ENVIROTHON
ALBERTA 2025

2025 WILDLIFE

STUDY RESOURCES

2025 NCF-ENVIROTHON ALBERTA

2025

Wildlife

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NCF-Envirothon 2025 Alberta
Wildlife Study Resources

Key Topic #1: Alberta Wildlife Biology

1. Distinguish between major taxonomic classifications of wildlife, their typical roles in ecosystems, and their habitat requirements (including mammals, birds, fish, reptiles, amphibians, and insects).
2. Identify anatomy of various wildlife species of Alberta and describe the functions of anatomical parts, particularly special physical adaptations.
3. Provide examples of behavioral adaptations in Alberta (such as mimicry, camouflage, freeze response, hibernation, mate attraction, and feeding) and how these adaptations benefit wildlife.
4. Explain the difference between generalist and specialist species and provide examples of each.
5. Explain how the needs of a species might change throughout its life cycle, and how these changing needs are addressed in management strategies.

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Classification of Animals: The Complete Guide

May 2024

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What is Animal Classification?

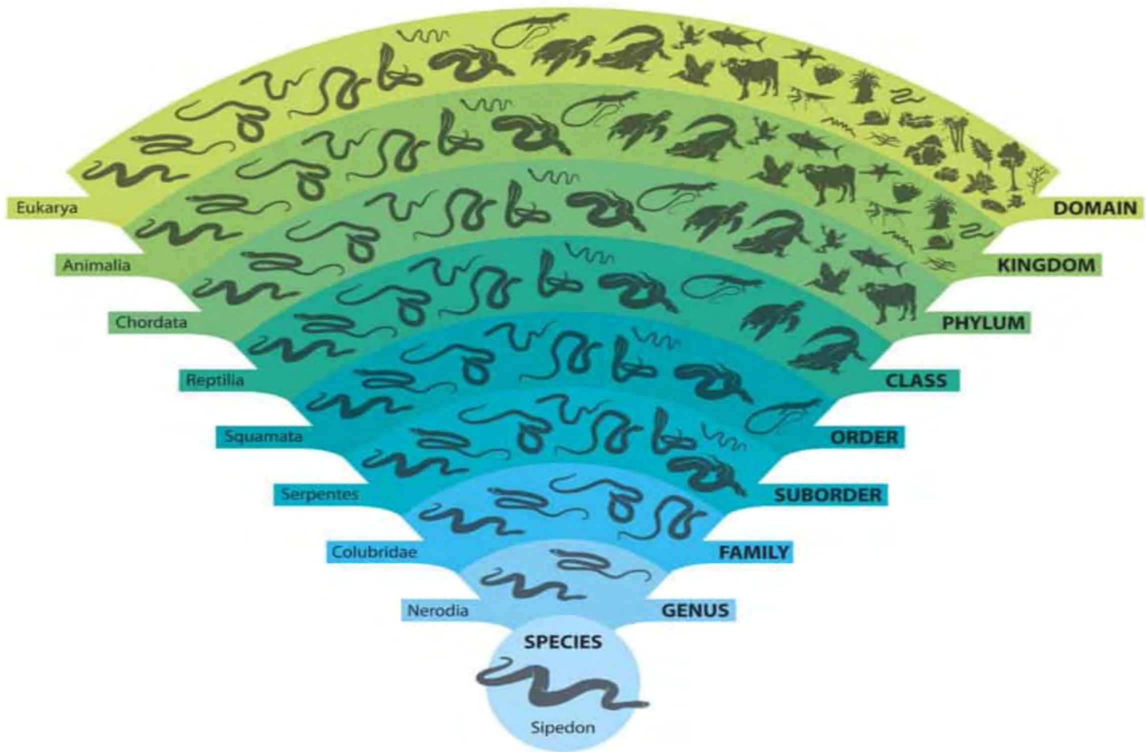
Animal kingdom classification is an important system for understanding how all living organisms are related. Based on the Linnaeus method, species are arranged and grouped based on shared characteristics.

This system of animal kingdom classification was developed by Swedish botanist **Carolus (Carl) Linnaeus** in the 1700s. The Linnaeus Method, also known as Linnaean Taxonomy, creates a hierarchy of groupings called taxa, as well as binomial nomenclature that gives each animal species a two-word scientific name.

This method of giving scientific names to animals is typically rooted in Latin by combining the genus and species. For example, ***humans*** are classified as *homo sapiens* while **wolves** are *canis lupus.*

The more features that a group of animals shares, the more specific that animal classification group is. Every species is defined based on nine branching categories. The primary method of animal classification is:

1. Domain
2. Kingdom
3. Phylum
4. Class
5. Order
6. Suborder
7. Animal Families
8. Genus
9. Species



Animal Classification Chart for Water snake (Nerodia Sipedon)
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Animal Classification: The Six Different Animal Kingdoms

All living organisms can be placed in one of **six different animal kingdom** classifications. The characteristics of each animal kingdom are:

1. Animal – A kingdom of complex multi-celled organisms that do not produce their own food. This kingdom contains all living and extinct animals. Examples include **elephants**, whales, and humans.
2. Plants – Complex and multi-cellular autotrophic organisms, meaning they produce their own food through photosynthesis. Examples include trees, flowers, and grass.
3. Fungi – Multi-celled organisms that do not produce their own food, unlike plants. Examples include molds, mushrooms, and yeast.
4. Protista – Single-celled organisms with more complexity than either eubacteria or archaebacteria. Examples include algae and amoebas
5. Eubacteria – Single-celled organisms found in everything from yogurt to your intestines. This kingdom contains all bacteria in the world not considered archaebacteria.
6. Archaebacteria – The oldest known living organisms. Single-celled and found in hostile and extremely hot areas like thermal vents or hot springs

Animal Phylums Explained

After animal kingdom, animal species usually fall into one of seven different phylum or phyla:

1. Porifera – Marine animals more commonly known as sponges and found in **every ocean on earth**.
2. Cnidaria – Mostly marine animals that include over 11,000 species. Examples include **coral**, **jellyfish**, and anemones
3. Platyhelminthes – Typically parasitic flatworms. Lacking in any respiratory or circulatory system, oxygen passes through their bodies instead in a process known as diffusion. Examples include tapeworms and flukes.
4. Annelida – More complex than Platyhelminthes, these are segmented and symmetrical worms containing a nervous system, respiratory system, and sense organs. Examples include the common earthworm and leeches.
5. Mollusca – The second largest phylum by species count, and the largest marine phylum. Invertebrates with soft unsegmented bodies. It is estimated almost a quarter of marine life falls in this category. Examples include clams, mussels, and snails
6. Arthropoda – Invertebrate animals with an exoskeleton and segmented bodies. Contains insects, crustaceans, and arachnids. This is the largest phylum by species count. Examples include scorpions, butterflies, and shrimp
7. Chordata – Vertebrates. Animals that develop a notochord, a cartilaginous skeletal rod that supports the body in the embryo and can often become a spine. Most animals we are familiar with, including dogs, horses, birds, and humans fall into this category.

Animal Classes

The phylum group is then divided into even smaller groups, known as animal classes.
The Chordata phylum splits into these seven animal classes:

1. Agnatha (jaw-less fish) – Primitive jawless fish including lampreys, hagfishes, and extinct groups.
2. Chrondrichtyes (cartilaginous fish) – Composed of fish with skeletons composed of cartilage. Includes two subclasses: Elasmobranchii (rays, skates, sawfish, and sharks); Holocephali (chimaeras–ghost sharks).
3. Osteichthyes (bony fish) – Includes saltwater and freshwater fish with bony skeletons like eels, anglerfish, clown fish, swordfish, and catfish, carp, trout, and salmonids.
4. Amphibia **(amphibians)** – Four-limbed, ectothermic vertebrates, including frogs, toads, salamanders, and newts.
5. Reptilia **(reptiles)** – Vertebrates with dry skin and scales such as snakes, turtles,

lizards, and crocodilians.

