claims. In aboriginal settlement claim areas, co-management boards are made up of both aboriginal and government appointees, working to effectively manage wildlife populations and their habitats. This approach has provided opportunities for Inuit and other aboriginal people to participate in resource management decision-making, a process from which they had largely been excluded in the past. Co-management regimes that have been established as a result of land claims are providing a new level of power sharing in resource planning and management.

There are many co-management agreements that take a variety of forms and address a range of issues. For example, the Beverly and Qamanirjuaq and Porcupine Caribou Management boards focus on migratory caribou that cross several jurisdictions. Other co-management boards have been created as the result of land claim settlements such as the Inuvialuit agreement, which created a variety of co-management boards at local and regional levels. Another example is the Yukon Fish and Wildlife Management Board, which is composed of several stakeholders including...
aboriginal, nonaboriginal and government groups. Co-management groups work together to meet designated needs and responsibilities, making decisions, conducting and commissioning research, and sharing recommendations and information.

In this activity, students will act as members of a caribou co-management board, representing a variety of stakeholder organizations. These representatives must work together to make decisions regarding caribou management. The activity uses a role-play strategy that illustrates the complexities of decision-making when people with different points of view are involved.

In this fictional situation, the students are members of a co-management board that works on issues relating to a relatively remote northern caribou herd. The herd ranges close to the students' community during its fall migration, and winters in forested areas near the town. A mining company has discovered valuable silver deposits in an area 50 kilometres from town and proposes to open a mine in this area. The proposed site is in a relatively rarely used part of the caribou's winter range. However, the company wishes to build an all-weather road linking the community with the mine. The road cuts through the main migration route of the caribou. The road could disturb caribou, thus affecting the number of caribou in the area and the length of time they stay near the community. It may disrupt the caribou's migration pattern and give local community hunters easier access to the caribou. Many people in your community depend on caribou for their winter meat supply. The mine and associated workers would bring economic growth to the community and provide jobs for locals. The co-management board must make a recommendation regarding the mine. The board may recommend against it, for it, or propose guidelines or modifications to the company's plans.

Procedure

1. Photocopy roles cards on page 76, one set for each group of students, and cut up.

2. Familiarize the students with the concept of co-management as described above or as it applies to your community. Tell the students that they are going to act as members of a co-management board. Read aloud the fictional situation that will be discussed.

3. Divide the class into groups of approximately five students. Place a stack of role cards in the centre of each group.

4. Have each group member pick a card from the stack. Each student must debate the issue from the viewpoint of the person described in the role card.

5. Have one student in each group take notes on the discussion. Encourage each group to come to an agreement using co-operation and compromise.

6. At the end of the allotted time, have one student from each group read
the group's recommendations. If the group has not yet reached consensus, have the student explain to the class what issues held the group up and why they were so difficult to resolve. Remind students that it is not always possible for everyone to agree.

7. You may wish to do the activity several times, giving the students a chance to play various roles. Afterwards, have the students discuss what they learned from the activity. Did playing a role affect their own opinions on the issue?

Variations

1. Use dilemma cards from the "Caribou dilemmas" activity. Debate the issues described on the cards using the students' roles as members of the co-management board.

2. Have students think up their own caribou management issues and discuss them while playing the roles of members of the co-management board.

3. Have students think up their own roles to play in the management scenario. Or have students play themselves, writing a brief description of what influences their viewpoint in a format similar to the role cards.

Extensions

1. Have students or groups of students research a co-management board in Canada, describing its history, purpose, members and activities.

Evaluation

Discuss with students:

1. The concept of co-management.

2. Why co-management might be necessary or useful in the management of caribou herds.
## Role cards: Members of the Caribou Co-management Board

### James or Janie Wilson
*Wildlife biologist representing the government*

You are 25, a new biologist to the area. You are not totally familiar with local issues, but you are concerned that adequate research and wildlife surveys have not been done.

### Elmer or Elma Friesen
*Trapper representing the local trapping association*

You have lived on the land for many years, trapping local fur-bearing animals. You are now in your 60s. You worry about the mine's and the road's effects on the land. You must speak for other trappers, yet you are near retirement age and might consider moving south if reimbursed generously for your trapping rights.

### Fred or Freida Lewis
*Business owner representing the local chamber of commerce*

You own a gift shop in the centre of town. You know that new development will bring more customers to town and more money into the community and local businesses. You are also an avid skier and use trails that would be disrupted by road construction.

### Jake or Josie Armstrong
*Construction worker representing the local labour union*

You and your fellow union members would be employed during road construction and also possibly in the mine. You are also an avid hunter who has supplemented your winter food with caribou for many years.

### Jim or Janine James
*College student representing the local First Nation*

You see the possibility of jobs for yourself and your friends if the mine opens, yet you are worried about the effects of the road and mine on the caribou. Your family depends on caribou meat for food. The caribou is an important part of your culture.

### Elmer or Elma Friesen
*Trapper representing the local trapping association*

You have lived on the land for many years, trapping local fur-bearing animals. You are now in your 60s. You worry about the mine's and the road's effects on the land. You must speak for other trappers, yet you are near retirement age and might consider moving south if reimbursed generously for your trapping rights.

### Larry or Louise Willis
*Elder representing the local First Nation*

You fear the changes the mine will bring to both the community and the natural environment, yet you know that the mine may provide good jobs for members of your community.

### Heather or Harold Hakamoto
*Writer representing the local environmental group*

Your organization wants to protect the caribou from habitat destruction and overhunting, but you also see your community suffering from unemployment. You know the road may increase wildlife viewing and thus tourism opportunities.
Dilemmas caribou style
(Adapted from Project WILD's Ethical-reasoning activity)

Objectives
Students should be able to:
1. Examine their values and beliefs related to wildlife and other elements of the environment.
2. Evaluate possible actions they might take that have an impact on wildlife and the environment.

Method
Students read, discuss, make judgements and write about hypothetical dilemmas concerning wildlife and/or natural resources.

Background
This activity is designed to give students the opportunity to examine their values and beliefs as they relate to wildlife and other elements of the environment. It is not the intent of this activity to prescribe 'right' and 'wrong' answers for the students, except with respect to legislation.

Laws affecting wildlife and the environment vary from jurisdiction to jurisdiction. Each jurisdiction has a wildlife agency that is legally responsible for caring for most wildlife within the province or territory. Students can contact the agency in their province or territory to request general information about laws affecting wildlife in their area. For example, it is legal to hunt and fish for some animals in all areas; however, which animals can be hunted, and under which conditions, are specified by laws and regulations for which the government wildlife agency is responsible.

There are also federal laws and regulations affecting wildlife. Students can contact the Canadian Wildlife Service for information about such laws. For example, federal law protects non-game migratory birds from shooting or any other intentional cause of death, injury or harassment. It is also generally illegal to possess nests and eggs of game birds—even those found lying on the ground. Threatened and endangered species are protected by law in some jurisdictions. It is also against the law to intentionally harm songbirds.

Caribou, like other wildlife, are affected by the guidelines and laws enacted by governments and management agencies. There are many laws, and they are complex. Again, it is useful and important to contact local authorities about the laws protecting and affecting wildlife in your area.

Whether or not students agree with certain laws and regulations, questions of law can be separated from questions of ethics. An individual’s choices as to what seem right or wrong for him or her in terms of values and behaviours may be described as a personal code of ethics. Hunting,
for example, is controversial for some people from an ethical point of view. Some people say that even though hunting is legal, it is unethical, because a human being is taking the life of a wild animal. Others believe hunting to be a responsible and ethical practice, whether as a form of recreation, for the purpose of acquiring food, or in order to control animal populations. These differences of belief may be sincerely held. Whether or not a person chooses to hunt is a personal choice dictated by one's personal ethics. Conflicts arise, however, when a person motivated by one set of ethics tries for force his or her ethics on others through activities such as arguments, harassment or legislative action.

It is the purpose of this activity to provide students with an opportunity to come to their own judgments about what they think are the most responsible and appropriate actions to take in situations affecting wildlife and the environment.

**Procedure**

1. Photocopy and cut up the dilemma cards on pages 80 - 83. You will need one card per student.

2. Divide the class into groups of four, and give each group four different dilemma cards. Place them face down in the centre of the group.

3. Ask a student in each group to draw a card from the top of the stack. The student studies the situation, decides what he or she should do about it, and formulates his or her reasons.

4. When the student is ready?typically in less than two minutes?the student reads the situation and the options aloud to the rest of the group. The student gives the decision he or she has chosen and briefly describes the reasoning involved. In turn, each of the other members of the group is invited to comment on the dilemma and state what he or she would do in the situation. Group discussion of each dilemma should take about five minutes. The student whose dilemma is being discussed should have the opportunity to ask questions of the other members of the group and to offer clarification about his or her decision. The discussion gives the students experience in having ideas examined by peers and is intended to remind the students of the need to take personal responsibility for decision-making. It is not necessary and may not be desirable for the students to reach consensus; there are legitimately differing views of the most appropriate and responsible actions to take in many situations. The purpose is to provide students with an opportunity to examine, express, clarify and take responsibility for their own reasoning.

5. The card is then returned to the bottom of the stack and the next student selects a card from the top of the stack. This process continues until all students have had the opportunity to make and defend their decisions about the various dilemmas.
Variations

1. Have students make up their own dilemma cards.

2. Adapt the discussions to a debate format.

3. Have the students play various roles during the discussions. Role playing possibilities include conservationist, hunter, government worker, person who lives in a city, person who lives in a small town, etc. How do these roles change the way students look at ethical dilemmas?

Extensions

1. Have students choose issues affecting caribou and then attempt to create management guidelines that can be accepted by a wide variety of interests.

2. Have a policy maker from a local wildlife agency or First Nation organization come into the classroom and discuss the way policy decisions are made.

Evaluation

Ask students to choose a dilemma concerning caribou and write a short paragraph on the positive and negative effects of all the options listed for that dilemma. Students should identify what seems in their judgment to be the most responsible decision and explain their reasoning. Students should also indicate what additional information, if any, is needed in order to make a responsible and informed decision.

Adaptations for different ages

Primary: Using simplified versions of the dilemmas, have the students discuss how they feel about them. Ask the students to think about where their opinions on these issues come from. Have the students think about possible sources they could go to for more information about wildlife issues.
CARIBOU DILEMMA CARD #1
You are a member of an environmental group that supports animal rights. However, the caribou population in your area is so high that it is eating all of the food resources very quickly. The data that researchers have collected suggests that if nothing is done, the population will crash in less than 10 years due to a food shortage. Wildlife managers have suggested that the number of caribou must be reduced in order to protect the entire population from starvation in the future. However, some members of your group have argued that killing is not a suitable way to limit the population. Your group must vote to decide how to deal with this problem. Do you:

• Vote to allow hunters to kill more caribou?
• Vote to leave the caribou population alone to regulate itself naturally?
• Take some other course of action?

CARIBOU DILEMMA CARD #2
Two years ago you bought and began using a cottage located near a lake. Recently, researchers have determined that a local caribou herd has stopped using the area around your cabin because your presence is scaring them away. They have found that this is an important area during the time that the calves are being born because the lake has many islands which wolves cannot reach. Do you:

• Keep using your cabin and hope the caribou will get used to you?
• Try to keep quiet when at your cabin to minimize the disturbance?
• Sell your cabin and find one somewhere else to go?
• Move your cabin out of the area?
• Take some other course of action?

CARIBOU DILEMMA CARD #3
You are a wildlife biologist. One of the most southerly woodland caribou populations in North America is located on an island several miles offshore in an inland lake. There are no predators on this island. This area has the highest known density of woodland caribou in the world, specifically because there are no wolves. During a recent severe winter, the lake froze from the mainland to the island, and two wolves travelled to the island. The sex and age of these wolves is not known, but it is possible that they will breed, increase in number, and dramatically reduce the caribou population over time. Do you:

• Consider this a natural situation and monitor the establishment of the wolf population and the expected negative impacts on the caribou population, then publish your results?
• Try to kill the wolves before they can breed and increase in number, so that this unique caribou ecosystem will remain?
• Establish a committee to study the question?
• Do nothing?
• Take some other course of action?

CARIBOU DILEMMA CARD #4
You are a hunter out searching for a moose during hunting season. You spot one and shoot it, but when you get up close to it, you realize that it is actually a woodland caribou, which cannot be legally hunted in this area. Do you:

• Bury the caribou in the snow?
• Inform the conservation officer that you found a caribou carcass that someone shot?
• Tell the conservation officer that you shot a caribou by mistake?
• Take the caribou home to eat?
• Take some other course of action?
CARIBOU DILEMMA CARD #5
You are a wildlife biologist who has been contracted by the government to conduct research on barren-ground caribou. One of the projects important to your research involves capturing animals and outfitting them with satellite collars. This will allow you to track their locations with a high degree of accuracy. When seeking project support you discover two conflicting views. Many elders feel that this practice shows great disrespect to the animals and are morally opposed to it. On the other hand, a majority of hunters is in support because it will help them better understand the caribou and allow them to travel directly to the herd, saving a great deal of time and money. Do you:

• Abandon plans to satellite-collar caribou?
• Work with the community to find alternate ways of collecting the data you need?
• Ignore the views of the elders and side with the majority?
• Try to convince the elders to let you tag one animal as a demonstration in hopes of gaining their support?
• Take some other course of action?

CARIBOU DILEMMA CARD #7
You are a wildlife biologist. An all-weather road is being built to give northern communities road access to communities in the south. This road cuts through the main migration route of a large herd of barren-ground caribou. Local hunters now have easy access to the caribou. First Nation elders are worried that the hunting pressure keeps the leaders of the herd from migrating to their traditional areas. They say that shooting the leaders is disrespectful to the caribou and that herd knowledge will be lost. Conservation officers have seen the herd turn back and take an alternate route when hunting pressure on the highway is great. Do you:

• Ignore the concerns of the elders as most animals still cross the road at some point?
• Close the highway for a period of time when the main herd approaches to allow the leaders to go to traditional areas undisturbed by hunters?
• Try to institute an educational program and ask hunters not to hunt caribou when the main herd approaches?
• Take some other course of action?

CARIBOU DILEMMA CARD #6
You are a young woman living on a caribou range. Since graduating from high school you have worked in part-time, temporary jobs and are currently unemployed. Just when you think you may have to leave community to find work elsewhere, you hear that a large corporation is proposing a diamond mine in the area, promising many jobs for young northerners. This development may have a negative impact on the caribou upon which most of your family depends. You know that the caribou have not travelled through that area for many years, but you also know from your relatives that caribou migration patterns change over time. In the future the caribou may come in contact with the development. Do you:

• Support the proposal and apply for a high paying job?
• Campaign to prevent the mine from going ahead?
• Move to Edmonton and look for work?
• Support the mine as a source of employment for your friends but not work there yourself?
• Remain in the community, live a traditional lifestyle and earn extra money working part-time at the band office?
• Take some other course of action?

CARIBOU DILEMMA CARD #8
You are a young native man who lives in a remote northern community. Your community depends on a herd of barren-ground caribou for much of its food, crafts and clothing. Your culture has depended on the caribou for thousands of years. Your community has worked for many years to keep the range of the herd free from any development. However, there is little local employment. An oil company wants to start oil development in the winter range of the herd and has offered young people from your community jobs and training. A job would give you money and a sense of worth but would go against the wishes of your community. Do you:

• Take the job and live a good ‘southern’ style of life?
• Take the job and try to make sure the company follows all environmental regulations?
• Take the training and then quit, as the training might help you get a job within your community?
• Stay in your community and try to get odds jobs when you can?
• Take some other course of action?
CARIBOU DILEMMA CARD #9
You are a scientist who has discovered that there is a chemical in the noses of caribou that can be used to make a cure for the common cold. You are all set to patent your idea when you realize that many caribou must be killed in order to obtain the chemicals. Do you:

• Keep working to come up with a cure that doesn’t need caribou noses?
• Patent your idea and make a huge fortune?
• Sell your idea to someone else and make a small fortune?
• Take some other course of action?

CARIBOU DILEMMA CARD #10
You have lived and worked in a small northern community for 20 years. A PhD student from a southern university has contacted you about doing a study of traditional knowledge about caribou in a northern native community. The student has never been to the north and wants to know how to get started with her project. Do you:

• Tell her to forget it because you sense that people are fed up with southern researchers?
• Send her some relevant literature about doing research in the north and/or advise her to contact a First Nation government directly?
• Advise her that traditional knowledge is a touchy subject for research and that she had better make a trip to the north and talk to a lot of people before she decides to pursue this as a thesis project?
• Take some other course of action?