6. Aves (birds) – Warm-blooded, egg-laying animals characterized by two wings, two legs, and feathers.
7. Mammalia (mammals) – Warm-blooded four-legged (or two-armed, two-legged) animals that breathe with lungs and birth live young.

Different Animal Orders

Each class is divided into small groups again, known as orders. There is no universally accepted breakdown for the class Mammalia. Some outline as many as 26 different orders for the class Mammalia. Some of the most popular examples include:

- Artiodactyla (even-toed hoofed animals) – Examples include **moose**, **camels**, and **giraffes**
- Carnivora – Animals that specialize in mostly eating meat, but also contain some omnivores and herbivores.
  Characterized as having nonretractable claws and long snouts. Examples include **bears**.
- Rodentia (gnawing mammals) – Examples include **beavers**, **mice**, and **squirrels**
- Chiropptera (bats) – The only mammals that can fly. Examples include free-tailed and **vampire bats**
- Cetacea (porpoises and whales) – Examples include **killer whales**, **dolphins**, and **hump-backed whales**
- Primates – Includes prehensile hands and feet, commonly with opposable thumbs. Examples include **gorillas**, **chimpanzees**, and **humans**.

Animal Families

In every order, there are different animal families which are defined by groups that have very similar features. Animal families are basically sub-divided into two main groups–vertebrates and invertebrates.

One example of animal families would be the 12 families that fall under the Carnivora order (Carnivores). The twelve families include:

- Felidae (Cats)
- Canidae (Dogs, Wolves, Coyotes, African Wild Dogs, etc.)
- Ursidae (Bears)
- Mustelidae (Weasels, Badgers, Otters, etc.)
- Procyonidae (Raccoons, Coatis, Olingos, etc.)
- Mephitidae (Skunks, Stink Badgers)
- Herpestidae (Mongooses)
- Hyaenidae (Hyenas)
- Viverridae (Civets, Genets, and Linsangs)

- Otariidae (Sea Lions, Fur Seals)
- Phocidae (True Seals)
- Odobenidae (Walrus)

An additional example would be Lagomorphs, falling under the order Lagomorpha and containing two families:

- Leporidae (Rabbits and Hares)
- Ochotonidae (Pikas)

Animal Genus Types

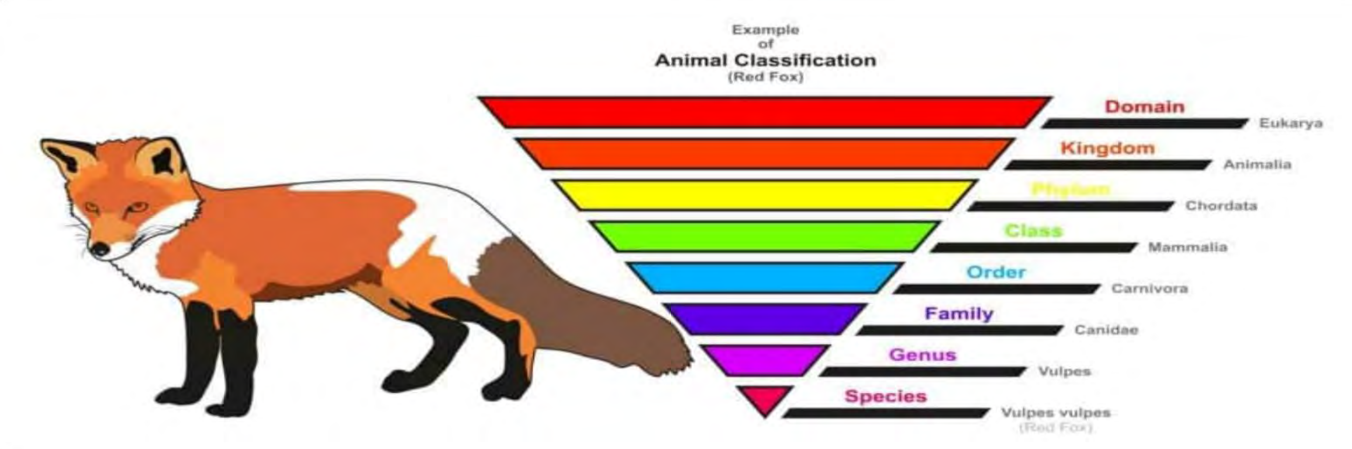
Every animal family is further divided into smaller groups known as genera, or genuses. Each genus contains animals that have very similar features and are closely related.

For example, the Felidae (Cat) family contains genuses including:

- Felis (small Cats and domestic Cats)
- Panthera (Tigers, Leopards, Jaguars and Lions)
- Pumas (Panthers and Cougars)
- Leopardus (American Spotted Cats)
- Lynxes
- Neofelis (Clouded Leopard, Suna Clouded Leopard)
- Prionailurus (Asian Spotted Wildcats)
- Acinonyx (Cheetah)
- Catopuma (Asian Golden Cat and Baby Cat)
- Saber-toothed Cats (Extinct)
- Proailurus (Extinct)
- Pardofelis (Marbled Cat)
- Pseudaelurus (Extinct)
- Homotherium (Scimitar-toothed cat, Extinct)
- Caracal (Serval and African Golden Cats)
- Asiatic Linsangs (Banded and Spotted Linsangs)
- Sivaelurus (Extinct)
- Miopanthera (Extinct)
- Machairodus (Extinct)
- Paramachairodus (Extinct)
- Megantereon (Extinct)
- Styriofelis (Extinct)
- Metailurus (Extinct)
- Machairodus (Extinct)
- Dinofelis (Extinct)
- Leptailurus
- American Cheetah (Extinct)
- Sivapanthera (Extinct)
- Leptofelis
- Namafelis
- Asilifelis
- Diamantofelis
- Yoshi
- Mellivorodon
- Uncia
- Nimravides
- Xenosmilus
- Adelphailurus
- Nimravus
- Lokotunjailurus
- Rhizosmilodon
- Amphimachairodus
- Bassariscus
- Nasua
- Cryptoprocta (Fossa)
- Viverra
- Genet

Animal Species Names

Each species within the genus is named after its features and characteristics. The names of animals are based in Latin and consist of two words. The first word in the name of an animal will be the genus, and the second name indicates the specific species. This method of organizing scientific names of animal species was developed by Carl Linnaeus in the 1700's. As an example, a **dolphin** species name is *Delphinus Delphis.* A **red fox** is *Vulpes vulpes.* This animal classification chart of a red fox is an example of Linnaean Taxonomy:



An animal classification for red fox, based on the Linnaeus Method
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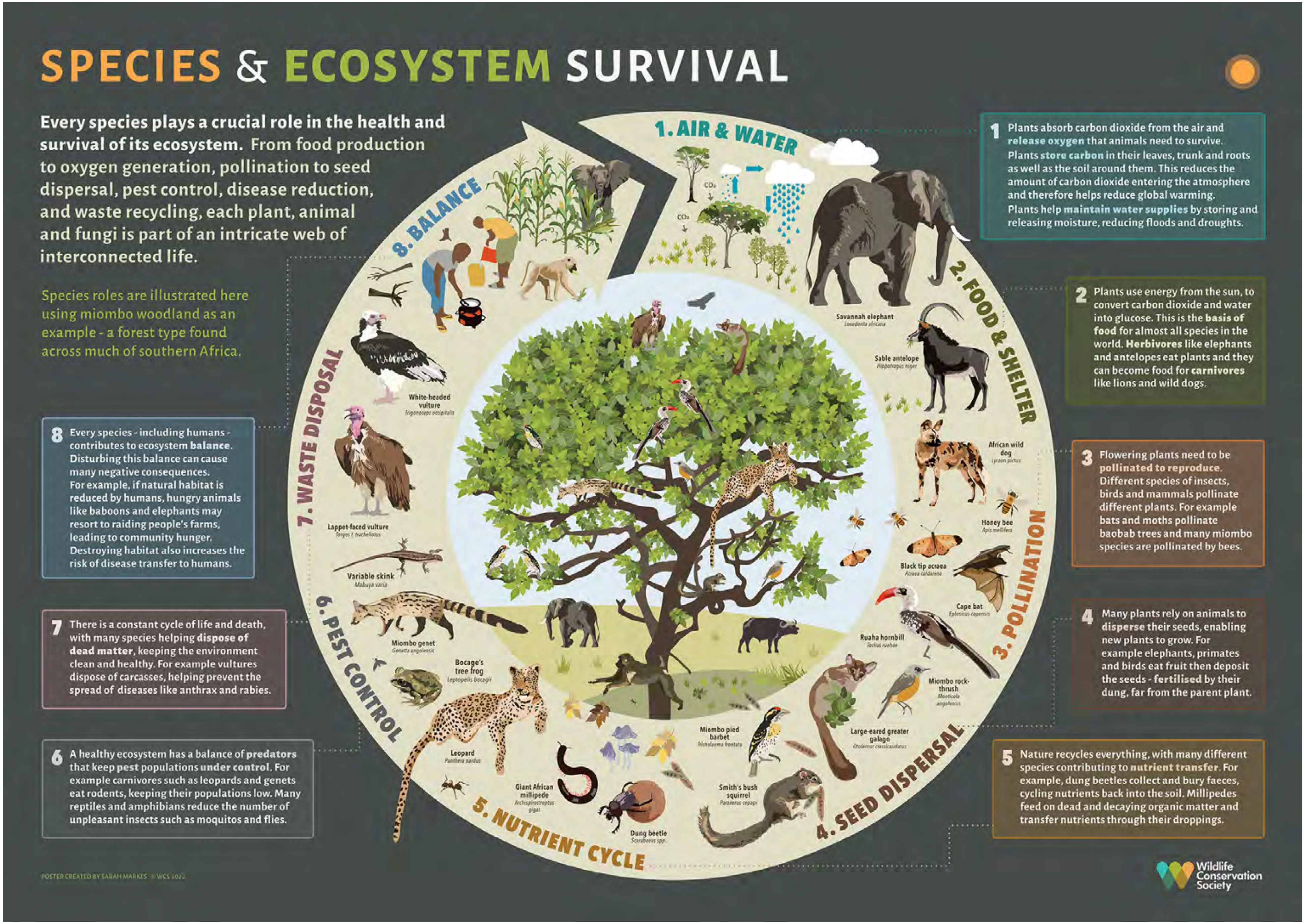
Animal Classification Example 1 – Red Fox

- (Vertebrate)
- Class: Mammalia (Mammal)
- Order: Carnivora (Carnivore)
- Family: Canidae (Dog)
- Genus: Vulpes
- Species: Vulpes vulpes (red fox)

Animal Classification Example 2 – Orang-utan

- Kingdom: Animalia (Animal)
- Phylum: Chordata (Vertebrate)
- Class: Mammalia (Mammal)
- Order: Primates
- Family: Hominidae (Great Apes)
- Genus: Pongo
- Species: Pongo pygmaeus (Orang-Utan)


SPECIES & ECOSYSTEM SURVIVAL
Every species plays a crucial role in the health and survival of its ecosystem. From food production to oxygen generation, pollination to seed dispersal, pest control, disease reduction, and waste recycling, each plant, animal and fungi is part of an intricate web of interconnected life.
Species roles are illustrated here using miombo woodland as an example - a forest type found across much of southern Africa.
1. AIR & WATER
2. FOOD & SHELTER
3. POLLINATION
4. SEED DISPERSAL
5. NUTRIENT CYCLE
6. PEST CONTROL
7. WASTE DISPOSAL
8. BALANCE
1 Plants absorb carbon dioxide from the air and release oxygen that animals need to survive. Plants store carbon in their leaves, trunk and roots as well as the soil around them. This reduces the amount of carbon dioxide entering the atmosphere and therefore helps reduce global warming. Plants help maintain water supplies by storing and releasing moisture, reducing floods and droughts.
2 Plants use energy from the sun, to convert carbon dioxide and water into glucose. This is the basis of food for almost all species in the world. Herbivores like elephants and antelopes eat plants and they can become food for carnivores like lions and wild dogs.
3 Flowering plants need to be pollinated to reproduce. Different species of insects, birds and mammals pollinate different plants. For example bats and moths pollinate baobab trees and many miombo species are pollinated by bees.
4 Many plants rely on animals to disperse their seeds, enabling new plants to grow. For example elephants, primates and birds eat fruit then deposit the seeds - fertilised by their dung, far from the parent plant.
5 Nature recycles everything, with many different species contributing to nutrient transfer. For example, dung beetles collect and bury faeces, cycling nutrients back into the soil. Millipedes feed on dead and decaying organic matter and transfer nutrients through their droppings.
6 A healthy ecosystem has a balance of predators that keep pest populations under control. For example carnivores such as leopards and genets eat rodents, keeping their populations low. Many reptiles and amphibians reduce the number of unpleasant insects such as moquitos and flies.
7 There is a constant cycle of life and death, with many species helping dispose of dead matter, keeping the environment clean and healthy. For example vultures dispose of carcasses, helping prevent the spread of diseases like anthrax and rabies.
8 Every species - including humans - contributes to ecosystem balance. Disturbing this balance can cause many negative consequences. For example, if natural habitat is reduced by humans, hungry animals like baboons and elephants may resort to raiding people's farms, leading to community hunger. Destroying habitat also increases the risk of disease transfer to humans.
CO_2
Savannah elephant
Sable antelope
African wild dog
Honey bee
Black tip acraea
Cape bat
Ruaha hornbill
Miombo rock-thrush
Large-eared greater galago
Smith's bush squirrel
Miombo pied barbet
Dung beetle
Giant African millipede
Leopard
Bocage's tree frog
Miombo genet
Variable skink
Lappet-faced vulture
White-headed vulture
POSTER CREATED BY SARAH MARKES © WCS 2022
Wildlife Conservation Society

CARIBOU FACTS

Things you didn't know about caribou antlers!

In the north, caribou are an iconic circumpolar species whose distribution ranges from the arctic and tundra to the boreal and mountains of Europe, Siberia and North America. Caribou are members of the cervidae family, a branch of ungulates, who grow antlers every year. The process of shedding and re-growing antlers year after year is a unique process. In just a matter of weeks, bull caribou can grow antlers which weigh up to 20 pounds and are over a meter in length!

A small group of bull caribou in the Autumn season (August/September) at Arctic Haven - notice the red antlers.

Caribou are the only species among the deer family which both males and females have antlers:

Within the Cervidae family, the female caribou is unique in that they are the only of their gender to carry antlers. While the antlers of female caribou are much smaller than their male counterparts, cows will carry their antlers throughout the winter season whereas the bulls will loose theirs by late fall after the rut. Pregnant caribou won't shed their antlers until after they have given birth in the spring. It is thought that females keep their antlers to defend food which is critical during their pregnancy. There are exceptions where 3-5% of cows will never grow antlers at all.

Female caribou & their young migrating past two guests at Arctic Haven in April.

In the early stages of development, caribou antlers are covered in a soft fuzz known as velvet.

Initially, caribou antlers grow as a soft cartilage-like tissue filled with blood vessels and nerves which carry calcium and other nutrients necessary for antler development. As the season progresses, antlers become calcified and harden and eventually the vascular skin falls off. Bull caribou shed their velvet just before the rut and as a result will often have red stained antlers in mid-September. In order to supply enough calcium to allow for antler growth, bull caribou will temporarily draw from calcium in their skeletal system.

Caribou in Autumn colours on the tundra - notice the velvet antlers

A caribou's diet varies throughout the season but will often consist primarily of lichen and mosses. However, even in the summer with abundant forage, a caribou's diet simply is not enough to provide the calcium necessary for antler development. Caribou grow their antlers at a rate of up to 2.5cm per day. As a result, male caribou can actually draw calcium from parts of their existing bone structure, such as ribs. When process of ossification is complete, caribou eventually replenish the lost calcium in their skeletal structure in anticipation of the rut.