CARIBOU DILEMMA CARD #11
You are the chief executive officer of a large oil company that wants to drill exploratory wells in the calving grounds of a caribou herd. Local First Nation people depend on the herd for food and clothing. The oil is needed to serve the growing demand for fuel by southern interests, but the cost of finding oil and transporting it may outweigh the environmental cost. Do you:

• Proceed to drill with environmental safeguards in place to protect the caribou?
• Drill for oil regardless of the environment and give royalty payments to the native people to compensate for damages?
• Decide to drill for oil in less environmentally sensitive areas and recommend protection of the calving grounds?
• Take some other course of action?

CARIBOU DILEMMA CARD #12
You are a wildlife manager. In your area, woodland caribou occupy a large portion of the landscape at some times during the year, but are never found in high densities. Moose also occur in the area. People hunt moose but are not allowed to hunt caribou. Current logging practices improve the habitat for moose, but are clearly not beneficial to caribou populations. Scientists believe that changes in forestry practices will allow the caribou to continue to occupy their range, while also allowing forestry to continue. However, moose habitat will not improve to the same degree, and the forest industry will not be able to harvest as much wood every year. Do you:

• Continue with current logging practices to maintain wood harvest and improve moose hunting?
• Change logging practices to ensure the survival of caribou, and accept reduced wood harvest and moose populations?
• Change logging practices to ensure the survival of caribou, and restrict moose hunting to protect the diminished moose population?
• Take some other course of action?
CARIBOU DILEMMA CARD #13
You are a biologist responsible for wildlife viewing in your area. A large barren-ground caribou herd is not crossing the highway that crosses their winter range. Regulations are in place which prohibit hunting along the highway. Local business owners are concerned that with the restrictions on hunting, there will be fewer hunters and thus fewer benefits to the local communities. Wildlife viewing opportunities exist, but there is some concern that the increased traffic caused by wildlife viewers could cause even greater disturbance by increasing road traffic. Local businesses are beginning to exert political pressure to remove the corridor restriction. Do you:
• Advertise the wildlife viewing opportunity in hopes that it will increase education and awareness of the herd?
• Monitor the situation to see how the herd is reacting to the highway with the new corridor in place?
• Allow some hunting from the highway?
• Close the highway altogether when the herd is passing by?
• Take some other course of action?

CARIBOU DILEMMA CARD #14
You are a farmer who has just received an agricultural permit to grow potatoes on your land, which is located 50 kilometres from the nearest small community. After planting your crops, you receive a letter from a conservation organization telling you that your fences pose a threat to a local woodland caribou herd. The herd’s movement within its range is restricted by the fences, and several caribou have become entangled in the wire. Do you:
• Look for safer ways to construct your fences?
• Remove the fences and allow wild animals to tramp through your fields?
• Relocate your farm to another area?
• Leave your fences the way they are and hope the caribou will learn to use another route?
• Take some other course of action?

CARIBOU DILEMMA CARD #15
You love to ride your snowmobile. You hear that a local snowmobiler’s association is planning to construct a series of trails in a beautiful wilderness area. This area is within the range of a local woodland caribou herd. A meeting is planned to discuss the trail construction. Do you:
• Get ready to experience some new snowmobile thrills?
• Attend the meeting and tell the association to scrap its plans because of possible effects on caribou?
• Ask a biologist to do a study on the area before the trail plan goes ahead?
• Attempt to educate snowmobilers on methods to avoid disturbing caribou during sensitive parts of their breeding cycle?
• Take some other course of action?

CARIBOU DILEMMA CARD #16
You are a community health worker. A local study has determined that there are toxic levels of cadmium in the kidneys of caribou and has calculated that eating a certain amount of kidneys from older female caribou is a health risk. The results of this study have been sensationalized by the media and people have stopped eating caribou kidneys altogether. Do you:
• Assume that kidneys are not very important to northern diets and so there is no need to intervene?
• Consult with the communities about the importance of kidneys to local people and then decide if this needs further work?
• Consult with local people about the importance of kidneys to local diets and try to figure out how many kidneys of what age caribou could be consumed?
• Investigate the source of the health standard on cadmium to see if it is relevant to northern diets and lifestyles, make a judgment about the likelihood of anyone becoming seriously contaminated by cadmium in kidneys, and then make a statement about the risk as you see it?
• Take some other course of action?
First Peoples stories about caribou

Objectives
Students should be able to:

1. Understand the importance of caribou to Inuit and other aboriginal cultures as expressed through stories, music and visual art.
2. Study and understand one story about caribou.
3. Illustrate, dramatize or create their own legends about caribou.

Method
Students read or listen to a story about caribou and draw pictures and/or create a dramatization of the story.

Background
Caribou are important to many aboriginal cultures across Canada. They have always formed a basic part of the cultures of people living in the Arctic and subarctic. People such as the Vuntut Gwich’in of Old Crow (see Porcupine Caribou Herd case study) have depended upon caribou for thousands of years for food, clothing and a way of life that involves close ties with the northern land. Many other Dene and Inuit cultures have also depended upon caribou.
All human cultures create stories that express ideas about the world around them. They sing songs, tell tales and create dances and artwork that express how they feel about important natural creatures and places. Stories are passed on from generation to generation, sharing important information about culture and environment. Animals are depicted in stories and legends in various ways according to beliefs about them and their importance. In the north, many stories contain powerful figures based on animals such as the bear and the raven.

People also formed mythologies and legends and structured their cultures around the caribou. They travelled to known migration routes to intercept herds for hunting. They told stories about caribou. They taught their children to respect these animals. Traditional hunters believed that if they had the right thoughts about animals and treated the carcasses properly, they would always have enough to eat.

**Procedure**
1. Discuss the importance of caribou as portrayed in legends and stories from various cultures, using background information and other sources.
2. Read aloud or have students read a story about caribou. (Two sample stories are given at the end of this lesson plan.)
3. Separate the students into groups. Ask each group to dramatize the story. The students may wish to mime the story, use sounds, or add dialogue.
4. Have each group present its caribou skit to the class.
5. As a follow-up discussion, ask the students to think about what the story taught them about caribou behaviour and about the relationship between people of various cultures and caribou.

**Variations**
1. Have each group present a play using a different caribou legend.
2. Have students write their own stories and dramatize or illustrate them.

**Extensions**
1. Find Internet collections of First Nation tales about caribou.
2. Research other traditional stories about caribou and share them with the class or school.

**Evaluation**
Discuss with students how one First Nation culture views caribou and how this view is expressed in stories and other art forms.
The Man Who Became a Caribou

(From www.gov.nt.ca/kids/legend/inuitleg.htm)

An Inuit man was unhappy because he was a poor hunter.

One day he decided to leave home. He left all his weapons and began to walk inland. All the time, as he was walking, he thought, "I wish I were an animal, not a man. No one can be as unhappy as I am."

He saw some ptarmigan eating the leaves and berries and making little noises. He followed the ptarmigan all day hoping they would feel sorry for him and, perhaps by their magic, change him into a ptarmigan. At last he came to a village where, he knew, the ptarmigan lived when they changed themselves into people.

"I'm sorry," said the chief of the village, "You cannot stay with us. You will not like being chased by the big birds of the air and men with their bows and arrows."

So the hunter left the village and, seeing some arctic hares playing among the rocks, he thought, "That's the life I want. They seem very happy." He followed the two hares all day and at last, saw them enter a little house at the bottom of a hill. When he got inside the house there were two old people already there, but no hares.

"Why have you followed us?" asked the man.

"I want to be a hare," answered the hunter.

"I'm sorry," said the hare. "You cannot stay with us. You will not like being hunted by the big birds of the air and the men with their bows and arrows."

So the hunter left the little house and walked further inland until he saw a herd of caribou. All day he followed them until, in the evening, he came to a large village. Knowing that all the men were in the meeting house, the hunter went there, hoping that he could talk to the chief.

"Why were you following us all day?" asked the chief.

"I was not hunting you," said the man. "See, I have no weapons." Then the man told everyone of his wish to become a caribou and how he had talked to both the ptarmigan and the hares. They felt sorry for him so the chief allowed the hunter to join them.

When the hunter ran with the caribou herd he found it difficult. He could not run quickly. He found the food unpleasant to eat and he did not grow big like the other caribou. Also, he was always afraid because the men came with their bows and arrows, and he never knew whether they were near. Sometimes, there were traps set for caribou, sometimes holes in the ground for them to fall into, but the old hunter who had become a caribou was never caught. Because he was old, however, he decided he would like to see his family again, so he went to see the chief.

"It will be very hard," said the chief. "You are a clever caribou now. It will be hard for you to learn to be a man again."

"I know," said the hunter, "but I must see my family before I die."

For many days the hunter who had become a caribou walked. When he was getting near his village he was so excited he forgot about the traps, and his legs were caught so that he could not move.

In the evening two boys came and they were very happy to find a caribou in their trap. Before they could shoot him the hunter spoke. The two boys were afraid.

"Don't shoot me," said the hunter, "Just take your knife and take off my skin."

The two boys did what they were told and were surprised to find a man inside the skin. They recognized him as their father who had left home many years before.
The Boy Who Found the Lost Tribe of Caribou

(Told by Donald Kaglik of Inuvik in People and Caribou in the Northwest Territories)

A group of Inuit lived along the seashore. Now, there lived a poor boy whose parents had died, and he was living with his grandparents, who were very old. The ruler, knowing this, called the boy over to his place and asked him if he would do odd chores for him. He would always make sure the boy and his grandparents had something to eat. The boy was very glad and he ran home and told his grandfather and grandmother.

The years went by and he became a boy whom no one could beat in sports. One winter he was allowed to go out hunting, but he had to listen to all that was said in the meeting before the hunt. The hunt was very good. They had almost enough meat to last through the long winter.

The ruler then decided to teach the boy how to get a caribou with a knife, without the use of a bow and arrow. The boy was now very excited, for he was always anxious to learn of new ways to catch his game.

They had to use a skin to cover themselves with and sneak up to the herd until they were close, and then use a knife to kill. It had to be placed in just the right spot.

When it was time for him to try this new way of hunting, he crept very close to some caribou. But just as he was ready to spring, the caribou spoke to him. "You must be using my brother's skin to cover yourself with. Why don't you put it on the right way and I will tell you what to do?" Was he going mad, or was the caribou really speaking to him?

The caribou continued, "Those of us who are to be leaders in the future have this gift of being able to lift the face-mask, and so we are able to speak on behalf of our people. Now close your eyes and slip the coat on, and I'll tell you more as we travel. Hurry, for we do not have much time." He did as he was told, and to his surprise, he was now a caribou.

"Follow me," the caribou said, and now they were all travelling at a great speed.

After a bit he saw that he was getting left behind, and now he stumbled. He didn't know how far they had gone when he heard a voice saying, "We are safe now, and you can have a rest. We have been going for a good half-a-day, and now I will tell you how we travel. When we are running at high speed, we never look back at the ground. This slows you down. Hold your head high and just look where the ground meets the sky, and run. This way you can see your direction and also anything that may be on the ground to trip you. I will give you a test run after you have had a little more rest."

They ran and soon the ground below him seemed to be a blur. Soon they turned and they were on their way back to the herd.

Once back he realized that he was hungry. As they fed on the sweet lichen, his friend told him, "You must never stray far from us until we have told you more of the dangers we face in life."

To his surprise, there was a lot he had to learn. First of all he was told never to go near anything if he was not sure what it was. He was told of wolves, and always to stay with the herd when in danger. Also, there would be times when they would be hunted by humans.

Now, the air was cool and there was snow on the ground. The next day they had a long journey to make, and the only time they would stop was in the evening to feed and bed down. To his surprise, there were a few browsing around and feeding. He looked around, but there were no lichens he could find.

His friend came over to him and said, "I will have to show you how to search for food in the winter. However, you must not waste any food when you eat. You must always eat all you find, for those who waste food don't always find food when the chips are down."
He took him aside and told him to dig in the snow and turn up the ground. To his surprise, there were berries and fresh plants. They were very delicious and he ate all he had found. Now his friend told him, "Never dig for food till you are hungry. That is our way of life."

The winter was long and the days grew short, and there were times when he bedded down without anything to eat, for he would be too tired to eat. And then he would be up very early for another long day.

Soon the days were long and the sun shone very warm. Spring was here and now they were to watch even more carefully than before, for they were now passing a very dangerous country where a different tribe of Inuit lived. Water was beginning to show in some places.

One day they were attacked, and he was wounded in the neck by what he knew to be an arrow. To his own surprise, he was able to slip out of his coat. He was now back in human form. To his surprise, there was his hunting knife still in his belt.

Now as he lay where he had fallen, one of the hunters came running to his aid. He looked in awe and wonder as he saw he was from a different tribe. At last he spoke, and asked, "Where did you come from? For I know your tribe of people. From a long way back I have heard many stories and tales of them."

He told him what had happened, and as he spoke, he saw others come and they were listening as well. After applying some kind of spruce tree gum to his wound, they built a fire and had some roasted meat like he had never tasted before. At first he was a little slow in eating, for he remembered the friends he had made. Soon he was over it and he enjoyed his meal. He helped in preparing the meat to pack, for he was told that he was now one of the tribe.
Likin’ lichen

Objectives

Students should be able to:

1. Identify the various species of lichen in their area.
2. Conduct a ground study and measure the amount of lichen in a given area.
3. Research and identify airborne pollutants lichen may absorb in their tissues.

Method

Students will be given samples of the types of lichen they may find in their area and identify them as fruticose, crustose or foliose. (They may also find filamentous.) Students will do a ground plot survey and determine the percentage composition of lichen in a specific area.

Background

Caribou are herbivores, or plant-eating animals. The average caribou eats at least three kilograms of vegetation each day, the equivalent of about two garbage bags of food! Caribou eat different types of plants during the year, but their most important food is lichen. "Fruticose" ground lichens are the most significant. Famous among these is the “reindeer lichen,” called Cladina rangiferina. In winter, when green vegetation is not available, caribou depend on the lichens they find beneath the snow. In boreal forests, caribou will eat lichens growing on the ground or on trees.

Lichens are made up of two kinds of plants?algae and fungi?that live together in a mutually beneficial, or symbiotic, relationship. Algae contain chlorophyll, which produces sugars and starches through the process of photosynthesis. Fungi are able to store lots of water to support the algae, in return absorbing the sugars and starches produced by the algae.

Lichens come in many shapes and sizes. They do not have roots, stems, leaves or flowers. There are over two thousand kinds of lichens. These are divided into three main groups. "Crustose" lichens are flat lichens that often attach themselves to rocks. "Foliose" lichens have a leaf-like form. "Fruticose" lichens are tufted, or composed of erect stalks.

Lichens need water to grow. They act like sponges, absorbing moisture from the air, rain and snowmelt. When there is no moisture available, lichens dry out and become dormant. In the north, the season when lichens can grow is very short. Thus, even small-sized lichens can be decades or centuries old.

Caribou depend on lichens as a primary source of food in the winter months. Lichens take nutrition from moisture. Lichens grow very slowly and live a very long time; because of this, nutrients are more concentrated in them than in other plants.
Unfortunately, heavy metals such as cadmium and cesium accumulate and become concentrated in the same way. Cesium is passed along to caribou that eat the lichens. Radioactive elements like cesium may be cancer causing. In northern Canada, tests have shown the levels of contamination to be low enough that Health and Welfare Canada have not recommended against the human consumption of caribou meat. However, contamination levels were so high in northern Europe after the Chernobyl nuclear disaster that reindeer meat had to be destroyed. Even in Canada, levels of contamination increased by up to 25% in some caribou herds after the disaster.

Cesium does not persist in the body tissues of caribou. This means that the level of it found in meat will be higher in winter, when the animals are on a lichen diet, than in summer, when caribou eat a wider variety of plants. However, other forms of pollution, like heavy metal fallout, do accumulate in body tissues such as the liver and kidneys.

When studying large communities of plants or animals, scientists are unable to examine every individual. Instead, they take random samples and apply statistical analysis to determine ‘average’ characteristics of the group. For forest floor cover studies, scientists use simple devices called quadrats for sampling. Quadrats are placed on the ground, and everything found within its frame is measured carefully. In this activity, students follow the same process.

**Procedure**

1. Pre-measure sample area.
2. Provide students with background information and samples of lichen in a manner appropriate to the group.
3. Discuss with the group proper survey techniques and procedures.
4. Divide students into pairs and provide them with proper materials.
5. Go to sample area.
6. Place quadrat in sample area. Identify all the ground cover lichen and other types of vegetation that fall inside the quadrat.
7. Map the plot on grid paper, indicating the vegetation. Label the map.
8. Find the percentage of each type of lichen for the sample area.
9. Combine group data for the area and find the average percentage ground cover of lichen for the entire area.
10. Prepare written submissions as if they were to be presented to caribou biologists.
**Variations**

1. Have students study (and possibly map) the effects of various air- and water-borne contaminants on lichens and caribou.