Caribou have two permanent stumps of bone from which their antlers grow each season.

Every spring caribou begin the process of re-growing their antlers. The vascular cartilage grows from two attachment points in their skull called pedicles. Antlers are made completely of bone, whereas horns on animals of the bovidae family, are part bone which is covered by a sheath made of specialized hair follicles.

All images taken at Arctic Haven during the spring (April/May) & Autumn (August/September) caribou migrations by Nansen Weber.

Horns and Antlers

The terms horns and antlers are often used interchangeably, but in reality, they refer to quite different structures. Antlers are a pair of bony, branched structures that protrude from the frontals of the skull of animals and are shed annually; horns are also paired and protrude from the frontals, but they are permanent, unbranched, and made up of a bony core and a keratinized sheath.

Antlers

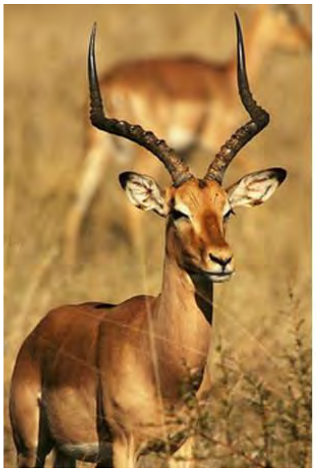
Antlers are one of the most easily recognized characteristics of the family Cervidae. They are present only in males (with the exception of caribou) and are capable of growing astoundingly large. Their morphology varies among species. Antlers grow from pedicels, which are bony supporting structures that develop in the lateral region of the frontal bones.

The growth cycle is regulated by testicular and pituitary hormone. Secretions from the pituitary initiate the growth in April or May. In the northern hemisphere increasing day length also plays a role. Early in their development, antlers have high water and protein content. As they grow, antlers are covered with skin and soft hair called velvet, which carries blood vessels and nerves.

As antlers near the end of the growing process, spongy bone in their outer edges is replaced by compact bone, while their centers become filled with coarse, spongy, lamellar bone and marrow spaces. The velvet dies and is removed in part by the animals rubbing and thrashing their antlers against vegetation. The antlers also are stained during this action, giving them the brown, polished, wooden look.

Males use their full-grown antlers during the breeding season in social interactions in competition for females. In winter, pituitary antler-growth hormone stimulation decreases as day length shortens, and androgen secretion lessens. As a result, the pedicel loses calcium, weakening the point of connection between it and the antler, and eventually the antlers are shed. Males then are without antlers for a few months in late winter until the cycle begins again. Curiously, some cervids have large canine teeth, which are used in sexual displays and fighting. Often species with large canines have small antlers or are missing antlers altogether.

Horns

Horns occur in males of all species of Bovidae, and females often bear them too. Horns are composed of a bony core covered with a sheath of keratin. Unlike antlers, horns are never branched, but they do vary from species to species in shape and size.

The growth of horns is completely different from that of antlers. Neither the sheath nor the core are ever shed, and in many species, the horns never stop growing. Horn cores begin as small bony growths under the skin, over the skull, in the subcutaneous connective tissue. They are not attached to the skull and are known as ossicones. They possess their own centers of ossification and fuse secondarily to the skull bones. In members of the family Bovidae, horns develop from or over the frontals.

Similar to antlers, horns are often used by males in fights and displays during the breeding season. These fights often include clashes that determine body strength. In general (but with many exceptions), horns are present in both sexes of larger species but absent in females of smaller species. This is probably because larger species are more likely to fight whereas smaller species tend to run and/or hide. In species where members of both sexes have horns, some degree of sexual dimorphism is usually the rule. Horns on males are thicker at the base and able to withstand more force. On females they are straighter and thinner, which may make them better for stabbing (defensive weapons).

male Greater kudu female
(*Tragelaphus strepsiceros*)

Similar structures

Giraffe Horns:

Giraffe horns are paired, short, unbranched, permanent, bony processes that are covered with skin and hair. They differ from other artiodactyl horns in that they do not project from the frontal bones, but lie over the sutures between the frontal and parietal bones. Giraffe horns begin as cartilaginous structures in the fetus and may not fuse to the cranium until the animal is 4 years old. Horns are present in both sexes of giraffes and even on newborns.

Rhino Horns:

white rhino (*Ceratotherium simum*) black rhino skull and closeup of horn surface (*Diceros bicornis*)

Rhino horns differ from true horns because these horns have no core or sheath. They are made up of multitude of epidermal cells and bundles of dermal papillae, extensions of the dermis. Cells from each papilla form a horny fiber similar to thick hair. These fibers, which are held together by the mass of epidermal cells, are not true hairs. True hair grows from follicles that extend into the dermis, whereas rhino horns grow from dermal papillae which extend up into the horn. The rhino horn is situated over the nasal bones. In species that have two horns, the second horn lies over the frontal bones. Rhino horns commonly curve posteriorly.

Pronghorn Horns:

pronghorn antelope (*Antilocapra americana*)

Pronghorn antelope, in the North American family Antilocapridae, have distinctive upright horns. They differ from the horns of bovids in two important respects. First, they are branched. Each has a short, posteriorly-directed branch near the base, and a short, anteriorly-directed hook near the tip. Second, while the horns consist of a bony core and keratinous sheath like those of bovids, the sheaths are shed annually. In bovids, the sheaths are always a permanent part of the horn.

Dental and Skull Anatomy of Carnivores, Herbivores, and Omnivores

An animal's diet is one of the most important aspects of its biology, and it helps shape the behavior, evolution, and anatomy of the species. The development and arrangement of an animal's teeth, known as its dentition, reflects this best; but an animal's skull evolves to suit its diet as well. In general, meat-eating carnivores have teeth for tearing and skulls capable of biting with great force, while the plant-eating herbivores have teeth and skulls equipped to grind tough vegetation. Omnivores, which eat both plants and animals, have skulls and dentition suitable for a wide range of foods. These trends are so strong that paleontologists can often determine the diet of an extinct animal from nothing more than a few teeth or skull fragments.

Carnivores

Carnivorous animals subsist on the flesh, bones, and viscera of other creatures. Most carnivores have long, sharp teeth adapted to ripping, tearing or cutting flesh. While many also possess a few molars in the back of their mouths, and sharp incisors in the front, the most important teeth for carnivores are their long, sharp canine teeth. Carnivores drive these teeth through the flesh of their prey with the help of very large temporalis muscles, which are responsible for pulling the lower jaw upwards and backwards towards the skull. The temporalis muscles attach to the jaw at one end, and the top of the skull at the other end. To help accommodate larger temporalis muscles, some predators have evolved to have an enlarged ridge, termed the sagittal crest that acts as an attachment point or anchor for the muscle. However, the sagittal crest is not exclusively limited to carnivores, as it also appears in many herbivorous primates as well. Additionally, because predators must capture and kill their food before they can eat it, some possess teeth that aid in prey capture. Cats, for example, use their four, long canine teeth to sever their prey's spinal cord. Some snakes have even more specialized prey-capturing teeth that have evolved into hypodermic-needlelike fangs to deliver venom into their prey.

Herbivores

Herbivores survive by consuming plant material. While some are indiscriminate grazers that consume a variety of plants, others are specialists that only eat a single plant species. For example, goats may eat virtually any vegetation they encounter, but koalas subsist entirely on eucalyptus plants. In general, plant foods are difficult to breakdown and digest; so, many herbivores have several pairs of broad molars that they use to grind leaves, shoots, and twigs. Often, herbivores feature ridged molars and jaws capable of moving sideways. Both of these traits help herbivores to grind their food more effectively. Most herbivores are missing canines entirely, and those that do possess them usually have very small or reduced canines that are not very important for chewing food. Some herbivores have large incisors for clipping or tearing vegetation, but they may only occur on the lower jaw. For example, most deer lack upper incisors and press their lower incisors against their hard, upper palate to rip twigs and branches from trees. By contrast, horses have both upper and lower incisors that they use to clip vegetation cleanly. Some herbivores have evolved teeth that are no longer involved in feeding at all. For example, the large tusks of elephants are highly modified incisors. Elephants use their tusks to manipulate items in their environment, dig for water, and defend themselves. Walruses and some pigs also feature incisors that have evolved into tusks used for foraging, defense, and intra-species combat.