2. With the help of a chemistry teacher, have students test lichens for minerals and contaminants.

**Extensions**

1. Invite someone who does vegetation mapping to come into the classroom and talk about his or her work, possibly assisting with the activity.

2. Do the "Bioaccumulation?the story of time" activity described in this guide.

**Evaluation**

Discuss with students:

1. Two different varieties of lichens.

2. Why people perform vegetation mapping and how mapping helps in understanding and managing caribou herds.

3. How heavy metals like cesium accumulate in caribou.
**Song for a Caribou**

**Objectives**
Students should be able to:

1. Write a factual song about caribou to an original or familiar tune.
2. Recognize references to caribou/reindeer in popular music.
3. Perform in a caribou song festival or Christmas concert with reference to caribou.

**Method**
Students brainstorm a list of songs that have reference to reindeer or caribou (mostly Christmas songs), write new songs about caribou and perform them for the class or school.

**Background**
Everyone knows the famous Rudolph, the red-nosed reindeer, but they may not know that Rudolph is related to the caribou. Songs about animals can be beautiful, silly, entertaining or educational. We sing songs to entertain ourselves and others and to share cultural information.

Caribou and other wild animals are sometimes used in songs as symbols. This means they are used to suggest meanings based on people's knowledge of caribou and concepts related to caribou. Reindeer symbolize Christmas for many people because they are used in Christmas songs and carols.

**Procedure**
1. Have students brainstorm songs that have reference to reindeer and caribou. You may wish to expand this to other Canadian animals if the students have difficulty.
2. Play a song that makes reference to caribou. Hand out lyric sheets to students and have them sing along.
3. Using a web format on the blackboard or a large piece of paper, have the students write down as many facts about caribou as they can think of. Break the students into pairs. Tell them each pair is going to write its own song about caribou. The lyrics may rhyme or they may not. The song may tell a story about caribou. Ask the students to include in the song some factual information they have learned about caribou. You may wish to provide a sample tune for the students to work with. For example, you may ask them to use the tune of “Rudolph” and write their own lyrics, e.g., "Rangifer, the barren-ground caribou, had some very hollow fur..."
4. Have each pair sing or present its song to the class. (Some students may wish to simply read the lyrics aloud.)
Adaptations for different ages

**Primary:** Have students think of and sing other songs they know that feature Canadian animals.

5. If this activity is being undertaken in a music class, you may wish to set one or two of the caribou songs to music and have the students play along on instruments.

6. If possible, teach several of the best songs to the entire class and have the students perform them in a song festival or school concert.

**Variations**

1. Have each pair of students write one verse in a class song about caribou.

2. Have students add a verse to "The Caribou Song" or write a song to the tune of "Rudolph."

3. Write a "rap" about caribou.

**Extensions**

1. Study how other animals are portrayed in songs. Are the portrayals accurate?

**Evaluation**

1. Have the students name three songs that feature Canadian wild animals.

2. Discuss how one of these songs portrays the animal. Discuss the accuracy (or lack thereof) of the portrayal. Discuss what the song teaches about the animal.

_Southern Lakes caribou_
The Caribou Song

(by Remy Rodden  (c) 1997 Think About…Productions, reproduced with permission)

Once upon a time throughout this land the caribou did roam
Thousands and thousands wandered through the hills
Our backyard was their home
They provided food and shelter for the First Ones
Then along came the miners and the rails, the habitat began to change
And up went the fences and the roads in the middle of their winter range
Now the Carcross herd is barely just surviving
We've got to do something soon

O caribou, caribou
Symbol of the northland, the wilderness so true
O caribou, caribou
We will be in trouble if we don't take care of you

Now the caribou is perfect for the North, it's adapted to a land that's cold
Its hooves are big and wide and they act like snowshoes
and shovels in the deep, deep snow
And their hollow hair keeps them toasty warm
They dine on lichens, a kind of plant, that no other critter wants to eat
So caribou survive where other animals can't, they have a very special niche
And the caribou when it dies, it feeds its neighbours
The wolves and the ravens too

O caribou, caribou
Symbol of the northland, the wilderness so true
O caribou, caribou
We will be in trouble if we don't take care of you

As goes the land so go ourselves, and all of us depend on the land
If the wildlife is in trouble then we are too, so we'd better lend a helping hand
Won't you take the time to try and help your neighbour
Everything's connected somehow

O caribou, caribou
Symbol of the northland, the wilderness so true
O caribou, caribou
If we take care of your habitat, we'll be taking care of you
Project Caribou

Symbolic Caribou

Objectives

Students should be able to:

1. Recognize that caribou are found in symbols and signs of traditional and modern popular culture.
2. Understand how wild animals are used as symbols of qualities held by countries or people.
3. Create their own 'coat of arms' based on their knowledge of caribou biology.

Method

Students will research how caribou are portrayed in coats of arms, on Canadian money and in popular culture, and then create a coat of arms from the caribou's perspective.

Background

Caribou and other wild animals are sometimes used as symbols. This means they are used to suggest meanings based on people's knowledge of caribou and concepts related to caribou. For example, many countries have in their coats of arms animals that are seen as powerful, such as lions or eagles, or animals that are seen as wise, such as owls or foxes.

The province of Newfoundland has a caribou-like animal on its coat of arms, but it is actually an elk. The coat of arms was designed in 1638, when elk were erroneously believed to inhabit Newfoundland. What people thought were elk were actually caribou! Newfoundland re-adopted its coat of arms in the 1920s.

Caribou can also be found in popular culture. Santa's reindeer are a kind of caribou. And, of course, caribou can be found on the Canadian quarter, used every day by millions of people.

Procedure

1. Call out the names of a number of animals and have the students brainstorm qualities associated with the animals. Are these qualities based on the animal's biology and life cycle, or are they based on inaccurate human perceptions of the animals?
2. Have the students brainstorm places where they may have seen caribou portrayed. Remind the class that reindeer are a kind of caribou. Once they make the connection to reindeer, it may open up some new ideas. Discuss the importance of caribou to traditional cultures, early pioneers and northerners in remote areas. Remind the class that we tend to incorporate important species into our cultural symbols.
3. Break the class into small groups.

4. Tell each group that they are going to make their own caribou coat of arms. The coat of arms can be a drawing or collage of drawings by students in the group. It can include pasted-on features cut out from magazines or objects glued onto the paper.

5. Remind the students to think about things that are important to the caribou when making their coats of arms. For example, it might include lichen or other important caribou foods. It might include wolves or other animals that interact with caribou. They may add a drawing of a river to symbolize barren-ground caribou migration. Also have them keep in mind that they can use symbols to show parts of caribou biology. They can exaggerate important parts of the caribou's body, such as the hollow hooves or branched antlers.

6. Have each group present their coats of arms to the class and explain what each part symbolizes.

Variations

1. Have the class redesign the coat of arms for their province or territory, incorporating symbols that they feel are important.

Extensions

1. Have the class study the coats of arms of other Canadian provinces and territories and learn what each symbolizes.

2. Read a story or legend that involves caribou and have a class discussion about the symbolism in the story.

Evaluation

Discuss with students:

1. What a symbol is and why humans use animals as symbols.

2. How caribou are portrayed as symbols and whether or not the portrayals are accurate.

Tundra Ghost by Willow Q. Jones, Fairbanks, Alaska. 1998. Metal and caribou bone sculpture. (Photo used with permission of artist.)
What is a caribou herd?

Objectives

Students should be able to:

1. Describe how caribou herds are identified.
2. Understand why caribou and other animals move in herds or large groups.
3. Experience a simulation of a caribou herd in migration.

Method

Students will study a caribou herd (preferably local) to find out how it is defined, map its range, view videotapes and/or listen to audiotapes of a caribou herd in migration.

Background

Caribou need to be able to do two things at once: they need to eat, and they need to keep watch for predators. Like many other animals, caribou fill this need by gathering in herds. When caribou are in a group, several animals will be looking up and around while others are eating. They sniff the air regularly and can recognize predators by scent. They can alert other caribou to danger.

Barren-ground caribou form different kinds of herds at different times of the year. Prior to calving, pregnant cows will band together in small groups called "maternity bands." After the young are born, the mothers and calves may form "nursery bands." Larger and larger groups of caribou may move together through the summer as a strategy to reduce harassment by insects. When cool August nights mean fewer insects, these large groups break up and animals wander in smaller groups until fall. By early September larger groups again start to reform and continue through fall migration. In winter bull caribou may avoid groups of cow caribou and their calves, because they know that predators like wolves are drawn to the vulnerable young caribou. Also, they may be challenged for feeding territories by the cow caribou, which still have their antlers.

There are other advantages to travelling in herds. By travelling together to calving grounds in large groups, pregnant cow caribou in the barren-ground herds reduce the risk of predators killing their calves by sharing the risk with thousands of others. The animals in the centre of the caribou herd are better protected from predators that may attack unprotected animals or stragglers. In the same way, forming a tightly knit herd may help caribou protect themselves from aggravating clouds of insects.

Woodland caribou are much more solitary. Prior to calving, pregnant cows may separate to give birth and raise their calves in secluded patches of forest. Caribou are most scattered across the range in summer. They do, however, band together in the fall when males are courting females,
especially just before winter. Cows, calves and teenage caribou of both sexes travel in small bands throughout the winter, while mature bulls separate until late winter when, for a very brief time, most members of the herd gather together in search of the fresh green plants appearing where snow has melted.

Biologists and managers need to understand what defines a caribou population and where it is located in order to effectively study and manage it. Caribou herds are often named for where their calving grounds are, or for the geographical area where they are found. The Porcupine Caribou Herd, for example, is named for a river that the herd crosses during its annual migration.

**Procedure**

1. Begin with a general discussion of herds and groups, the advantages of travelling in a herd and how herds are named.
2. Have the students look at regional maps of the study herd. Discuss features after which the herd could be named.
3. Hand out range maps and have the students draw the range as indicated on their base maps.
4. Have the students calculate the total area of the range and divide by the total number of caribou in the herd to come up with a caribou/area in km$^2$ figure. You may wish to have the students compare this figure to that of other herds (which they may have to calculate). Are they similar? What might cause the differences?
5. Finish this activity by listening to tapes of herds and/or watching videotapes of caribou herds in migration. Ask the students to imagine what it would be like to be in the middle of a caribou herd. Then have them write about their impressions as a short descriptive paragraph or poem.

**Variations**

Have students make up range maps for a fictional caribou herd, describe the herd's characteristics, and give it a name. They may also make a density calculation for their herd.

**Extensions**

1. Do the aquatic extension of the Project WILD activity "Muskox Manoeuvres".

**Evaluation**

Discuss with students:

1. Some of the advantages of travelling in a herd.
2. Why and how caribou herds are named.
3. How population density of a caribou herd is calculated.
Ya gotta lichen caribou!

(Adapted from *Wildlife Trees* with permission of Wild BC, Habitat Conservation Trust Fund)

**Objectives**

Students should be able to:

1. Understand the role trees play in the life cycle of the caribou.
2. Understand the concept of habitat fragmentation.
3. Describe how habitat fragmentation affects caribou.

**Method**

Groups of students become four separate herds vying for food, water and space in this physically active demonstration of how our old forests are becoming more and more fragmented.

**Background**

Habitat fragmentation is the breaking up or destruction of a habitat's components. Fragmentation occurs when it becomes difficult for a species to cross from one section of an originally intact habitat to another or for that species to survive in a habitat that no longer provides the necessary food, water, shelter or space.

Fragmentation can happen on many levels, from small or "microhabitats" to larger or "macrohabitats." For example, in some urban parks and housing developments fragmentation can occur by the removal of the forest "understory." The understory can consist of a variety of different bushes, ferns, flowers and leaf litter which provide food and shelter for various creatures. Humidity, wind exposure, light availability and temperature also have an affect on the life cycles of the species found in this microhabitat.

On the macrohabitat level, the loss of habitat or habitat fragmentation through resource extraction, agriculture, road building and urban encroachment have contributed to the loss of trees. One species that uses trees and could be affected by habitat fragmentation is the caribou.

During the summer, caribou depend on a variety of grasses, sedges, horsetails, flowering plants, and the leaves of willow and dwarf birch for their diet. In the winter, when snow covers most of the vegetation on the ground, the caribou's diet consists exclusively of lichens. Caribou do not depend on specific, individual trees. However, they do rely on having stands of trees with enough diversity to provide lichens for immediate use as well as stands of trees that will ensure dispersal of lichens to future generations of trees. Often the trees that provide the most lichens are living trees with larger diameters. Stands of mature forests, with their wide crowns and multi-layered canopies, provide areas with less snow cover and protection from wind.

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**Age**

Grades 4 – 12

**Subjects**

Science, Math, Social Studies, Physical Education

**Skills**

Application, comparing similarities and differences, description, discussion, evaluation, generalization, physical mobility

**Duration**

30 – 45 minutes

**Group size**

15 and larger

**Setting**

Indoors or outdoors (large area needed)

**Materials**

- Four pylons
- Food and water tokens (different coloured popsicle sticks)
- Three hula hoops
- Suitable lengths of rope to delineate roads
- Tarps to indicate clearcuts or urban development
In the past, large clearcuts have suited the food needs of other, more adaptive ungulates such as mule deer. The increase of their numbers has strengthened populations of wolves who in turn have preyed upon some caribou populations. Logging and mining roads have increased the accessibility by humans to hunt caribou. The increasing number of roads in general has meant urban encroachment, which in turn affects traditional feeding territories and migration routes of the caribou.

**Procedure**

1. Prior to the start of this activity, ask the students to describe the components of habitat. What do all animals need to survive? Together discuss the habitat requirements of caribou. Brainstorm with the students what some of the limiting factors are that affect the survival of caribou.

2. Discuss with the students the term habitat fragmentation and what it means. Tell the students that they are going to participate in an activity that looks at how fragmentation of habitat affects caribou.

3. To start this activity, mark out the winter habitat of the caribou as shown in the diagram below.

4. Spread food tokens throughout the winter habitat and place water tokens within the hoops.

5. Divide the students into four herds: North, South, East and West. Although caribou drop their antlers in winter, the caribou for this activity can hold their hands above their heads like antlers. Have all the caribou stand facing away from the habitat with one herd on each side of the square. They may only exit or enter the square from their side.

6. On your signal, have the caribou run into the habitat to get both a food (lichen) and water token. There should be enough for everyone.

7. Prior to introducing the effect of habitat fragmentation on caribou populations, try introducing a predator such as wolves to demonstrate that animal populations are not static year after year but are continually changing in response to a variety of natural limiting factors. Natural limiting factors tend to maintain populations of species in predictable ranges. This balance of nature often goes up and down over time.

Since wolves hunt in packs, the wolves in this activity must hold hands and encircle the caribou they wish to eat. If they capture a caribou, they must take it to the sidelines before entering the habitat again. The goal for the caribou is to reach the sidelines with both a food and water token without being caught. This round may be tried several times depending on the success of the wolves.
Adaptations for different ages

Primary: Have students discuss the concept of habitat. What are some of the things they have in their own habitats (their bedrooms, houses, cities or towns)? Which of these things are essential? Have students discuss the essential components of caribou habitat. Primary students can play a simplified version of the game above. Have several students play wolves and the rest play caribou. Have the wolves attempt to capture the caribou by running around an open area. Then block off part of the area (i.e., fragment the habitat) and play again. Try several variations. The students can then see that fragmenting the habitat makes it easier for the caribou to be hunted.

Variations

Have students brainstorm other factors that contribute to habitat fragmentation. Try adding factors such as urban encroachment, clearcuts, agricultural development, hiking trails, etc. as shown in diagram C.

Extensions

1. Have students graph the progress of the herds by following the steps outlined in the Project WILD activity "Oh Deer."

2. Have students research current logging practices by writing to appropriate agencies or by asking community experts to present the new methods. They can then make changes to the activity that include:
   - Smaller clearcuts and partial cutting.
   - Wildlife corridors.
   - Deactivation of logging roads.

3. Using maps and aerial photos, discuss the effect roads have played on caribou and other species.

Evaluation

1. Ask students to name the essential components of habitat.

2. Ask students to define habitat fragmentation.

8. In the next round, with the caribou facing away, distribute the food and water tokens as before, but add some roads and/or clearcuts as shown in the diagram. For the purposes of the activity, caribou are not allowed to cross roads or clearcuts. Those caribou unable to get both food and water will die and become part of the habitat. After the round, those caribou that have died can now become wolves in the next round. Try this a couple of times so the students get a good idea of what is happening.