Omnivores

Omnivores, such as raccoons, opossums, bears, and humans, are animals that consume both plant and animal material. Accordingly, omnivores have dentition, skulls, and teeth suitable for handling a variety of foods. Most omnivores have evolved different types of teeth, located in different parts of their mouths. In such scenarios, each type of tooth excels at handling a different type of food. For example, humans use their incisors and canines for ripping and cutting, and their molars and premolars for grinding. Biologists describe animals with such teeth as having heterodont dentition. By contrast, the teeth of homodont animals, such as iguanas, are all the same shape. As with some carnivores that have teeth to aid in prey capture, some omnivores have teeth that help them to obtain, rather than process, their food. Rodents are famous for their long, continuously growing incisors, which they use to chew through husks, shells and wood. This allows them to access well-protected or difficult-to-access foods, such as nuts. Although rodents are omnivores that occasionally eat insects and scavenge carcasses, plant material makes up the bulk of their diet. Their dentition reflects this as well: Rodents have strong molars, yet lack canine teeth entirely. Instead, rodents have a gap between their incisors and molars, termed a diastema.

Video – Types of Adaptations

https://youtu.be/vnmPdHmRv9o?si=yjkGN8l9MaaErl4w

Types Of Adaptations

Video - Generalists vs Specialists

https://youtu.be/bswS-Ooe4iQ?si=QqbyexRS7OH872Dj

Generalists vs Specialists | Ecology & Environment | Biology | FuseSchool

Canadian lynx: clever specialized hunters of the snowy forests

In the snowy winter landscape, the Canadian lynx's white and grey speckled coat helps it blend in with the barren trees and ice. As temperatures warm, the brown in their fur becomes more apparent, camouflaging into the summer forest. A specialist predator, the Canada lynx's seemingly shape-shifting, or rather color shifting, is to hunt for one particular species, the snowshoe hare.

Canadian lynx are the flagship species of the Midwest Canadian Shield Forests ecoregion, located in the Canadian Shield & Coastal Taiga-Forests bioregion (NA9).

Ranging across Alaska, Canada, and northern areas of the contiguous United States, the Canadian lynx is a lean, medium-sized cat. They average 51 centimeters (20 in) tall at the shoulders and weigh an average of nine kilograms (20 lb). Sexually dimorphic, males are larger and heavier than females.

Long, dense fur provides the Canadian lynx with insulation in subzero temperatures, while broad, snowshoe-like paws allow them to walk atop the snow. They are known for their triangular ears with black tufts at the tips and completely black, stubby tails. Like their cousin the bobcat, Canadian lynx's hindlimbs are longer than their forelimbs, sloping their back down to the front.

While they are primarily nocturnal, Canadian lynx can be spotted anytime as they roam around nine kilometers (5.6 mi) daily. The skeletal muscles of the Canadian lynx make up roughly 57% of their body weight. This makes them strong for their size, good swimmers, agile climbers, and fierce predators.

The life of the Canadian lynx relies heavily on the snowshoe hare. Estimates suggest that up to 97% of the Canadian lynx's diet is specifically this species. This creates a prey-predator cycle, intertwining the two species and keeping both their population numbers in balance.

Other prey of the Canadian lynx includes ducks, moles, red squirrels, voles, young Dall's sheep, mule deer, and caribou. Sleath hunters, lynx wait on specific trails or in "ambush beds" for their meal and then pounce. They can spot prey in the darkness from 250 feet away.

Solitary creatures, Canadian lynx evade human contact and even avoid each other except for mating. Breeding occurs from March to early April, and after a gestation of two to three months, one to eight kittens are born in logs, stumps, or tangles of vegetation.

Only females care for their young and, once a few months old, begin teaching them hunting techniques. The young stray with their mother until the following spring's mating season.

Currently, the Canadian lynx is of least concern in conservation status, rising and falling in almost perfect synchrony in population size with the snowshoe hare every ten years. However, both species are vulnerable to a changing climate.

As temperatures increase and warmer seasons are longer, Canadian lynx and snowshoe hares migrate to find colder weather. This creates smaller ranges for both species and ultimately will dwindle both populations.

A project from RESOLVE is protecting these species by revitalizing lynx management for the Western United State's new wildfire reality. Using a new cloud-based mapping system called TerrAdapt, habitat shifts due to a changing climate and other factors can be predicted and planned for.

With data on where ecosystems will move, scientists can plan more effectively, and decision-makers factor climate change into policy more accurately. Land managers will also make better decisions to support regionally essential species like the Canadian lynx.

COSEWIC Assessment and Status Report on the Caribou *Rangifer tarandus* Barren-ground population in Canada

Executive Summary

Wildlife Species Description and Significance

All the world's caribou and reindeer belong to a single cervid species, *Rangifer tarandus*, and are found in arctic and subarctic regions as well as in northern forests. Barren-ground Caribou are characterized by long migrations and highly gregarious behaviour, often travelling in groups of hundreds or thousands. As a relatively large herbivore with an extensive distribution and high numbers, Barren-ground Caribou is a keystone species, playing a key ecological and cultural role in northern ecosystems.

The significance of Barren-ground Caribou to the peopling of northern Canada is evident from archaeological findings tracking the distribution of people and Barren-ground Caribou relative to the retreating glaciers some 8,000 years ago in the central barrens and as long as 12-15,000 years ago in the central range of the Porcupine subpopulation. Barren-ground Caribou have been and continue to be a key resource for people in northern Canada; in some cases these animals have such importance that families would follow their migration. They have significant direct economic value from harvest, primarily for subsistence use. They also contribute to the northern economy through wildlife tourism and recreational hunting; beyond this, they have incalculable cultural value for people throughout the subpopulation ranges.

Distribution

The global range of Barren-ground Caribou extends from Alaska to western Greenland, and is continuous across northern continental mainland Canada, from northwestern Yukon to Baffin Island. The northern extent is the Arctic mainland coast; the southern extent is northern Saskatchewan, Alberta and Manitoba. Sampling efforts and methods have varied among subpopulations, leading to differences in interpreting subpopulation structure; 14-15 are recognized in this report. Some are combined for the purposes of generating population abundance and trend estimates, for a total of 13 units. Ten subpopulations have been consistently identified for the past several decades, mainly through fidelity to calving areas.

Fluctuating abundance of individual subpopulations affects distribution; as Barrenground Caribou decline in abundance their distribution (especially during winter) changes, reducing the length of fall and pre-calving migration. Mainland subpopulations of Barrenground Caribou generally migrate toward the Arctic coast to calve, and occur during summer and fall on the tundra of the Southern Arctic ecozone. Western and central mainland subpopulations usually winter in the boreal forests of the Taiga Cordillera, Taiga Plains or Taiga Shield ecozones.

Habitat and Habitat Trends

Habitat requirements are partly driven by the need for forage, which depends on the timing of the caribou's annual breeding cycle and its nutritional costs relative to the brief plant growing season and long winters of the sub-arctic and arctic regions. Caribou are generalist foragers, especially in summer, and select among grasses, sedges, shrubs and forbs for nutrient content according to the stage of plant growth rather than plant species. Barren-ground Caribou require large annual ranges (several hundred thousand square kilometres in size) to enable selection of alternative habitats in response to annual variations in the environment, such as snow cover, plant growth, and/or predation or parasite risk. Habitat attributes that are important for calving include those that reduce predation risk and maximize nutrition intake; these vary among calving grounds. Forage requirements depend on the timing of the annual breeding cycle relative to the brief plant growing season and long winter that is characteristic of the sub-arctic and arctic regions. On summer ranges, caribou seek habitats that reduce exposure to insect harassment, while obtaining high-quality forage. While most subpopulations winter in the boreal forest, several remain in tundra habitats at that time.

Within the previous three generations, there has been some reduction in habitat as a consequence of the natural fragmentation of the winter ranges caused by forest fires and increasing human presence (i.e., infrastructure) on the caribou ranges. However, habitat outside the forested winter range is still largely intact at the landscape scale. The generally increasing trends in human population will increase economic development (industrial development, roads and traffic) within Barren-ground Caribou ranges in the future.

Biology

Caribou usually first calve at three years of age, although they can calve at two years when conditions are favourable. Females give birth to a single calf and may breed every year, although if nutritionally stressed they do not conceive every year. Calving is highly synchronized, generally occurring over a 2-week period in June. The breeding system is polygynous. Annual migrations and gregarious behaviour are the most conspicuous characteristics of most Barren-ground Caribou subpopulations. They are adapted to a long winter season when cold temperatures, wind chill and snow impose high energetic costs. Those costs are met through reducing their maintenance energy requirements and mobilizing fat and protein reserves.

Predation is an important factor affecting many facets of caribou ecology, as caribou movements and habitat choices are often made to minimize exposure to predators. An array of predators and scavengers depend on Barren-ground Caribou: Grizzly Bears (Ursus arctos) are effective predators on newborn calves, while Gray Wolves (Canis lupus, hereafter referred as Wolves) are predators of all sex and age classes throughout the year. Pathogens (including viruses, bacteria, helminths and protozoa) together with insects, play an important role in caribou ecology with effects ranging from subtle effects on reproduction through to clinical disease and death.

Population Sizes and Trends

The current population of Barren-ground Caribou is estimated at about 800,000 individuals. Between 1986 and mid-1990s, the overall trend was an increase to > two million, followed by a decline, which has persisted through today. Of 13 subpopulation units used to derive abundance estimates, eight are declining, two are increasing, and three are unknown. The median three-generation percentage decline in the total number of Barrenground Caribou was 56.8% (range = -50.8 – -59.0%), based on the summed population change for seven subpopulations with sufficient survey data, which comprise almost 70% of the total current population. Four of these seven subpopulations declined by >80% during this period, one had a median decline of -39%, characterized by marked variability, whereas the remaining two increased. Available survey data for three additional subpopulations, representing about 25% of the total population, also suggest declines; the current trajectories of another three subpopulations are unknown, due to lack of recent surveys.

Evidence from ATK and scientific study suggests that Barren-ground Caribou subpopulations undergo periods of high and low numbers (fluctuations) that might resemble population cycles. The evidence is, however, insufficient to consistently infer a naturally occurring cyclic increase across the full range of subpopulations. Available demographic data, cumulative changes to the environment, habitats, and harvest regimes for many of these subpopulations are without historical precedent, such that it would be risky to assume there will be a naturally occurring recovery, at least to numbers recorded in the 1990s, for many of the subpopulations.

Threats and Limiting Factors

Climate and weather influence other limiting factors important for Barren-ground Caribou, including forage availability, predation, parasites and diseases – in complex nonlinear and cascading ways. So many aspects of caribou ecology are affected by weather that a warmer climate could have a significant but complicated suite of positive and negative effects.

Industrial exploration and development in Barren-ground Caribou ranges has increased over the past several decades, such that there are several new mines and hundreds of prospecting permits, mineral claims and mineral leases on several subpopulation ranges. Subsistence and sport harvest can be significant causes of mortality that can increase the rate of decline and lead to a lower population size after populations have been reduced for other reasons. Chemical contaminant levels in tissues are generally low at present. The changing conditions on the caribou ranges also include the administrative and political complexity of a mix of settled and unsettled land claims, with changes in jurisdictional boundaries and mandates. The implementation of management actions is challenged by the inter-jurisdictional complexity between political, land management and wildlife management agencies, combined with the migratory nature of caribou and their use of extensive seasonal ranges.

Protection, Status, and Ranks

Protection of Barren-ground Caribou subpopulations by territorial and provincial jurisdictions is through harvest regulation and habitat protection. The co-management regime is a shared management responsibility among governments and bodies established through land claim legislation and through renewable multi-jurisdictional agreements among public governments (for the Porcupine, Beverly and Qamanirjuaq subpopulations). The Porcupine Caribou subpopulation is the only subpopulation of Barren-ground Caribou covered by an international agreement signed between Canada and the United States in 1987. The Barren-ground Caribou designatable unit (DU) was assessed for the first time by COSEWIC as Threatened in November 2016. It is currently not scheduled under the federal Species at Risk Act (SARA). The 2015 national general status for Caribou in Canada will not be available until the 2015 General Status Report is published August 2017. This Canada-wide rank will apply to all DUs of Caribou combined, with nothing specific to Barren-ground Caribou. The 2015 territorial rank for Yukon for Barren-ground Caribou is Vulnerable to Apparently Secure, and for Northwest Territories is Sensitive. At present, there is no specific rank for Barren-ground Caribou for Nunavut; however, for all DUs combined, the territory-specific general status rank for Caribou in Nunavut is Apparently Secure. Federal protected areas that exclude industrial land uses but allow continued subsistence hunting cover about 6% of Barren-ground Caribou ranges, including eight national parks.

Canada Goose

Branta canadensis

Branta canadensis [4]

The Canada Goose is the goose species most familiar to people living across much of North America, often occurring in large numbers in lakes and parks near cities and towns. This large goose may be anywhere from 30 to 43 inches long with a large body and short tail. Canada Geese may be identified by their brown backs, pale bellies, black necks, and large white "chinstrap." Male and female Canada Geese are similar to one another in all seasons. The Canada Goose breeds widely across North America. Migratory breeding populations breed across Canada and winter in the northern half of the United States, while many populations living in human-altered environments are non-migratory. The Canada Goose has also been introduced in Britain, Ireland, and portions of western continental Europe. Wild-type Canada Geese breed in lakes and freshwater marshes, wintering in similar habitats. Non-migratory Canada Geese are habitat generalists, living in ponds and lakes as well as human-altered environments (including golf courses, city parks, and reservoirs). This species subsists primarily on plant matter, including aquatic vegetation and terrestrial grasses. Canada Geese are often present in large numbers where ducks and other waterfowl are fed by humans. Canada Geese may be best observed foraging for food; both on land, where they may be seen walking on the shore or on grass further inland; or in the water, where they may be seen submerging their upper bodies to seek out aquatic vegetation. They may also be observed in the in large "V"-shaped flocks flying on migration or between bodies of water. This species is primarily active during the day.

Summary [5]

The **Canada goose** (*Branta canadensis*) is a large wild goose species with a black head and neck, white cheeks, white under its chin, and a brown body. Native to arctic and temperate regions of North America, its migration occasionally reaches northern Europe. It has been introduced to the United Kingdom, Ireland, New Zealand, Argentina, Chile, and the Falkland Islands. Like most geese, the Canada goose is primarily herbivorous and normally migratory; it tends to be found on or close to fresh water.

Description [6]

The black head and neck with a white "chinstrap" distinguish the Canada goose from all other goose species, with the exception of the cackling goose and barnacle goose (the latter, however, has a black breast and grey rather than brownish body plumage).

The seven subspecies of this bird vary widely in size and plumage details, but all are recognizable as Canada geese. Some of the smaller races can be hard to distinguish from the cackling goose, which slightly overlap in mass. However, most subspecies of the cackling goose (exclusive of Richardson's cackling goose, *B. h. hutchinsii*) are considerably smaller. The smallest cackling goose, *B. h. minima*, is scarcely larger than a mallard. In addition to the size difference, cackling geese also have a shorter neck and smaller bill, which can be useful when small Canada geese comingle with relatively large cackling geese. Of the "true geese" (i.e. the genera *Anser*, *Branta* or *Chen*), the Canada goose is on average the largest living species, although some other species that are geese in name, if not of close relation to these genera, are on average heavier such as the spur-winged goose and Cape Barren goose.