Note: If the wolves are becoming too successful, the caribou that have died could then become deer, which feed in clearcuts and can move throughout the habitat.

9. End the activity by asking the students what could be done to decrease habitat fragmentation for the caribou. Deactivation of logging roads is an example of something that is being done in real life situations.
Case Studies
Case Study
The Porcupine Caribou Herd: The International Wanderers
Prepared by Kirsten Madsen

Range and ecosystem
The Porcupine Caribou Herd is a barren-ground caribou herd that ranges from northeastern Alaska across the northern Yukon to the Mackenzie Delta in the Northwest Territories (NWT). The herd winters in the boreal forest of the Richardson and Ogilvie mountain ranges. In recent years, the herd has most often wintered in the southern part of its range in Canada. The caribou feed among the trees, using their hooves to dig for lichens. Wary of predators, they move to clearings and hilltops with open views to rest and ruminate.

In spring, pregnant female caribou lead the migration to calving grounds located on the coastal plain and foothills of Alaska's Arctic National Wildlife Refuge (ANWR) and the Yukon's Ivavik National Park. The reason the herd returns each year to traditional calving grounds is not fully understood. However, it is likely that they choose these areas because spring vegetation appears here first. They may also choose these locations because they offer better protection from predators and insects.

After an arduous journey, the females rest in the calving grounds where each cow gives birth to a single calf in early June. The newborn calves struggle to their feet and begin walking within hours of birth. They must quickly learn to follow their mothers during the herd's migration. Though resilient, nearly half the calves die in their first year of life. Travelling with the herd is perilous, and many die of pneumonia, by drowning or by having become separated from their mothers. Predators such as grizzly bears, wolves and golden eagles also prey on the calves.

The Porcupine caribou spend the short northern summer moving about the tundra in large groups. They seek relief from mosquitoes and parasitic insects by searching out windswept areas. Among the foods in their summer diet are grasses, sedges and shrubs. Fall migration begins in early September, when groups of caribou begin moving southward towards the boreal forest. Fall is also mating time. The bull caribou spar with each other to establish dominance. Breeding takes place, and the cycle of the herd continues.

Unique characteristics
The Porcupine Caribou Herd is one of the largest herds of mammals in North America. Currently numbering over 125,000 animals, the herd appears as a massive moving river of caribou passing over the landscape. Each year, the herd completes an arduous journey. The known range of the herd is about 260,000 square kilometres. The herd travels to different habitats within this range on a seasonal basis. Even very young calves travel with the herd, crossing open tundra plain, hills and mountain passes, and swimming swift-flowing streams and rivers. River crossings are particularly treacherous, especially during spring break-up when chunks of ice fill the streams.

The herd's annual migration brings them close to several northern communities. The indigenous people of these communities have an ancient relationship with the caribou, relying on the bounty of the herd for food, clothing and an intimate connection to the land. Though the people of these northern communities have experienced many changes, this relationship with the caribou remains strong. The Porcupine herd has returned year after year, and the people of the north rely on them to do so.
Cultural and social significance

The Porcupine herd is hunted by Gwich'in, Northern Tutchone, Han, Inuvialuit and Inupiat from 17 communities. Some of these groups have relied on this herd for centuries to provide food, clothing and shelter. But the ties between the people and the herd go much deeper. The Porcupine herd is part of their entire social and cultural fabric.

The Inuvialuit of the Mackenzie Delta area of the Northwest Territories traditionally hunted the Porcupine caribou to provide food for themselves and their sled dogs. They used hides with fur intact to make parkas and fur boots. Today, Inuvialuit hunters from Tuktoyaktuk and Aklavik begin to harvest Porcupine caribou in July, when the caribou stray near to their whaling camps on the Arctic coast. Inuvialuit and Dene hunters, including Tsiigehchic from Inuvik and Fort McPherson, are able to hunt the caribou in the late summer as they move southward through the Richardson Mountains.

The Gwich'in people of Old Crow, Yukon, are one of the most consistent users of the Porcupine herd. Each year, the herd passes very close to the village on its migration across the Porcupine River. The relationship between the people and the caribou is an ancient one. A fleshing tool made from caribou antler that is at least 1,350 years old has been found near Old Crow. Ancient wooden fences, which were used to guide and trap the caribou, have also been found near the village. For thousands of years, the Gwich'in have lived off the land and taught their children how to hunt, use and care for their most important resource, the caribou. In the past, the Gwich'in used nearly every part of the caribou: fat for light and cooking, hides for clothing and shelter, and bones for needles, fish hooks, and ornaments.

Today, many of these traditions are still passed on. Young people are shown how to hunt wisely, share the meat and give thanks. They also learn how to preserve the meat and prepare the hides. Elders share their knowledge of traditions with their people. The fall hunt along the Porcupine River is one of the most important times of the year. The herd's arrival is anxiously awaited. The animals are in prime condition after a summer of feeding on the tundra. A supply of caribou is needed to last through the long winter, and the entire community is involved in the hunt and preparation of the meat. In an isolated community such as Old Crow, which has no road access, caribou meat provides a healthy, nutritious staple.

The people of Old Crow value their subsistence lifestyle and relationship with the caribou. Norma Kassi, a former member of the Yukon Legislative Assembly from Old Crow says, "We have lived here for thousands of years, and we know what we need to sustain us. The caribou are our life. We must safeguard them forever." Johnny Abel, a former Chief of the Vuntut Gwich'in Tribal Council, put it this way: "I sure don't want to see our kids, one or two hundred years from now, reading about the caribou in storybooks and about how we used to live."

Historical and current status

Between 1972 and 1998, the Porcupine Caribou Herd has numbered as low as 100,000 animals and as high as 180,000 animals. Reliable estimates of the herd's size before the early 1970s are not available. The number of animals in the herd grew steadily until about 1989. Since then, their numbers have been decreasing slightly. It is normal for caribou populations to fluctuate. At this point, the herd appears healthy. It is not being over-harvested and is still occupying its traditional range.

A 1998 photo census of the Porcupine herd estimated the herd to contain 129,000 animals. The last count, in 1994, estimated the herd at 152,000. The causes of this recent decline are not fully understood, but poor weather conditions in the early 1990s may be responsible. When there is deep snow during the winter, caribou may be in poor condition because they must work harder to dig for lichens. In the same way, when the snow melts later than normal, the arrival of caribou on the calving grounds may be delayed, and the health of the young calves may be poorer. These conditions did occur for several years in the early 1990s, and the herd may still be feeling the effects. Even though the herd has declined, the caribou are in good condition, and as long as there are no more unusual environmental events the herd may begin to increase.
Current and future threats

The Porcupine Caribou Herd faces a possible threat on its calving grounds. The desire to exploit oil and gas reserves on the coastal plain has led to debate about opening up the Arctic National Wildlife Refuge to exploration and development. Most of the Refuge is designated as “wilderness”; however, a section of the coastal plain known as the “1002 Lands” was left out of the Wilderness designation. It is up to the U.S. Congress to decide the fate of the 1002 Lands. It is not known what the effect of exploration and development would be on this herd or on the 7,000 northern aboriginal people who depend on it.

The Porcupine Caribou Herd is not only sensitive to human activity on its calving grounds; development on the herd's winter range or migration routes could also affect the health of the herd. Such development would fragment the herd's range, possibly limiting the animals' access to good food areas during the cold winters.

Hunting pressure is another possible stress on the herd. Aboriginal peoples in 17 communities hunt this herd. Non-aboriginal hunters from these communities and from larger cities such as Whitehorse also hunt the caribou. Before the construction of the Dempster Highway, there was no road access for hunters. The Dempster Highway cuts through part of the winter range of the herd, allowing easier hunting access for both local and outside hunters. Managers of the herd and those who depend on it must keep a careful account of the number of animals killed and weigh this against the herd's productivity.

There are several possible threats to the Porcupine Caribou Herd due to events that are occurring on a global scale. Activities of people on the other side of the country and the world may affect this northern caribou herd. Pollution from large industrial centres can travel great distances. Lichens gathered in Canada's far north show traces of contamination caused by pollution. Because caribou eat lichens in such quantity, there is the possibility that contaminants could harm the caribou and those who eat them. In the years following the explosion of the Chernobyl nuclear reactor, levels of radioactive cesium rose in the herd. However, the level of contamination was found to be low enough to present no health risk to humans eating the caribou.

Another change that may affect the Porcupine herd is global warming. Researchers and northern peoples are keeping close track of changes, such as temperature and snow depth, to gauge the effects of global warming. If global warming continues, it may affect weather patterns, snow depth, insect numbers and the spread of diseases, all of which could have an impact on the Porcupine herd.

Management and study

Wild animals like caribou take little notice of political boundaries. Because the Porcupine Caribou Herd ranges internationally, it presents a challenge to managers and others interested in the welfare of the herd. The International Porcupine Caribou Board was established to provide advice and recommendations to improve cooperation and coordination between Canada and the U.S. in managing the Porcupine herd. This Board consists of four members from Canada and four members from the U.S.

In Canada, efforts to protect the herd resulted in the creation of the Porcupine Caribou Management Board, which represents aboriginal groups and the Yukon, NWT and federal governments. The objective of this board is to ensure the conservation of the herd and its habitat, making sure that the herd will always be able to provide for the subsistence needs of the traditional users who depend on it.

Many studies of the Porcupine caribou herd are conducted jointly by Canadian and American wildlife agencies, First Nation organizations and co-management agencies. There are several ongoing studies of the Porcupine herd. Aerial photographs of the herd are taken every three years in late June or early July, when the caribou are gathered in large groups. Radio transmitters attached to a sample of caribou help the researchers locate the various groups. The caribou are then counted from the photographs to obtain a population estimate. Researchers also attempt to make a composition count of the herd, estimating the numbers of cows, calves and bulls.

Radio-collared cow caribou are also located each year to see where they are having their calves. Determining the location of major calving grounds helps managers identify the herd's critical habitat. Researchers also survey the cows one month after calving to estimate the
survival of the calves during their critical early days. There are also several programs set up to keep track of the caribou harvest. Questionnaires and interviews with hunters are set up in an attempt to monitor the number of caribou taken by hunters each year. Since 1985, the Porcupine caribou harvest has ranged between 3,000 and 5,000 animals per year. This harvest rate is lower than 3% of the total herd, an acceptable harvest.

There are also a number of impact studies being done to try to determine the potential effects of oil development in the 1002 Lands area of the Arctic National Wildlife Refuge.

Because the Porcupine Caribou Herd has such a large range, tracking the herd's migrations over great distances across Alaska, Yukon and NWT is difficult and expensive. In 1997, the Yukon government purchased and fitted ten satellite collars as a practical way to track the herd's movements over a long period of time. Five agencies and co-management bodies were part of this program. In March 1999, biologists will replace the old collars with new ones that will be good for another three years. Caribou locations, updated each week, are viewed eagerly on the Internet by schoolchildren and others interested in the herd's movements.

The Porcupine herd is truly one of the last of the great herds of animals that once roamed this continent. It is a vital part of the northern environment.

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To view the latest locations of the caribou with satellite collars, check out:
www.taiga.net/satellite/index.html
Case Study

The Southern Lakes Caribou:
A Suburban Caribou Herd

Prepared by Kathi Egli and Kirsten Madsen

Range and ecosystem

Three herds of woodland caribou make up the Southern Lakes caribou: the Carcross, Ibex and Atlin herds. The herds are located in the southern Yukon and extreme northern part of British Columbia.

These woodland caribou give birth to their calves alone on the tops of mountains between snow patches and sometimes at the base of glaciers. The females try to find places where there are few predators and where they can be isolated for a couple of weeks so that the young caribou calf can grow strong and learn to run fast and steadily. The peak of calving for woodland caribou in the Yukon is around May 26. Most of the calves are born on this date; however, caribou may begin calving about five days before this date and five days after. After calving, mother caribou will slowly begin to move closer to other females with calves. A month or more after calving, groups of caribou and calves can be seen on mountaintops. At this time of year the caribou are often hot and are trying to find refuge from insects, so they can often be seen on snow patches.

In late September and early October the female and male caribou meet to breed. They meet on large rolling mountain plateaus. By this time of year calves have become stronger and smarter. They are no longer killed by predators at a higher rate than are adults. As winter approaches and snow begins to accumulate in the mountains, caribou slowly move down off the slopes towards the forested lowlands where the snow is not as deep and where lichen is plentiful. During the winter these caribou use a much smaller range than during the mating season, or rut. As the winter progresses caribou become more and more concentrated in the lichen-rich areas that have the least amount of snow. This makes mid and late March the best time of the year to accurately count these caribou herds.

The most common predators of caribou in the Southern Lakes area are wolves and bears. Caribou calves are also killed by lynx, eagles and coyotes.

Unique characteristics

A Yukon biologist out hiking in the mountains of the southern Yukon several years ago noticed a strange sight and a strong smell coming from an alpine ice patch. The source turned out to be ancient caribou droppings, preserved in ice and now coming to the surface. To date, 64 of these ice-patch remains have been discovered in the southern Yukon, and more likely exist in northern British Columbia. Carbon dating shows that the droppings range in age from 960 to 7,000 years old. The preserved droppings show that caribou have existed in this area for millennia, and that the caribou population may have been very large at times.

Ice-patch remains also show a long-time human hunting association with the caribou. Bows, arrows, blades and “atlatl” hunting tools have been found in the patches. Studies of the ice-patch remains will tell us more about vegetation and climate change as well as the food habits and distribution of caribou in past times. The recent discovery of human remains in an ice patch in northern B.C. will provide even more clues.

The caribou that live in the Southern Lakes area of the Yukon and northern B.C. are the depleted and fragmented remains of a herd that was once large and healthy. The remaining caribou are in three small herds, moving within ranges that are highly populated with humans. Caribou herds in southern and central British Columbia have been extirpated due to human development and activities. The Southern Lakes Caribou Recovery Program is a unique example of First Nations, governments, biologists and communities coming together to study and protect caribou. This is called co-management. Protecting a herd that ranges within the highest concentration of people in the Yukon is the challenge facing the Southern Lakes Caribou Recovery Program. The Southern Lakes Caribou Recovery Program would like to show the rest of the world an example of caribou and people coexisting.
Cultural and social significance

The caribou that once roamed the southern Yukon and northwestern British Columbia were a source of staple food for First Nation peoples and an important part of their culture. Remains of old caribou fences, used by native hunters to funnel migrating caribou, and shed antlers have been found in areas far outside the current range of these herds. The remains of hunting tools found preserved in ice patches in the southern Yukon show the ancient relationship between humans and caribou in the north.

Today, First Nations in this area are involved in a voluntary no-hunting compliance to try to help with herd recovery. Taku River Tlingit First Nation elder Edward Jack puts it this way: "We're fighting these animals to extinction and we never even take a lesson from buffalo or the cod or anything. Good start doing it. Sometimes it's hard for me to speak like this, but we've got to think about it and say, 'Yes, it's going to be hard for us not to kill too much,' so at least some of the future generations could say, 'Hey, look at that moose or look at that sheep.' If we don't leave them something, there's going to be nothing."

Historical and current status

Caribou used to be very numerous in the Southern Lakes area. Elders speak of entire mountainsides moving with caribou. They say there were tens of thousands of caribou before the Klondike Gold Rush began in the Yukon. The Elders say that the decline of the caribou started with the arrival of the gold seekers in 1898. The caribou were hunted heavily to meet the demands of the prospectors, who brought with them market hunters, domestic livestock and more settlements. The construction of the Alaska Highway in the 1940s allowed for more development and access for hunters. As populations grew, mining activity increased and more land was cleared. The habitat and migration routes of the caribou were disrupted. Today the Southern Lakes herds are drastically reduced. The herd sizes have increased slightly, however, since the instigation of the Southern Lakes Caribou Recovery Program. The latest population estimates for the Carcross herd are 450 caribou; for the Ibex herd, 430 caribou; and for the Atlin herd, 750.

Current and future threats

Caribou in the Southern Lakes share their range with nearly 25,000 people in four communities, thousands of dogs and snowmobiles, several major highways, and a maze of trails and roads. And the pressure for development in this area continues. As communities expand, so does the area that wild animals will avoid due to noise, dogs and human activity. Caribou are killed and injured on highways and roads every winter.

There are also areas of agricultural land in the winter range of these caribou. While they may not be farmed, they are often fenced, sometimes with barbed wire.
Caribou do not jump fences and can use up a lot of precious energy in late winter wandering around fences to get to other feeding areas. Fences can also kill or injure caribou if they run or are chased into them. Members of the Caribou Recovery Program try to educate the public about the need to remove unused fencing and to build fences that are more caribou friendly.

The winter range of these caribou is used by people for a variety of other reasons. People go into the forested areas to cut logs for fuel or building. They also use the land for recreational activities such as snowmobiling, skiing and dog mushing. Each one of these activities would not in itself harm the caribou herd. However, all together these activities could cause the extirpation of this caribou herd.

**Management and study**

In 1992, six First Nations and the governments of the Yukon and British Columbia agreed to establish the Southern Lakes Caribou Recovery Program to recover the three small herds in the Southern Lakes area. The goal was to protect the animals themselves and to consider their long-term habitat needs. Along with biologists and local residents, they hoped to learn more about these caribou and how to help them. The program is a good example of co-management.

The six First Nations involved in the program are the Carcross/Tagish, Kwanlin Dun, Ta'an Kwach'an, Teslin Tlingit Council, Champagne/Aishihik and Taku River Tlingit Council. All six agreed to voluntarily stop hunting the Southern Lakes Caribou herds in 1993. This hunting ban is still in effect. Two First Nation "Game Guardians" are on the land each winter to ensure that no hunting takes place. Art Johns has been working as the Carcross herd's game guardian since the program began. Art makes patrols by vehicle through the many roads in the Carcross herd's winter range. Larry Bill has been working as the game guardian for the Ibex herd for the past two years. Larry does most of his patrol work by snow machine because the Ibex winter range is remote and does not have any roads through it.

Licensed harvest restrictions and voluntary compliance by First Nations have produced noticeable results. For example, the Ibex herd's population had appeared stable at 150 animals between 1983 and 1992, but has increased to 430 as of March 1998.

While all hunting has been stopped in the Yukon portion of these herds' ranges, the Carcross and Atlin herds are still hunted in Northern British Columbia by outfitters and residents. The Taku River Tlingits are very unhappy with the B.C. government on this issue, and have continued their own harvest ban.

The Southern Lakes caribou are studied using a variety of techniques. The herds are counted from the air at certain times of the year such as during the rut and in late spring. Caribou counts give information about total populations and also about the composition of the herd and about calf survival. In the winter, range surveys are conducted to help locate critical winter habitat. Caribou and their tracks are observed from an airplane that systematically flies over areas of potential winter range.

Some of the Southern Lakes caribou have been fitted with radio collars. These collars transmit a radio frequency that allows biologists to locate them from the air. Radio telemetry helps biologists learn more about the way caribou move about their ranges, the location of calving and rutting areas, and the survival of caribou and their calves.

To learn more about the food habits of the caribou, their droppings, or "pellets," are analyzed. And to learn more about the availability of winter food for caribou, biologists locate and measure the amount of lichens in various parts of the winter range.

Members of the Southern Lakes Caribou Recovery Program also work to communicate with and educate the public through community workshops, school presentations, public service announcements?even colouring contests. The collection and use of traditional knowledge is an important part of the Southern Lakes Caribou Recovery Program. There is also a 24-hour wildlife telephone hot-line, which the public can use to report sightings of caribou, moose and wolves in the Southern Lakes area.
The Southern Lakes caribou are still a long way away from a lasting recovery. Working towards this recovery will help us learn more about how to protect caribou herds that share their habitat with people.

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First nation hunters are voluntarily not hunting caribou in the South Lakes.
Case Study

The Qamanirjuaq Caribou Herd: An Arctic Enigma
Prepared by Leslie Wakelyn

Range and ecosystem

Every year for thousands of years, Qamanirjuaq caribou have migrated from calving and post-calving areas on the tundra, south to the wintering grounds, and back north for the next calving season. The year-round range of this barren-ground caribou herd has been identified by surveys conducted sporadically over the past 60 years. The total area used by the Qamanirjuaq caribou herd during this period spans more than 1,000 km from north to south, from north of Baker Lake, Nunavut, to south of Brochet, Manitoba (see Beverly and Qamanirjuaq caribou range map on page 118). The range extends about 500 km east to west, from the west coast of Hudson Bay inland across the southern Kivalliq (formerly known as Keewatin) region of Nunavut and northern Manitoba, and includes part of southeastern Northwest Territories and northeastern Saskatchewan. The western boundary of the Qamanirjuaq range is not well defined, as there is substantial overlap of Qamanirjuaq and Beverly caribou range, especially winter range. Qamanirjuaq caribou do not use all of their range in any particular year, as their movements and range use patterns vary according to weather and other factors.

The Qamanirjuaq herd returns to the same general area for calving each year, although not to the same specific location. As a result, the traditional calving grounds (the total area known to be used for calving over many years) are much larger than the area used in any particular year. The Qamanirjuaq herd’s traditional calving grounds (approximately 28,500 km²) are located in the Qamanirjuaq Lake area of Nunavut’s Kivalliq region, extending from about 60 to 240 km inland from the west coast of Hudson Bay, and from Maguse Lake to just south of the east end of Baker Lake (about 230 km). Annual calving areas used by Qamanirjuaq caribou have been located by surveys in 25 years between 1963 and 1994. Calving ground surveys conducted between 1989 and 1994 located calving Qamanirjuaq caribou in the east-central portion of the traditional calving grounds, east of Qamanirjuaq Lake, but most surveys between 1977 and 1988 found many caribou calving west of Qamanirjuaq Lake. That is why the entire traditional calving grounds, not just the area used for calving in one year, is important to the herd over the long-term.

The Qamanirjuaq winter range consists primarily of forested lands in northern Manitoba and tundra in Manitoba and Nunavut. Segments of the herd have often wintered on the tundra during the same year that other caribou groups have lived in the forest. In most years between 1972 and 1982, the majority of the Qamanirjuaq herd wintered on the tundra in coastal regions of Hudson Bay. In other years, much of the herd has wintered close to communities in northern Manitoba. In the winter of 1998/99, however, Qamanirjuaq caribou were found in Manitoba only in the far northwest corner of the province, and all the satellite-monitored caribou wintered farther north than in recent years.

Unique characteristics

The range use and movement patterns of the Qamanirjuaq caribou herd are neither consistent nor predictable. Variability in Qamanirjuaq range use patterns has caused much concern for biologists and wildlife management agencies over the years, and has frequently resulted in limited access to caribou for hunters from different parts of the range. Substantial changes in seasonal caribou distribution between years has caused much hardship in the past for aboriginal people dependent on Qamanirjuaq caribou as their primary food source. Before people moved to communities and used snow machines for hunting, famine resulted when the herd did not return to areas in which people had hunted them for many years. Even in modern times, hardship can result when caribou do not winter near communities. For instance, the 1998 Manitoba harvest of Qamanirjuaq caribou was the lowest since 1990, as it was necessary for hunters from northern Manitoba communities to travel long distances (10 to 22 hours by snow machine) to harvest only a few caribou.

One mystery that has never been solved concerns the large fluctuations in the numbers of calving Qamanirjuaq caribou that were observed during surveys conducted in the 1960s to the 1980s. Surveys in the
1960s and 1970s indicated that the population was declining sharply, but in 1982 and 1983 biologists found an unexpectedly large number of calving caribou, which indicated that the herd size was much larger than previously believed, and that it was actually increasing. Biologists had explained the apparent decline as a consequence of over-harvesting, but hunters did not agree with this interpretation. No simple explanation for the confusing survey results has been established, although it is likely that the answer has something to do with changes in Qamanirjuaq caribou distribution.

**Cultural and social significance**

Many Dene and Inuit historically depended on Qamanirjuaq caribou for much of their food, clothing and shelter. Caribou were used so much by the Inuit of the Kivalliq region that the people were given the name “Caribou Eskimo” by Europeans. The people known as the Ahialmiut group of Caribou Inuit subsisted almost entirely on caribou year-round, unlike other Inuit groups that depended at least partially on harvest of animals from the sea. The ancestors of the Ahialmiut had moved inland from coastal areas in what is now the Kivalliq region of Nunavut. When the Dene joined the fur trade, and consequently stopped following caribou onto the tundra each summer, the Ahialmiut moved farther inland, pushing south to the tree line by about 1850. They spent spring and summer inland, where they intercepted caribou travelling north in the spring, and had summer camps on the calving grounds.

Other groups of Caribou Inuit lived inland during winter and travelled to the coast in the spring, where they stayed through the summer. In the early fall, they returned inland to hunt caribou and make caches for the winter. Groups of families hunted caribou at water crossings during their southward fall migration, and cached caribou and fish under large rock piles on high points of land, so they could be found easily. Kivalliq Inuit relied primarily on caribou during the winter months, and winter food supplies that they cached saved many people from starvation when caribou were scarce. These people were successful inland hunters, although they were subject to famine in years when caribou wintered primarily in the southern forest, rather than on the tundra, or when they were unable to cache sufficient food supplies in the fall.

Regular trade between Caribou Inuit and Europeans began in the early 1900s, after which time Inuit lifestyles began to change. White fox trapping became popular in the Kivalliq region, as it was easy and profitable to check trap-lines while hunting caribou. The Inuit maintained a lifestyle of hunting and trapping while living in family groups on the land, and continued to rely heavily on harvesting Qamanirjuaq caribou. However, following years of hardship in the late 1940s and 1950s, many people started moving into communities, and were encouraged by government to do so to allow their children to attend school and to have access to medical care at nursing stations.

In spite of the change in lifestyle associated with community living, use of Qamanirjuaq caribou continues to be very important for sustaining the culture and traditional lifestyles of Dene, Metis and Inuit across the caribou range. The herd is harvested regularly by residents of nine communities in Nunavut, northern Manitoba, and northern Saskatchewan. Caribou still provide much of the food for families living on caribou range, as well as materials for traditional clothing and special tools. Both subsistence and commercial harvesting of Qamanirjuaq caribou are important to communities on the range.

**An Inuit legend about the origin of caribou**

*(Told by Kibkarjuk, from "Observations on the Intellectual Culture of the Caribou Eskimos" by Knud Rasmussen)*

Once upon a time there were no caribou on the earth. But then there was a man who wished for caribou, and he cut a great hole deep into the ground, and up through this hole came caribou, many caribou. The caribou came pouring out, till the earth was almost covered with them. And when the man thought there were caribou enough for mankind, he closed up the hole again. Thus, the caribou came up on earth.

**Historical and current status**

The population size of the Qamanirjuaq herd was estimated to be well over 100,000 on the basis of surveys conducted in the late 1940s and mid-1950s.
Calving ground surveys in the 1970s indicated a population decline, with estimates of fewer than 50,000 adult animals in the herd. By the late 1970s, biologists were concerned that the population decline could drive caribou numbers so low that harvesting would no longer be possible, which would have serious consequences for the many hunters and families that depended on Qamanirjuaq caribou as their main source of meat.

Hunters did not agree that the herd was declining, however, and believed instead that it was actually increasing. We know now that herd size was likely much higher than surveys in the 1970s indicated. Surveys in 1982 and subsequent years confirmed larger herd sizes and an increasing trend, with more than 200,000 adult caribou by 1985, and almost 500,000 by 1994. Although current survey techniques, such as photographic surveys, provide better estimates of herd size than earlier methods, population estimates still contain a degree of uncertainty.

**Current and future threats**

Mineral exploration and mines are currently the greatest threat to Qamanirjuaq caribou, as exploration activities continue to increase on the caribou range, including the calving and post-calving areas. For example, between 1991 and 1998 five mining companies submitted applications to the federal government for mineral exploration on the Qamanirjuaq herd's traditional calving grounds. With the creation of Nunavut in April 1999, the Nunavut Impact Review Board took over responsibility for screening applications for land use permits and leases from the federal government, including activities on Qamanirjuaq caribou range. In the absence of any coordinated strategy or policy for protection of caribou calving and post-calving areas in Nunavut, it is likely that exploration activities will continue in these and other areas on the caribou range, which will probably lead to proposals for mine development. All phases of the mineral extraction process (including exploration, construction, operation and abandonment) are of potential concern, although it is difficult to predict and accurately assess the possible negative impacts of these activities on Qamanirjuaq caribou.

Feasibility studies were proposed in 1999 for transmission lines and roads from northern Manitoba to communities on the west coast of Hudson Bay, and for hydro generation facilities just north of the Manitoba border. This proposal resulted from economic development agreements between the governments of Manitoba, Nunavut and Canada. These projects will undergo further assessment (engineering, environmental and socioeconomic) before decisions are made concerning whether to proceed with development of roads, transmission lines and hydro dams. Once a commitment to develop these facilities is made, construction would occur over a 5- to 10-year period.

These proposed facilities are all located on Qamanirjuaq caribou range and could have significant consequences for the herd. The proposed roads are of greatest concern, as they could increase unregulated harvest of caribou, act as barriers to caribou movement, and reduce habitat availability. There is a high potential for significantly greater harvest levels resulting from the increased access to caribou range that a road would provide. All-weather roads along the Hudson Bay coast could affect caribou movements during spring migration, as the proposed road corridor intersects with the herd's primary migration corridor between winter range and the calving grounds.

The proposed hydroelectric development could affect movement of Qamanirjuaq caribou during spring and fall migration. The herd may need to make long detours if traditional water-crossing sites become impassable because of changes to water levels and stream flow characteristics that result from hydro dams. Access roads inland from the coast may cut across traditional migration routes (which parallel the coast), and could also potentially create seasonal barriers to caribou movements.

A rapid increase in the number of hunters on the Qamanirjuaq caribou range could mean that unlimited hunting of caribou will not always be possible. Careful sharing of the caribou resource will likely be necessary some time in the future to ensure that the Qamanirjuaq herd continues to be abundant and productive, so that caribou are available for present and future generations.
Management and study

The Beverly and Qamanirjuaq Caribou Management Board (BQCMB) was established in 1982 to coordinate management of the Beverly and Qamanirjuaq caribou herds. The BQCMB consists of representatives of communities from across the range of both herds, and of the governments of Manitoba, Saskatchewan, the NWT and Nunavut (which replaced Canada in 1999). The Board's responsibility is to make recommendations to government and conduct projects for conservation and management of the caribou herds and their habitat. A report and map atlas on CD-ROM published by the BQCMB in 1999 provide information for impact assessment and land use planning on Qamanirjuaq and Beverly caribou range. (For more information on the BQCMB's projects refer to the Beverly caribou case study in this guide.)

An optimum herd size of 300,000 and a crisis level of 150,000 animals were established by the BQCMB in the 1987 management plan. If the Qamanirjuaq herd size declines below the crisis level, recommendations for emergency action for management and protection of the herd will be submitted by the BQCMB to the Nunavut and Manitoba governments.

The distribution and movements of up to ten adult female Qamanirjuaq caribou have been monitored since 1993 using radio-collars which are tracked by satellites. The results of this study have added much to our knowledge of the herd's recent distribution and movement patterns, and of the overlap between the Qamanirjuaq and Beverly caribou ranges. For instance, one of the caribou that was collared in April 1995 on Qamanirjuaq winter range (where it overlaps with Beverly winter range) travelled to the Beverly calving grounds each spring from 1995 to 1997, but wintered with the other collared Qamanirjuaq caribou in the southern NWT. (The other collared caribou had travelled to the Qamanirjuaq calving grounds with the rest of the Qamanirjuaq herd each spring.) This indicates that caribou from these two herds mix on the winter range. The satellite-monitoring study has also confirmed that the Qamanirjuaq herd travels north of Chesterfield Inlet in some years; in the spring of 1998, two Qamanirjuaq caribou collared near Rankin Inlet travelled north of Chesterfield Inlet. Although it was generally believed that Qamanirjuaq caribou may have ranged up to 100 km north of Chesterfield Inlet in historical times, before the satellite-monitoring data were available, no one was sure how far north Qamanirjuaq caribou travelled. The satellite-monitoring study is enthusiastically supported by hunters from Nunavut and Manitoba.

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Case Study

The Beverly Caribou Herd: Continental Wilderness Travellers
Prepared by Leslie Wakelyn

Range and ecosystem

Beverly caribou have migrated across the northern Canadian landscape for thousands of years, travelling as far as 2,000 km each year. The range used by this herd over the past 60 years extends across a huge and diverse area, from the boreal forests of Saskatchewan, across the subarctic taiga of the NWT, to the arctic tundra of west-central Nunavut (see Beverly and Qamanirjuaq caribou range map). The total range used by the herd during this period extends almost 1,000 km from south to north, from the Clearwater River and Reindeer Lake areas of northern Saskatchewan, to the Pelly and Garry lakes area of Nunavut. In some years, however, the caribou have remained north of their historical forested winter range in northern Saskatchewan and Manitoba. Because the herd overlaps with Bathurst caribou on the west and the Qamanirjuaq herd on the east, it is difficult to determine the western and eastern limits of the Beverly range. However, Beverly caribou range is at least 600 km from west to east, from Great Slave Lake, NWT, to somewhere east of Dubawnt Lake, Nunavut, and from the Slave River in Alberta across northern Saskatchewan to somewhere near Nueltin Lake in Manitoba.