Canada geese range from 75 to 110 cm (30 to 43 in) in length and have a 127–185 cm (50–73 in) wingspan. Among standard measurements, the wing chord can range from 39 to 55 cm (15 to 22 in), the tarsus can range from 6.9 to 10.6 cm (2.7 to 4.2 in) and the bill can range from 4.1 to 6.8 cm (1.6 to 2.7 in). The largest subspecies is the *B. c. maxima*, or the giant Canada goose, and the smallest (with the separation of the cackling goose group) is *B. c. parvipes*, or the lesser Canada goose. An exceptionally large male of race *B. c. maxima*, which rarely exceed 8 kg (18 lb), weighed 10.9 kg (24 lb) and had a wingspan of 2.24 m (7.3 ft). This specimen is the largest wild goose ever recorded of any species.

The male Canada goose usually weighs 2.6–6.5 kg (5.7–14.3 lb), averaging amongst all subspecies 3.9 kg (8.6 lb). The female looks virtually identical, but is slightly lighter at 2.4–5.5 kg (5.3–12.1 lb), averaging amongst all subspecies 3.6 kg (7.9 lb), and generally 10% smaller in linear dimensions than the male counterparts. The *honk* refers to the call of the male Canada goose, while the *hrink* call refers to the female goose. The calls are similar, however, the *hrink* is shorter and more high-pitched than the *honk* of males.

The Basics of Wildlife Management

Habitat Management Excerpt

by Dr. Jim Knight, Extension Wildlife Specialist (retired)

Habitat Management

The improvement or maintenance of habitat is one of the most important things a landowner can do to enhance wildlife habitat. Many people think locking up or preserving an area will make it best for wildlife. While development that would remove the space wildlife needs is certainly detrimental, activities that manipulate vegetation properly are usually good for wildlife. While some species such as red squirrels, mountain grouse and numerous non- game animals prefer older growth forests, most game animals thrive in areas that have younger stages of vegetation. The stage of growth of different vegetation communities is referred to as the stage of “succession.” Succession is the natural progression vegetation communities go through as they transform from bare ground to the mature forests or grasslands. Certain species of vegetation are found at the various stages of succession. Certain wildlife species also do best using various stages of succession. Succession can begin after a fire, a landslide, or any other phenomenon that results in removal of vegetation. It can also result from a pond filling in, turning into a marsh, then a grassy wet meadow, then a willow flat and eventually a wooded area. Man-made activities can also set succession back. Plowing a grassland, clear-cutting a forest or using an herbicide to kill vegetation are all examples of creating early stages of succession.

If a forest burns, succession normally goes back to its earliest, bare ground stage. Grasses and forbs appear first; then other plants that thrive in full sunlight emerge. Gradually, small shrubs appear, eventually to be replaced by larger trees that out - compete them for nutrients and sunlight. The process then leads to a forest that is composed of mature trees with very little understory. The same process takes place when a prairie burns. Grasses and forbs that thrive in early successional situations are eventually replaced by grasses and shrubs that represent the most advanced prairie stage. The most advanced vegetative compositions of forests and grasslands are called “climax” stages. As wildlife managers, landowners need to determine which stages of

succession they will manage toward to develop habitat for specific species.
It is important to remember that succession is always trying to advance. Therefore, the ideal stage today may be too advanced 20 years from now. Planning a “rotation” so there will always be some prime habitat available is part of any good habitat management plan. The plan will allow for optimal successional stages now and at 10 year intervals until the cycle can begin again. Throughout this book, we will discuss the idea l habitats for many wildlife species. Most species need more than one vegetation succession stage to meet their demands for food and cover. Creating a variety of vegetation communities, made up of a variety of species at different ages, results in a patter n called a “mosaic” or “interspersion.” This mosaic of vegetation is much more desirable than a large area made up of even -aged, single species vegetation. Creating this vegetation diversity is the best way to meet the multitude of habitat requirements that are best for the wildlife on your land. Wherever different types and/or ages of vegetation come together, they create an “edge.” Edge is a term used to describe a special, and usually very valuable, part of the habitat because it contains the characteristics of both converging vegetation types. A meadow meeting a woodland is an example of an edge that is an excellent feature of the habitat. When creating edge, landowners should realize that irregular boundaries result in a much greater amount of edge than straight boundaries.

NCF-Envirothon 2025 Alberta
Wildlife Study Resources

Key Topic #2: Wildlife Ecology in Alberta

6. Identify common wildlife diseases in Alberta, their causes, and their effects.
7. Identify the biological and social carrying capacities for wildlife, along with the limiting factors that influence these numbers.
8. Identify the essential components of a habitat and recommend suitable habitat for local wildlife species.
9. Identify the effects of various environmental impacts on the energetic relationships in food chains and webs.

Study Resources

Resource Title	Source	Located on Page
Wildlife Diseases: Chronic Wasting Diseases in Wildlife, Avian Influenza in Wild Birds, Whirling Disease, and White-nose Syndrome and Bat Health	*Government of Alberta, 2024*	33
What factors determine the carrying capacity of an ecosystem?	*Population Education, 2024*	39
Habitat	*National Geographic, 2024*	41
Common Alberta Wildlife Species and their Habitat	*ABMI, 2023* *Canadian Wildlife Federation, 2024*	43
Wolves and the Food Web	*Pacific Wild, 2024*	53

Wildlife Diseases

Chronic Wasting Disease in wildlife

Alberta hunters play an important role in monitoring for chronic wasting disease, a serious illness that kills members of the deer family.

Introduction

Chronic Wasting Disease (CWD) is a prion disease that infects members of the wild and farmed deer family. Once established, it is very difficult to control and is fatal in all cases. There is no treatment or vaccine. Prevention is the best solution, but early aggressive response is recommended when new incidents of CWD are detected.

Range of infection

- In western North America, CWD primarily occurs in wild mule deer, farmed elk and farmed white-tailed deer.
- In eastern regions, CWD is found in wild and farmed white-tailed deer and farmed elk.
- Transmission occurs from deer to deer and in certain situations may involve environmental contamination.
- There is no evidence that CWD infects humans or non-cervid livestock, but health authorities recommend taking precautions.

CWD impact on local deer populations

Within affected jurisdictions the disease generally is not widespread and often occurs in local adjacent deer populations.

Mortality does not seem to affect overall productivity in infected populations in the short term, although models and data collected in Colorado, and more recently in Wisconsin, suggest that deer populations at the heart of an affected area decline and disappear over the long term.

- Infected populations in the core areas of the western US, where CWD has been present for a few decades, have a lower proportion of older-aged deer, and particularly fewer older adult males.
- Infected deer populations have a lower mean age than uninfected populations.
- Infected females die prematurely and do not provide their full potential to the ongoing productivity of the population, that is, the fawns that would have been produced in later years are not available if the doe dies prematurely of CWD.
- CWD slowly expands across the landscape to adjacent populations. Natural or genetic barriers to limit the spread of CWD have not been found.
- There is no known treatment or vaccine to control CWD infections.
- All deer and elk infected with CWD die prematurely.

Prevalence of CWD (percentage of deer infected) continues to increase in populations with long-standing infection. As the prevalence increases, the effects in local populations are more pronounced.

Restrictions for cervid and cervid parts transport

Many jurisdictions have developed new restrictions on the intra- and inter-jurisdictional movement of farmed cervids and wild cervid parts in an attempt to limit potential spread of CWD.

CWD and BSE

A related concern about CWD is the potential for misrepresenting it as being equivalent to bovine spongiform encephalopathy (BSE), the infamous "mad cow disease," a prion disease of bovids (cattle).

BSE has been associated with a similar prion infection in humans, variant Creutzfeldt-Jakob disease, and poses worldwide concern for public health and agricultural economics. However, CWD and BSE are not the same.