The Beverly herd of barren-ground caribou migrates northward each spring to the calving grounds, and then travels back toward the more southerly winter range in July, and again each fall. Every year Beverly caribou return to the same general area for calving, although not to the same specific location. Consequently, the Beverly herd's traditional calving grounds (the total area known to be used for calving over many years) are much larger than the area used in any particular year. The Beverly herd's calving grounds (approximately 38,400 km²) extend from the area around the lower Thelon River and Beverly and Aberdeen lakes, north towards the Back River and Pelly and Garry lakes, and have been described by surveys in 23 years between 1957 and 1994. Calving ground surveys found that most Beverly caribou calved in the southeastern half of the traditional calving grounds between 1957 and 1974, but that calving occurred primarily in the northern portion of the calving ground since 1980. That is why the entire traditional calving grounds, not just the area used for calving in one year, are important to the herd over the long-term.

Unique characteristics

Unlike all other mainland barren-ground caribou herds, which spend part of their annual cycle in coastal areas, Beverly caribou remain inland year-round. The landscape through which the Beverly herd travels can be characterized as primarily wilderness, including hundreds of wild rivers and lakes, and one of the largest protected natural areas in North America, the Thelon Wildlife Sanctuary. Human habitation on the range is limited to 10 small communities around the fringes of the range, and five others nearby.

The wide-ranging movements of Beverly caribou take them across several political boundaries as they travel through portions of three provinces and two territories. The traditional calving grounds are in Nunavut, while most of the spring and fall migration range is in the NWT. Residents of Saskatchewan communities account for much of the harvest of Beverly caribou. The Beverly and Qamanirjuaq Caribou Management Board (BQCMB) was established in 1982 to deal with the multi-jurisdictional nature of the caribou herds. In the late 1970s, a confrontational situation existed among the several governments and many communities that had vested interests in management of Beverly and Qamanirjuaq caribou, and Aboriginal peoples were not included in decision-making processes. Over the years, the BQCMB has successfully brought people from these different governments, communities and cultures together to discuss issues and make recommendations for conservation and management of Beverly and Qamanirjuaq caribou and their habitats. The Board has fostered multi-jurisdictional and multi-cultural cooperation as a result of greater understanding and respect for diverse values and points of view, which has had positive ramifications far beyond caribou management issues. (For more information on the BQCMB refer to the Qamanirjuaq caribou case study in this guide.)
Cultural and social significance

Aboriginal people across the Beverly range historically depended on caribou for much of their food, clothing and shelter. Today, the Beverly herd is harvested by residents from about 15 communities in Manitoba, Saskatchewan, Alberta, the NWT and Nunavut located on or near the range of this herd. Use of the Beverly caribou herd remains very important for sustaining the culture and traditional lifestyles of Dene, Metis and Inuit people.

The traditional lifestyle of the group of Dene known as Ethen-eldeli-dene (caribou eaters) was attuned to the life patterns of caribou. Before the coming of the fur trade, these Dene were nomadic, following a continuous pattern of movement between the forests and the tundra. The Dene of this era were dependent on caribou for most of the basic necessities, so they followed caribou northward to their summering grounds on the tundra, and returned each year to spend winter in the forest. Some families stayed south of the tree line all year, while others spent most of the summer on the "barren-grounds." Although other sources of food were sometimes available when caribou were not, caribou always provided essential materials for clothing and shelter. For example, tents consisted of a framework of poles bound together at the top and covered with as many as 70 caribou skins.

The primarily nomadic lifestyle of the Dene ended in the 1940s and 1950s, when people began living in permanent settlements. Several Dene communities were strategically established on a major migration route of the Beverly herd in northern Saskatchewan, where caribou could be harvested during both fall and spring migration between winter range and calving grounds. These two major harvests provided people with a year-round supply of meat, which was eaten fresh during fall and spring, frozen in winter, and dried during summer. However, this food supply was only available when Beverly caribou wintered around or south of the Dene communities, when the migration route brought caribou within hunting range. When Beverly caribou wintered far from these communities, they were not accessible to the Dene, and much hardship resulted.

Availability of snow machines, aircraft, and modern communication devices has helped make Beverly caribou more accessible to Dene from northern Saskatchewan and Manitoba, although these options of gaining access to the herd are not always affordable. In the winter of 1998, for example, Beverly caribou were found in Saskatchewan only along the Manitoba border and in the northeastern corner of the province. Consequently, hunters from communities in northern Saskatchewan travelled as far as 200 km north to hunt caribou in the NWT that winter.

Famine and hardship resulting from the unpredictable movements and distribution of caribou from year to year were familiar to Dene people. One Dene explanation for the occasional scarcity of caribou was that caribou never die unless killed, and that if a caribou is captured or mistreated its spirit will warn other caribou to stay away from that area.

Historical and current status

The number of caribou in the Beverly herd has been estimated by government biologists numerous times over the past 50 years. However, caribou counts on the spring and winter ranges from the late 1940s to the 1960s did not provide adequate information for determining whether the herd was increasing or decreasing. Actual population size during this period was probably higher than estimates based on surveys (between 100,000 and 275,000 caribou), because caribou were missed during surveys, and the size of surveyed groups was often underestimated.

Calving ground surveys from 1971 to 1980 suggested that the herd was declining. Total herd size was estimated to be about 105,000 in 1980. Biologists believed that the herd would soon be in trouble if the number of animals harvested were not reduced. However, many Inuit hunters believed that the herd was actually increasing, or that it was using different parts of the range, and did not agree that hunting was a problem.

Surveys of Beverly caribou conducted in the 1980s indicated increasing herd size. Population estimates were 125,000 in 1982 and 190,000 in 1988. The 1994 population survey of the Beverly herd indicated that the trend had continued, resulting in a herd size of 276,000 caribou.
Current and future threats

Until recently, Beverly caribou have not had to contend with too many obstacles or human-caused disturbances across most of their range, as land use activities such as mineral exploration have been more prevalent elsewhere, such as in both of the neighbouring caribou ranges (Bathurst and Qamanirjuaq). Beverly caribou have also had the luxury of spending part of their annual cycle feeding and travelling on lands protected within the Thelon Wildlife Sanctuary. Furthermore, the lands between the Sanctuary and Saskatchewan are primarily wilderness. However, there is no certainty that this situation will continue, given the pro-development policies of current governments and ongoing expansion of mineral exploration activities in the Canadian north.

Roads, mineral exploration and mines currently pose the greatest threat to Beverly caribou and their habitat. The potential cumulative effects of development activities on Beverly caribou are of particular concern. Roads are a major threat to Beverly caribou, because they can increase human access, act as barriers to caribou movements, and reduce habitat availability. Roads that provide new access to caribou for unregulated hunters from southern Canada, such as the new Athabasca Road from Points North to Black Lake Saskatchewan, are the greatest concern. These roads create the potential for significantly increased harvest levels, as restrictions on use of roads for harvesting are very difficult to establish and enforce. In addition, caribou movements across roads can be blocked if traffic volume is high or if snow walls are created by plows. Roads on the Beverly calving ground and post-calving areas could result in loss of critical habitat, because caribou with calves avoid areas near roads.

Mineral exploration and mines are the most frequent major developments on Beverly caribou range, and the potential for new mines is increasing. Exploration and mining of uranium has been the greatest concern in the past for communities that harvest Beverly caribou, and many uranium mines are operating in northern Saskatchewan. Recently, however, exploration for gold and diamonds has increased throughout the NWT and Nunavut, and exploration for base metals (zinc, copper, nickel) is also occurring. Although most of the recent exploration boom has occurred northwest of the Beverly range, prospecting permits and mineral claims are active on Beverly range, including the calving grounds.

Activities associated with mining which have potential negative effects on Beverly caribou include frequent low-level aircraft flights (during exploration and development), construction of roads and airstrips, frequent travel by supply trucks on all-weather and winter roads, mine construction and operation, and pollution of land and water by toxic substances. These activities can result in loss of habitat, increased human access, and disturbance to caribou. In northern Saskatchewan, many uranium mines on caribou range are also sources of potential contamination to wintering Beverly caribou. The possible negative impacts of mineral exploration and mining on caribou are difficult to predict and assess because of variability in factors such as caribou movements and weather, and because measurable effects of disturbance may take a long time to develop.

Climate change over the next 40 years has significant potential to affect Beverly caribou and their habitat. Global warming may result in changes in snow depth and hardness, timing of spring melt, summer temperatures, and abundance of insects and parasites. These changes will affect herd size, migration patterns, and seasonal distribution of Beverly caribou.

Management and study

The BQCMB has compiled much of the information available from government surveys and satellite-monitoring studies between 1940 and 1995 concerning the distribution and movements of Beverly and Qamanirjuaq caribou. This information has been used to create reference materials intended to assist conservation of caribou and caribou habitat, by providing tools for use during impact assessment, protected areas planning and land use planning. The BQCMB has published a report and a map atlas on CD-ROM which contain background information about the caribou herds and caribou range, the BQCMB, and land use activities on caribou range; ratings for sensitivity of caribou and caribou range to land use activities during annual life cycle periods; maps showing seasonal caribou ranges; and information about the data used to create maps. (See the Qamanirjuaq caribou case study for more information about the BQCMB.)
Approximately half of the traditional Beverly calving ground is currently protected from development activities because it lies within the boundaries of the Thelon Wildlife Sanctuary. A small part of the winter range along the south shore of Lake Athabasca in Saskatchewan is also protected within Athabasca Sand Dunes Wilderness Park. The rest of the Beverly range is currently unprotected, although the Saskatchewan government has proposed three new protected areas on Beverly caribou winter/early spring range.

Biologists with the provincial and territorial governments review applications for land use permits, land leases and major development projects which are proposed on the Beverly range, and make recommendations intended to protect caribou and caribou habitat. Government members of the BQCMC also review applications for activities on the Beverly range, and make recommendations to the agencies that approve these projects, such as the Department of Indian Affairs and Northern Development (for the NWT) and the Nunavut Impact Review Board (for Nunavut). Aboriginal representatives on the BQCMC raise issues that are relayed to governments and others.

The latest survey of the Beverly calving ground occurred in 2000. Information provided by this survey will help biologists to determine the overall health and trends (increasing, decreasing or stable) of the Beverly herd, and to identify areas that should be protected from development activities because of their importance to calving caribou.

The BQCMC and NWT government have proposed that satellite radio-collars be used to monitor the movements and distribution of Beverly caribou, and several agencies have made funding commitments for a two-year satellite-monitoring study. However, the study will not proceed until support from all Beverly range communities is obtained. Information from the study would help to identify seasonal ranges, migration routes, and areas that are used by more than one caribou herd (Beverly, Bathurst and Qamanirjuaq), and to locate caribou for harvesting.

The NWT government is developing a proposal to monitor contaminant exposure in Beverly caribou as part of a larger study to determine whether levels are increasing, decreasing or remaining the same over time. Three caribou herds from across the NWT and Nunavut, including the Beverly herd, have been selected for long-term monitoring. Field collections will be conducted in cooperation with local hunters and trappers organizations or other appropriate local First Nation organizations, and local hunters will help with planning and conducting caribou collections. Community consultation, sample collection and laboratory analysis for Beverly caribou were proposed for 2000/2001.

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Case Study

Telkwa Caribou Herd: B.C.’s Hinterland Herd

Prepared by Ian Hatter and Kerrie Post

The Telkwa Caribou Herd is a woodland caribou of the northern ecotype. Its range is found 15 km from the major transportation corridor of Highway 16 near Smithers, Telkwa and Houston, B.C. Historically, caribou were once widely distributed throughout most of the mountainous areas surrounding the Bulkley Valley. Evidence of antlers, reports from elders of the Wet’suwet’en First Nation and historical sightings of caribou are consistent with reports that caribou were once found throughout the area. Large numbers of caribou in the Telkwa Mountains support the suggestion that the Telkwa represent an important area of caribou habitat.

Based primarily on behaviour and habitat use characteristics, including distribution and migration patterns, the woodland caribou of British Columbia are classified into three ecotypes: mountain, northern and boreal. The Telkwa caribou are part of the northern ecotype. They live primarily in the mountainous part of northern and western central B.C. The Telkwa Caribou Herd spend most of their time at or above tree line, but use forested areas in response to winter snow glazing and crusting in alpine areas. These caribou normally winter either on windswept mountain ridges or in pine forests at low elevations.

Unique characteristics

The three ecotypes of woodland caribou look similar but behave differently. The ecotypes differ by occupying different parts of the province, utilizing different habitats, and having different feeding habits and migration patterns. The differences are also thought to relate to the interactions of a variety of environmental conditions, including the amount and duration of snow cover, food types and availability, topography/terrain, predation. Genetic differences are possible as well.

Cultural and social significance

The Telkwa Caribou Herd represents a particularly valuable resource to the people of British Columbia due to its proximity to the urban centres of Smithers, Telkwa and Houston and because of the importance of maintaining genetically viable populations of caribou in the face of increasing urban developments and habitat fragmentation.

While caribou aren't easily found, there are some viewing opportunities. Snowmobiling is a popular recreational activity that can promote use and appreciation of wilderness areas, but its practice within caribou range is not without concern. While caribou may tolerate low levels of snowmobile use, harassment by high levels of unregulated snowmobile activity can displace caribou from preferred winter habitats, which may ultimately lead to increased mortality and population declines.

Caribou are hunted by most northern First Nations, except during the rutting season, when the meat acquires an unpleasant strong taste. Because of its high insulative quality, caribou provide one of the warmest hides available. Besides clothing, tanned hides were also used to make containers for storage and transportation. Sinews were sometimes used as thread for sewing and as twine, and strands of caribou hide were used in snares. Caribou antlers and some bones were used to make arrow points, knives, scrapers, digging sticks and tool handles.

Caribou have less capability for sustaining high hunting levels than do other members of the deer family. Low calf recruitment, migratory habits, dependence on critical seasonal habitats, and the vulnerability of mature bulls during the rut necessitate greater restriction of hunting opportunities than for moose, elk and deer. In the past, liberal hunting regulations combined with predation resulted in caribou population declines. Current management goals include restoring and maintaining appropriate sex and age ratios, monitoring population levels, and maintaining compulsory inspection of all caribou hunted.

Historical and current status

Of all the woodland caribou in British Columbia, the northern ecotype, which includes the Telkwa herd, continues to be threatened by a combination of impacts from human activities. Northern caribou are considered vulnerable in some locations within the Central Interior, where they have been singled out for special
management attention through various forestry and local and regional resource management plans. The Telkwa and other northern caribou are yellow-listed in British Columbia, meaning they are not at risk, although still of conservation concern.

The earliest population estimate of the Telkwa herd was in 1949 when a two-week horseback survey provided the basis for an estimate of 60 caribou. However, it is difficult to compare ground inventory to aerial surveys that covered larger areas over shorter periods of time.

**Estimates of the size of the Telkwa Mountain Caribou Herd**

It is suggested that the Telkwa herd has increased at an annual rate of 3% after being nearly extirpated in 1966 and 1967. It has slowed since 1984. Recent data indicate that the Telkwa Caribou Herd continues to decline in numbers despite a complete closure on hunting after 1973. To avoid imminent extinction of the herd, the B.C. Ministry of Environment transplanted 12 caribou (11 females and 1 male) from the Sustut-Chase herd to the Telkwa Mountains in November 1997.

**Current and future threats**

Population declines in the past were the result of an increase in forestry and mineral exploration activities in central British Columbia, which led to increased availability of helicopters in the Smithers area. At that time, it was legal to use helicopters to place hunters near wildlife and to transport wildlife with helicopters. Additional causes for population decline of the Telkwa Caribou Herd may include high mortality rates due to predation, movements of caribou out of the area, and/or range abandonment due to disturbance from human activities. The greatest future threats to herd growth in the near future are low population size and the effects of increasing recreational access and predation.

Predation of caribou by wolves has the potential to extirpate the Telkwa Caribou Herd given that current wolf numbers may be largely determined by densities of moose and goats, and that the Telkwa Caribou Herd is currently at a very low population level. Caribou calves are extremely vulnerable to wolf predation throughout the summer, and all age and sex classes of caribou are vulnerable to wolf predation throughout the year. Bears, wolverine, golden eagles, coyotes and lynx have also been documented as predators on caribou. All are present in the Telkwa Mountains at low densities.

There has been a complete closure on caribou hunting in the Telkwa Mountains since 1973. However, there are unconfirmed reports of some poaching (illegal hunting) occurring in the Telkwa Mountains right into the 1990s. Poaching is unlikely to result in a significant degree of adult mortality unless access to alpine areas improves and the level of human activity increases, but given the current population level of caribou, any poaching could seriously jeopardize the recovery effort.

The recreational use of snow machines in the Telkwa Mountains represents a serious impact on the Telkwa Caribou Herd and may result in winter range abandonment. Snowmobiles have the potential to impact large areas of winter range, disturbing the animals and causing energy loss at a time of negative energy balance or through direct injury. Snowmobiles use compacts the snow, increasing the mobility of wolves and other predator activity. All-terrain vehicles (ATVs) and motorized dirt bikes can also affect caribou in ways similar to snowmobiles.

Hikers and their dogs may cause both direct disturbance to caribou and in range abandonment, particularly if dogs are allowed to chase adult caribou and calves. However, there is less potential to impact large areas. Three areas within the Telkwa recovery zone that are popular for summer hiking activities include Hunter Basin/Camel Humps and Webster and Hankin Plateau. Skiers have the potential to cause many of the impacts described above for motorized access, but generally skiers cover less area and there is less potential for direct disturbance to animals.

Land alienation from urban development and agricultural encroachment has fragmented forested areas of the Telkwa Caribou Herd range. Forest harvesting practices contribute significantly to habitat fragmentation unless carefully planned and conducted in accordance with a sustainable watershed-based perspective. Timber extraction and associated road developments can lead to further habitat fragmentation and increased public access. Support by the forest industry for access management measures and for incorporating caribou protection measures into
harvesting plans will reduce the relative liability associated with forest harvesting.

Other threats include loss of habitat if a proposal to develop a coal mine south of the Telkwa River receives approval, and if mining proceeds. Recent forest harvesting practices and the policy of extinguishing all natural fires, with minimal consideration to mimicking natural disturbance patterns and rates, have changed the natural pattern of forest succession. The long-term impact of this on the Telkwa herd is unknown; however, the impact of changes in natural succession patterns is probably minor at the present time compared to the impact of habitat fragmentation and degradation.

Potential impacts of aerial harassment associated with low-level overflights for ecotourism, access to winter skiing areas, helicopter pilot training in the Telkwa Mountains, and survey and radio-collaring programs are similar to those described for activities associated with motorized access. Aerial harassment from low-level overflights, notably from helicopters (which are more intrusive than fixed-wing aircraft) can cause direct harassment leading to increased energy expenditure. As well, there is the potential for injury and range abandonment. Although the potential for aerial harassment to impact large areas of the Telkwa Mountains is great, the current low level of aircraft activity and lack of impact on snow compaction reduces the relative liability below that of activities associated with winter and summer motorized access.

Finally, with increasing habitat fragmentation, degradation and alienation, the potential for interchange between the Telkwa Caribou Herd and the nearest population of caribou in Tweedsmuir Park is reduced. Therefore, the potential for genetic effects on the long-term sustainability of the Telkwa Caribou Herd is increased. In general, the long-term impacts on genetic viability of small, isolated populations of caribou throughout British Columbia are poorly understood. However, studies elsewhere have documented that the likelihood that small, isolated populations of vertebrates will persist over the long-term is reduced as a function of the size of the gene pool and distance from other populations.

Management and study

Protecting the Telkwa Caribou Herd is important to the residents of the Bulkley Valley. Direction on how to protect the herd was provided through recently completed public planning processes and consultation associated with the Telkwa Caribou Recovery Plan, and reflects the value people place on maintaining wildlife populations in the face of increasing pressures on natural resources in the Bulkley Valley and throughout British Columbia.

The Telkwa Caribou Recovery Plan proposes management actions designed to:

1. Reverse recent declines in the size of the Telkwa Caribou Herd by augmenting the population with caribou from other populations.
2. Increase understanding of factors influencing population growth rates by frequent monitoring of radio-collared caribou.
3. Protect caribou habitat by modifying industrial activities and reducing potential disturbance to caribou arising from increased human access into and recreational use of the Telkwa Mountains.

Management actions, access management and habitat protection measures may change over time as we better understand the population ecology of the Telkwa Caribou Herd, obtain better information on the seasonal movements, distribution and habitat use of the herd, obtain better information on how caribou respond to various human activities, and better comprehend the long-term impacts on caribou habitat of current forest practices.

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Case Study

South Baffin Island Herd: Friends of the Inuit

Prepared by Mike Ferguson and Elise Maltin

Range and ecosystem

Baffin Island, which has an area greater than 500,000 km², forms the eastern margin of the Canadian Arctic Archipelago. The South Baffin Island Caribou Herd occupies approximately half of the island. Based on aerial surveys, the South Baffin population was estimated at 60,000 to 180,000 animals in the late 1980s. The population is composed of "sub-populations," defined as groupings of individuals within a population's range over the short term (i.e., 10 to 30 years), leading to distinct demographic characteristics.

South Baffin caribou migrate onto their wintering areas during October and November and usually remain there until late April. Satellite telemetry shows that seasonal movements are most restricted from January to March, and migratory movements are not really underway until May.

South Baffin caribou exhibit two seasonal migratory patterns, with some animals migrating up to 400 km to their summering areas, and others remaining close to their wintering areas. These two patterns can be termed as the upland-to-lowland migrators and the plateau-to-mountain migrators.

The terrain on the Foxe Peninsula wintering area consists of rugged uplands up to 410 metres above sea level (ASL). During winter, caribou largely abandon the northern coastal lowlands and head to the uplands.

Caribou occupy two terrain types on Meta Incognita Peninsula: rugged coastal uplands below 305 m ASL and rugged plateaus 305 to 850 m ASL. In winter, they head to the mountains.

These two ecotypes may occupy the same or similar winter range. They overlap or exist extremely close together.

Dwarf and low-lying shrub tundra characterize vegetation on most of the Foxe Peninsula and the Meta Incognita Peninsula, while some areas are in the low, erect shrub zone. Climatic conditions and plant communities on the plateaus of the Meta Incognita Peninsula resemble those at higher latitudes.

Unique characteristics

What sets the South Baffin Island Caribou Herd apart from other caribou is that they do not, or cannot, migrate into trees. Secondly, these caribou are defined by their wintering areas, not by their calving areas.

Most caribou survey techniques have been developed for the mainland and are difficult to apply on much of Baffin Island. On the mainland a typical calving ground survey estimates the number of breeding females on the calving grounds. This implies that all breeding females use the same calving ground every year, and that the boundaries of that calving ground are well known. If these requirements are met, the surveys do not have to cover the entire range of the caribou population.

This principle does not work for Baffin Island because not all caribou populations on Baffin undertake long migrations to calving grounds. In June, some caribou calve on or near their wintering areas. Because calving is dispersed, Baffin caribou are not divided into distinct calving "herds." Rather, Baffin caribou populations are based on distinct breeding areas where animals are concentrated in the fall.

Cultural and social significance

The importance of caribou to the Inuit of Baffin has varied with family group, hunting area and availability of caribou. In the past, some families would undertake long treks of hundreds of kilometres in a single year to hunt caribou. In years of caribou scarcity, many families would live a coastal existence and depend on marine animals.

Today, caribou is an important element in the diet of all Baffin communities. But caribou hunting represents more than just food; it also offers the personal pride of providing for one's family and sharing with others in the ways of one's ancestors.

As part-time hunter Pauloosie Kilabuk of Iqaluit expresses it, "I don't hunt for just me; I hunt for other people. I go out and get a caribou and I feel good about myself. It keeps me close to the men I hunt with. I make my parents, kids, relatives and friends happy because they don't have caribou sometimes, and we all come together and share the meat. Caribou is more important than seal to keep my family and community together. What is a community feast without caribou?"
Since caribou hunting can affect the social fabric of a community, the loss of hunting skills among young Inuit is a concern of the Elders.

**Historical and current status**

Historically, caribou across the north have undergone large fluctuations in population size over several decades. These fluctuations have been observed in caribou populations on Baffin Island. Information from Inuit suggests that entire subpopulations on Baffin Island and elsewhere occasionally undertake predictable, periodic shifts in distribution and abundance. This has implications for wildlife management decisions, because hunting and predation are unlikely to cause such movements.

Population fluctuations may be cyclical, as suggested by traditional Inuit knowledge. A recent study on Baffin Island has been devoted to the documentation of Inuit knowledge about the historical changes in caribou populations from about 1900 to 1994.

As muskoxen do not inhabit Baffin Island, and arctic hares are not known to occur in high densities, caribou are the primary prey of wolves.

Caribou distributions were extensive and abundance was high in most coastal areas from 1900 until the 1920s. After that, the numbers started to drop, and there was a decline of about 9% annually until the 1940s. Caribou returned to the Foxe Peninsula in the 1950s after a virtual absence of 30 years. From the 1950s until the mid-1980s, distributions expanded and numbers increased about 8%.

Subsistence harvesting of caribou by Inuit has been unrestricted during the past 40 years. In 1982, Inuit in Cape Dorset and Kimmirut harvested 2,260 and 550 caribou from the Foxe Peninsula and the Meta Incognita Peninsula sub-populations, respectively. Increases in caribou abundance followed phases of winter range expansion, range drift and, finally, range shift. When abundance was low, caribou frequently and unpredictably shifted their winter ranges. Inuit knowledge suggests that populations of South Baffin caribou are cyclic, with each cycle occurring over the life of an elder.

Michael A.D. Ferguson's study, "Long-term Population Fluctuations and Winter Foraging Ecology of Arctic Tundra Caribou" (1999), demonstrated how traditional Inuit knowledge can be used to describe caribou population fluctuations. Subsequent scientific research using radio telemetry confirmed what the Inuit described. From 1983 to 1994, Ferguson developed a method to collect and analyze Inuit knowledge about a caribou population. He conducted aerial surveys and satellite telemetry to scientifically examine population changes that were both predicted and observed by Inuit within the two winter ranges on the Foxe and Meta Incognita peninsulas.

The caribou population abandoned its main wintering area on the Foxe Peninsula during the late 1980s, emigrating to the Meta Incognita Peninsula. Caribou density on the Foxe Peninsula dropped from 6.2 in 1984 to 0.3 km² in 1992. These caribou started migrating during the winter of 1988-89. Caribou density on the Meta Incognita Peninsula increased from 0.2 in 1982 to 5.0 km² in 1992. The caribou were in better physical condition than those on the Foxe Peninsula. Overgrazing on the Foxe Peninsula reduced important food supply on accessible sites for caribou.

**Management and study**

Commercial quotas allow hunters to sell caribou meat through retail outlets. This makes it possible for settlements with few caribou to purchase meat from settlements where caribou is more plentiful. These quotas were first implemented during 1985-86. Hunters are aware of the need for careful management of such harvesting. As well, they have supported studies of movement, diseases, and physical and reproductive condition of Baffin caribou.

Most study efforts of caribou on Baffin Island have been directed at the South Baffin population because it is utilized by 70% of Baffin's human population.

Biologists and Inuit elders generally agree that it probably takes about 40 years for lichen to recover on overgrazed winter ranges in the Arctic. What will happen when there are not enough places with enough food for all the caribou on southern Baffin Island? Will the whole population decline for 20 to 40 years? Is that what the elders described as happening from the 1930s to the 1950s? If there is not enough food for the caribou, will we see die-offs of caribou in winter? Some Elders have suggested that we may see this if there is severe snow or ice on the land.
We could expect that caribou would shift their wintering areas every year or two as they search for plentiful food supply. This is how elders described hunting for caribou during the 1930s, 1940s and 1950s. Because it was difficult to predict where the caribou would be, several Inuit almost starved to death and some did die when they went hunting for caribou. In the future, it may also be difficult to predict where caribou may be.

We need to understand not only the abundance of caribou, but also their movements, food, physical condition, the effects of snow and ice, and the production and survival of calves to manage the harvest in the future. We should use the wisdom and knowledge of the Elders to plan how, when and where caribou should be harvested in the future.

Some Elders know of special places where there are usually a few caribou in times when there are no caribou anywhere else. Perhaps these areas should be protected from permanent human development now, as the caribou may need these places 10 or 20 years in the future.

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Case Study

Peary Caribou: An Arctic Endangered Species

Prepared by Brenda Hans

Range and ecosystem

Peary caribou are found only on Canada's high arctic islands. These islands are among the harshest environments on earth. Ice fields and bare rock limit caribou to foraging for sparse vegetation in small areas.

Unique characteristics

Peary caribou are smaller than barren-ground caribou. The average size of a Peary caribou cow is about 60 kg, whereas the average size for a barren-ground caribou cow is 80 kg. Peary caribou have shorter faces and legs and are also lighter in colour. Their summer coat is slate-gray and brown with white legs and underparts. In winter, their coat is mostly white. The velvet covering on antlers is gray, unlike the dark brown velvet of the barren-ground caribou.

Caribou across the arctic islands vary in body size and behaviour. We recognize the differences by grouping caribou from Banks Island, Victoria Island, Somerset Island, Prince of Wales Island, some smaller nearby islands, the Boothia Peninsula and the mainland south of Dolphin and Union Strait as arctic-island caribou, and caribou from the high arctic islands as Peary caribou. As we understand more about their genetic relationships, these names may change.

Peary and arctic-island caribou move seasonally from calving areas to summer and winter ranges, sometimes crossing the ice from one island to another. In spring, the caribou migrate to their traditional calving areas where most calves are born during the last two weeks of June.

During the brief summer, the caribou must rebuild their fat reserves for the coming winter. They forage in moist areas such as river valley slopes and upland plains, which provide sedges, willows, grasses and herbs. Willow leaves and flowers such as arctic poppies, purple saxifrage, mountain avens and arctic legumes are eaten for their rich supply of proteins and sugars.

As an adaptation to the sparse vegetation, foraging groups are small and constantly on the move. Bachelor groups are composed of a few prime bulls, yearlings or sub-adult bulls. Cows, calves, yearlings and juveniles band together in groups of up to 30 animals.

Biting insects do not interrupt the foraging of Peary caribou nearly as much as they do that of barren-ground caribou on the mainland. The almost constant wind on the islands offers protection from insects. On some islands, black flies and warble flies are rare, and mosquitoes are active for only a few days because of the cool summer temperatures.

The fall migration returns caribou to coastal areas where they rut in mid-October. A healthy animal with adequate size and fat reserves is able to breed after two years of age. It is possible for cows to produce a calf every year, but it is unlikely. If cows do not have sufficient fat by breeding season, they do not come into heat and so are spared the demands of pregnancy when they are not in peak condition. Cows may live to be 12 to 16 years of age.

During winter caribou feed in areas where snow is shallowest, generally in windswept uplands. Winter groups are smaller than summer groups, with a lone animal or a cow-calf pair being common. The caribou break the wind-packed snow with their feet and nose the chunks and loose snow away to get at dried grasses, sedges, herbs and lichens.

In some years, there are brief periods of thawing temperatures or freezing rain in early winter. When this happens, the surface snow freezes into a layer of almost impenetrable ice. These conditions, especially if followed by high snowfall, make it extremely difficult for the caribou to get to food. Malnutrition and starvation may result. The first to weaken in such conditions are calves, yearlings, and bulls that used up some of their fat reserves in the rut. Ice formed during spring thaw can also make foraging very difficult for the caribou, adding extra stress for the cows about to give birth.

In some areas, the caribou are important prey for the arctic subspecies of the wolf. Wolf numbers appear to be increasing on Banks and NW Victoria Island. However, the impact of wolf predation is unknown.
Historical and current status

There are no historical statistics on the populations of Peary and arctic-island caribou. Traditional and local knowledge of Inuit and Inuvialuit hunters suggests that local caribou populations repeatedly increased and decreased in the past. The first scientific population studies were done in the 1960s over most of the range, and have been done only infrequently since then. Based on these studies, various caribou populations have increased, decreased or remained relatively stable.

The overall population of Peary and arctic-island caribou declined across the NWT between 1961 and the late 1990s. On Banks Island, the most extensively surveyed area, caribou numbers declined from 12,000 in 1972 to about 450 in 1998. On Melville Island caribou numbers declined from about 13,000 in 1961 to about 800 in 1987, and were still about 800 in 1997. The Minto Inlet population of NW Victoria Island declined from about 4,500 in 1980 to about 100 in 1993, but numbered about 500 in 1998. Caribou on southern Victoria Island increased since the 1980s to about 28,000 in 1997. Boothia Peninsula numbers have remained stable. However, caribou have almost disappeared from Somerset and Prince of Wales Islands.

Cultural and social significance

The archaeological record gives few clues about the importance of the Peary caribou to the earliest hunters on the arctic islands. Camp sites in coastal areas and the remains of weapons and bones suggest that marine mammals were the main food source of those hunters. Perhaps caribou were hunted only when a relatively easy opportunity arose.

By the time Europeans were exploring the arctic islands, people were living only on the southern parts of Victoria and Somerset islands and eastern Ellesmere Island. Hunting pressure was light on most caribou populations except when an exploration party was in an area and needed fresh meat.

Permanent settlements were established in the arctic islands by the mid-1900s. Peary and arctic-island caribou have provided an important food source and cultural resource for Inuit and Inuvialuit living in Grise Fiord, Resolute, Holman and Sachs Harbour.

It is difficult to fully explain the observed declines in Peary and arctic-island caribou populations. There are probably several interrelated factors at work. The caribou are scattered over a very large isolated area, making them difficult to study. There is a lack of information about population trends, hunting, movement of caribou between islands, and the relationship of caribou and other species such as wolves and muskoxen.

Both predation and hunting are potential direct causes of declines in caribou populations. Unfortunately, there is no information on wolves and their predation of caribou for most of the arctic islands. Wolves could accelerate the decline of a caribou population, especially if that population was already small. Wolves could also prevent a small population from recovering. Hunting has likely been a factor in population declines in some areas.

Other factors can lead indirectly to population declines by affecting the availability of food or disrupting migration or calving. Human activities such as large-scale industrial activities could reduce habitat available for caribou and are a potential future threat. Local habitat destruction could be caused by tracked vehicles, fuel and chemical spills and construction of roads and landing strips. Marine shipping could disrupt migration between islands. Aircraft flying over calving grounds is also a potential problem.

Weather can be a major factor contributing to the deaths of large numbers of caribou, especially in the western High Arctic. Deep snow and ice created by freezing rain in the fall or thawing snow in the spring can make it almost impossible for caribou to get to food. Almost half the caribou population on Prince Patrick and Melville islands died in the winter of 1973-74. Mild fall temperatures with freezing rain and record snowfalls contributed to a 97% decline in the Bathurst Island caribou over the three-year period 1994 to 1997. Global warming may worsen these winter conditions but improve what forage is available.

Poor summer weather can decrease the quality and quantity of summer food, making it more difficult for caribou to store enough fat reserves to survive the winter. Cows will not become pregnant if they are not in
good enough condition in the fall, so fewer calves will be born in the spring.

Little is known about the relationship between caribou and muskoxen populations. Some people believe an increase in muskoxen in some locations has caused a decrease in caribou. Other people do not believe there is enough evidence to support this idea. Though their diets and habitat use generally do not overlap, there may be more competition between muskoxen and caribou when their numbers are high or food is scarce because of weather conditions.

Management and study

Peary and arctic-island caribou inhabit lands that are within the wildlife management responsibility of the Inuvialuit Settlement Region, Nunavut Settlement Region and the Government of the Northwest Territories. Decisions on caribou management are made through consultation among the wildlife agencies representing these jurisdictions and the community hunting and trapping organizations.

In response to the decline of caribou, some Inuit and Inuvialuit communities have voluntarily controlled their hunting. Hunters in Resolute Bay, Nunavut have restricted or banned hunting Peary caribou in the years since the 1973-74 winter die-off. Hunters in Grise Fiord, Nunavut stopped hunting Peary caribou on most of southern Ellesmere Island between 1986 and 1996.

A hunting quota system has been in place on Banks Island since 1991. Thirty-six tags, one male only per household, are available each year to hunters of Sachs Harbour. Hunters from Holman include caribou conservation as part of their Community Conservation Plan, restricting their hunting to certain locations and populations. In 1993, they began a voluntary five-year ban on hunting Minto Inlet caribou. The Government of the Northwest Territories has prohibited hunting of Peary caribou by people who are not beneficiaries to Inuit and Inuvialuit land claim settlements.

Since 1991, the High Arctic Peary caribou and the caribou on Banks Island have been designated "endangered" because of their low populations. Other arctic-island caribou have been designated "threatened" because of their high death rates during winter, low reproductive rate and possible pressure from hunting and development. The endangered and threatened designations are made by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

A National Recovery Strategy for Peary caribou and arctic-island caribou is in the final stages of development. The strategy is part of a program called RENEW (Recovery of Nationally Endangered Wildlife). Under this program, a team of experienced biologists is put together to prepare a plan to prevent extinction of a species and help populations recover.

The plan will include population objectives for the caribou (the size the population needs to be before its status can change from, say, endangered to threatened). It will set research priorities and recommend recovery actions for the populations of caribou on different islands. Cultural, ethical, logistical and financial factors must be considered. Any actions that are taken will have to be monitored to see if they are successful.

Peary and arctic-island caribou are vital components of the High Arctic ecosystem. Learning what is needed to ensure their future will help us understand much more about this amazing environment.

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Appendices
Appendix 1

Conceptual Framework

**Concept A:** Caribou are culturally and socially important to human beings.

**Curriculum concept links:** people and their environments, Canada studies, wilderness, pollution, circumpolar issues, cultural history, current events, global environment

Many aboriginal peoples in North America have evolved cultural, spiritual and social relationships with caribou.

Caribou are found in many elements of the dominant North American society, and are considered to be a symbol of the North and wilderness, e.g., Santa’s reindeer, the Canadian 25¢ piece, Newfoundland coat of arms.

People value caribou and their continued existence for both intrinsic and aesthetic reasons.

Caribou are valued by humans for both consumptive and non-consumptive uses such as tourism, hunting and wildlife viewing.

**Concept B:** Caribou are part of global and local ecosystems that have evolved over time.

**Curriculum concept links:** adaptation, evolution, Chordata-Subphylum Vertebrata, food webs, population dynamics, ecosystems, extinction, Beringia, predator-prey systems, wilderness, anatomy, parasite life cycles, biodiversity.

The caribou is a member of the deer family, which includes moose and elk.

The caribou is one of the most ancient forms of deer and has evolved from mammals bearing similar characteristics that existed during the last great Ice Age (up to 400,000 years ago in Europe and 10,000 years ago in North America).

Modern caribou are classified as caribou because they have evolved common physical and behavioural characteristics, or adaptations, which allow them to survive in the cold, northern circumpolar regions of the planet, e.g., thick blunt muzzle to minimize heat and water loss during breathing, thick and hollow hair, etc.

North American caribou are further classified into five major subspecies (barren-ground, woodland, Grant’s, Peary and reindeer) each of which has specific behavioural and physical adaptations to its habitat.

Each subspecies has specific habitat needs. For example, barren-ground caribou migrate extensively in well-defined herds in response to environmental conditions, biting insects, etc.

Caribou have co-evolved with a multitude of other species and are a vital component of circumpolar food chains and food webs (including parasitic insects and humans).

Caribou populations continually fluctuate in response to a number of factors.

Caribou can be considered an “indicator species” of ecosystem health.

**Concept C:** Humans and caribou interact, and human decisions and actions affect caribou and our joint environments.

**Curriculum concept links:** how human activity affects local and global environments, climate change, analysis of the cost and benefits of making alternative choices that affect a global problem, First Nations culture, valuations, habitat, habitat threats, urbanization, industrialization, recreation, agriculture, scientific research and tourism.

Human beings and caribou share a common global ecosystem, and the actions of each affect the other in some way.

The caribou’s range has been reduced significantly over the last 200 years because of human activity.

Caribou can be affected, both positively and negatively, by human activities that take place far from the caribou’s home range, e.g., contaminants and pollutants that are carried by air and water currents over long distances (nuclear, acid rain, etc.), political advocacy, consumer choices, etc.

Caribou can be affected, both positively and negatively, by human activities that take place within the caribou’s home range, e.g., resource exploration and development, road and pipeline construction, forestry, agriculture, hunting, tourism, scientific research, etc.
Governments can take actions that affect caribou and their habitat by regulating human activities on the land. There is a growing trend to consider all living species in making decisions about how the land is used by humans (ecosystem-based management).

Caribou migrate across political boundaries, and therefore decisions about caribou must be made cooperatively by different governments. Co-management of caribou by different governments is taking place in many jurisdictions.

Individuals can take actions that will help preserve caribou and their habitats.
Appendix 2

Glossary

*abomasum* A ruminant’s fourth and final stomach chamber, where food nutrients begin to be absorbed into the blood.

*Artiodactyl* An order of ungulates with an even number of toes, usually either a ‘cloven’ hoof with two toes or a spreading foot with four. Deer, cows, giraffes and camels are examples.

*babiche* Strips of tough, dried or untanned animal hide.

*barron-ground caribou* (*Rangifer tarandus groenlandicus*) Caribou that undertake the longest seasonal migrations from winter to summer ranges. Barren-ground caribou often travel in large herds.

*Beringia* The land known as Beringia existed as a refugium during the last ice age. The ice caps locked up much of the earth’s water, causing sea levels to rise and a land bridge to form between North America and Asia. Beringia was comprised of this ‘Bering Strait Land Bridge’ as well as parts of what is now Alaska and Yukon.

*bioaccumulation* The building up of contaminants in bodily tissues over time.

*biomagnification* The process by which contaminants collect in animal tissue in progressively higher concentrations towards the top of the food chain.

*brucellosis* A disease, caused by bacteria, that causes spontaneous abortion in animals.

*calving grounds* A traditional location to which the caribou return each year to give birth to their calves.

*Cervidae* A family of mammals, including deer species, elk, moose and caribou.

*chionophile* Species that has adapted for winter survival, from a Latin word that means “snow-loving.”

*co-management* A process that brings local resource users and government representatives together to share the management responsibility for local or regional resources.

*cratering* The act of caribou digging in the snow with their hollow hooves in search of food.

*crustose* Forming or resembling a crust.

*cud* Half-digested food returned from the first stomach of a ruminant for further chewing.

*dew claw* A rudimentary toe. Caribou have two large, flat dew claws, which help support and balance them in deep snow.

*filamentous* Threadlike, having filaments.

*foliaceous* Having a leaf-like form.

*fruticose* Growing in a shrub-like or tufted form.

*habitat* The natural environment characteristically occupied by an organism.

*harem* A group of female animals sharing a mate.

*heat* The receptive period of the sexual cycle in female mammals.

*herbivore* An animal that feeds on plants.

*indicator species* A species of plant or animal found in a particular environment whose condition reflects conditions in that environment.

*Inuit* A human-like figure made from stones, used to scare caribou into an ambush, and now sometimes used as a marker to guide travellers.

*key habitat* A particularly important part of an animal’s habitat.

*larvae* Insects in an early form of development, between egg and pupa.

*lichen* A plant composed of a fungus and an alga in symbiotic relationship.

*macrohabitat* A large-scale, comprehensive habitat.

*maternity bands* Groups of pregnant female caribou that gather together before calving time.

*microhabitat* A habitat which is small or limited in extent and which differs in character from surrounding, more extensive habitat.
nursery bands  Groups of female caribou and their calves that gather together.

omasum  A ruminant’s third stomach.

omnivore  An animal that feeds on many kinds of food, including both plants and flesh.

Organochlorines  Organic compounds with chlorine substituted for a hydrogen atom on one of the carbon atoms in the basic structure. Organochlorines include dioxins, PCBs, pesticides such as DDT, and solvents such as chloroethylene.

parasite  An organism living in or on another and benefiting at the expense of the other.

pedicles  Permanent bony stumps on a caribou’s head, from which the antlers grow.

pelage  The fur, hair or wool of a mammal. Caribou have fine underfur, as well as a thick coat of hollow guard hairs.

pemmican  Meat that is pounded into berries and grease and dried to form a long-lasting food.

Perissodactyl  An order of ungulate mammals with an odd number of toes, usually one main central toe, or a single toe, on each foot. Horses and rhinoceroses are examples.

protozoa  Unicellular and microscopic organisms. Amoebae are examples.

Rangifer tarandus  The species name for caribou.

refugium  An area in which a population of organisms can survive through a period of unfavourable conditions, such as a glaciation.

regurgitate  To bring swallowed food back up again to the mouth.

“reindeer lichen” (*Cladina rangiferina*)  A lichen commonly eaten by caribou.

reticulum  A ruminant’s second stomach.

rumen  The first stomach of a caribou or other ruminant, in which food is partially digested by bacteria.

ruminate  The act of chewing cud regurgitated from the rumen.

sedge  A grass-like plant with a triangular stem. It usually grows in wet areas.

stress syndrome  A syndrome caused when snow machines, automobiles or aircraft frighten caribou into running long distances. This violent exertion causes chemicals to build up in muscles faster than the blood can remove them. The resulting muscle changes can lead to injury or death for the caribou.

symbiotic  An interaction between two different organisms living in close physical association, usually to the advantage of both.

tarsal gland  A gland found between the caribou’s toes.

trophic level  Successive levels of nourishment in a food chain.

understory  A variety of different bushes, ferns, flowers and leaf litter found underneath a forest canopy.

ungulate  A hoofed mammal.

velvet  The layer of fuzzy skin that covers an animal’s growing antler.

woodland caribou (*Rangifer tarandus caribou*)  A generally heavier and larger caribou than the barren-ground caribou, sometimes called ‘mountain’ caribou, found south of the Arctic Circle. Woodland caribou tend to stay in small groups and do not migrate large distances.
Appendix 3

For further study
Listed below are a number of resources you may wish to reference for further study of caribou. A more complete and updated list is available at the Project Caribou web site (www.projectcaribou.net).

Most jurisdictions have wildlife education staff who will be able to help you find further information on caribou. Many will have brochures and pamphlets or other materials specific to caribou in their regions. They will also be able to tell you how you can contact a caribou biologist in your area.

The following contacts may also act as coordinators of Project WILD and other resource education programs:

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E-mail: bqcmb@cyberus.ca
Web: www.arctic-caribou.com

Porcupine Caribou Management Board
Box 4999
Whitehorse, YT
Y1A 4S2
Phone: (613) 633-4780
E-mail: pcmb@polarcom.com
Web: www.pcmb.yk.ca

Learning resource packages
Some of the activities and illustrations in Project Caribou came from the following learning resource packages.

*Bellow Zero Activity Guide.* (In production at time of this publication.)
Contact:
WILD Education /Canadian Wildlife Federation
350 Michael Cowpland Drive
Kanata, Ontario
K2M 2W1
Phone: (613) 599-9594 or 1-800-563-WILD (9453)
Fax: (613) 599-4428
E-mail: info@cwf-fcf.org
Web: www.wildeducation.org

Contact:
Wild BC/Habitat Conservation Trust Fund
PO Box 9354 STN PROV GOVT
Victoria, BC
V9W 9M1
Phone: (250) 356-7111 or 1-800-387-9853
Fax: (250) 952-6684
E-mail: wild@gems5.gov.bc.ca
Web: www.env.gov.bc.ca/hctf/wild.htm

Contact:
Chair, Yukon Contaminants Committee
Phone: (867) 667-3139
Web: www.contaminants.ca

Contact: BQCMB Secretary-Treasurer
3565 Revelstoke Dr.
Ottawa, ON
K1V 7B9
Phone: (613) 733-1304
E-mail: bqcmb@cyberus.ca
Web: www.arctic-caribou.com

Other related learning resources
Alaska Department of Fish and Game. 1995.
*Alaska’s Forest & Wildlife K - 12*
*Alaska Wildlife Curriculum Teacher’s Guide K - 12*
*Wildlife for the Future K - 8*
*Alaska’s Ecology K - 8 and Ecology Cards*
Contact:
Alaska Department of Fish and Game
P.O. Box 25526
Juneau, AK
99802-5526
Phone: (907) 465-4190
Fax: (907) 465-6142
Web: www.state.ak.us/local/akpages/FISH.GAME

Contact:
Yukon Department of Education
Box 2703, Whitehorse
Yukon Y1A 2C6
Phone: (867) 667-8249

Contact:
See *Wildlife Trees* above
Contact: See Wildlife Trees above
Contact: Yukon Renewable Resources Conservation Education Box 2703 Whitehorse, Yukon Y1A 2C6 Phone: (867) 667-3675 E-mail: remy.rodden@gov.yk.ca Web: www.renres.gov.yk.ca/teacher

Contact: See Wildlife Trees above
Contact: See Yukon Edition above

Books


Audiovisual material
• Government of Northwest Territories (www.gov.nt.ca) To Have Forever: Hunting the Bathurst Caribou Herd. 1986, 26 min.
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