Based on the documented risk to wild deer populations, and the perceived human health concerns, wildlife managers throughout Canada and the US expend considerable time, effort, and monies on surveillance programs aimed at defining exactly where CWD occurs or does not occur in the wild

Alberta CWD surveillance programs

Alberta began surveillance of wild deer and elk for CWD in 1996. Submission of heads of hunter-killed deer is the primary source of surveillance samples, supplemented with testing of clinical suspects (deer that display behaviour or body condition consistent with possible CWD infection).

- Particular emphasis is placed in testing heads of deer killed in the areas at risk for CWD in east and central Alberta, although the program accepts heads from deer or elk killed anywhere in Alberta.
- Over 90,000 heads of wild deer and elk have been tested since the program began.
- There are numerous research projects underway to better define
    - Host range
    - Method of transmission
    - Diagnostic tests
    - Impact on wild cervids
    - Risk to the public and livestock

Avian influenza in wild birds

Overview

Avian influenza viruses are common infections in wild birds, primarily waterfowl. Many strains of avian influenza viruses occur naturally in wild birds around the world, particularly:

- Ducks
- Geese
- Shorebirds

These viruses usually do not cause disease in wild species but spread occasionally to domestic birds (ducks, chickens, turkeys). Such strains present a significant concern for poultry producers by causing considerable mortality in domestic bird species. In addition, swine (pigs) can be infected with some strains of avian influenza viruses.

During poultry outbreaks, some avian influenza viral strains can pass from domestic poultry to humans, but this is rare. Avian influenza viruses are not the same as the human influenza (common "flu" viruses) that circulate every year in people.

While these viruses rarely cause disease or mortality in wild birds, extensive mortality occurred across Canada and USA due to the spread of a high pathogenic strain in 2022 (see update below for full details).

November 2023

H5 avian influenza was detected in wild birds in Alberta in mid-August 2023. Starting in mid-September, multiple cases were identified across Alberta, primarily in Canada geese. As in 2022, infected skunks also were detected. Related outbreaks were seen in domestic poultry. While considerably less than the mortality seen in 2022, the fall mortality is an indication that a pathogenic form of the virus is still present in wild waterfowl and poses ongoing risk to other wild and domestic species.

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Whirling disease

Whirling disease is a disease of salmonid fish that has infected some trout and whitefish populations in Alberta.

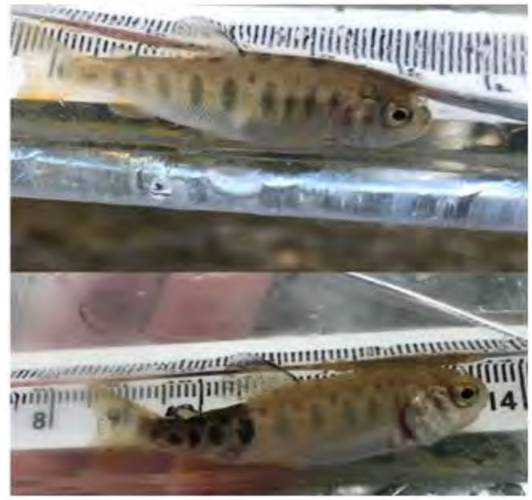
Overview

Whirling disease is caused by Myxobolus cerebralis, a microscopic parasite that affects salmonid fish such as trout, salmon and whitefish. The parasite has a complex lifecycle that requires a salmonid fish and an aquatic-worm, Tubifex tubifex, as hosts.

Species such as rainbow trout, cutthroat trout and whitefish are particularly susceptible to whirling disease, though disease impacts differ among salmonid fish species and in different water bodies.

The severity of whirling disease depends largely on the age and size of the salmonid host. Young fish are most vulnerable, with mortality rates reaching up to 90%.

Fish infected with whirling disease may show the following signs: A 'whirling' swimming behaviour may be observed as the parasite invades cartilage and impairs the nervous system. Changes in physical appearance, including (but not limited to): skeletal deformities of the body or head.



Lower picture depicts skeletal deformities caused by whirling disease

Whirling disease in Alberta

Whirling disease has been declared in 4 major watersheds in central and southern Alberta:

- Bow River
- North Saskatchewan River
- Oldman River
- Red Deer River

Responses to whirling disease

The Alberta government and the CFIA are developing long-term detection and surveillance plans to protect Alberta’s trout and whitefish fisheries as much as possible.

Additionally, the Whirling Disease Program provides annual reports highlighting the program year and the priorities for the upcoming year.

Fish quarantine

In 2016, the Alberta government issued Ministerial Order 52/2016: Fish Quarantine Order to quarantine all commercial fish culture operations until individual fish farms and hatcheries licensed for salmonids are tested for the presence of whirling disease.

The precautionary quarantine of fish farms and hatcheries reduces the risk of whirling disease transmission from fish farms and hatcheries to wild populations, and helps protect Alberta’s fish populations and world-renowned fishing industry.

The quarantine will be in place until each facility has tested negative free of whirling disease. Fish farms may resume stocking once they are confirmed to be free of the disease.

Temperature Monitoring Project

In 2018, the Whirling Disease Program initiated a large-scale stream temperature monitoring project to assess water temperature conditions associated with the presence of the parasite in Alberta. Whirling disease staff installed temperature loggers throughout the eastern slopes region of Alberta, ranging from the Athabasca River watershed to the South Saskatchewan River watershed in 2018. The Whirling Disease Program partnered with Trout Unlimited Canada, Canadian Conservation Corps (in association with Alberta Parks), Paul Band First Nations, and internal regional programs to install temperature loggers.

Susceptibility Study

In 2018/2019, mountain whitefish, brook trout and brown trout fry were reared from wild populations within Alberta in order to determine their susceptibility to whirling disease. In collaboration with the University of Alberta, fry were challenged with known quantities of the whirling disease parasite and the results indicated that all 3 species had increased mortality compared to fish that were uninfected. Mountain whitefish had the highest mortality (4.8 times higher than uninfected fish), followed by brown trout (4.1 times) and brook trout (1.8 times). Future testing is planned for other Albertan species including rainbow trout, cutthroat trout, arctic grayling and bull trout.

Crowsnest River Project

In 2019, Alberta government staff conducted a sentinel cage study to determine the extent and impacts of whirling disease within the Crowsnest River. Several cages, containing uninfected rainbow trout, were installed on the Crowsnest and Oldman River. These fish were tested to determine the severity of whirling disease in the river.

Decontamination Protocol

The Government of Alberta has developed a Decontamination Protocol for Watercraft and Equipment. If you participate in water-based outdoor recreation such as angling or boating, or you work around waterbodies, you can help prevent the spread of whirling disease.

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White-nose Syndrome and Bat Health

There are few diseases or parasites of bats in North America that threaten the health of bat populations. White-nose syndrome is an exception.

White-nose Syndrome is a disease caused by a cold-loving fungus that grows in caves and transfers onto wintering bats. It is associated with the death of millions of bats in eastern North America, and was found in Alberta in 2022.

Slowing the spread

The fungus that causes White-nose Syndrome was detected in guano samples from a few locations in southeastern Alberta in 2022. In May 2024, the disease was found on 2 Little Brown Bats collected in southeastern Alberta.

Since the discovery of the disease in New York, in 2006, millions of bats have died. The fungus irritates the bats and causes them to arouse from hibernation. The bats quickly burn through their stored fat – and in the absence of insect prey – they starve to death. Some bat populations have declined by 90%.

Now that the fungus and the disease have been detected in Alberta, we expect to see it spread. We anticipate that Alberta's hibernating bat species will experience severe population declines in the coming years.

What you can do

We cannot prevent or eradicate the fungus. However, we can help our bat populations by protecting them and their key habitats. Maintaining places for bats to roost, hibernate and forage will help populations to recover after initial declines; evidence from eastern North America suggests that some species are developing a resistance to the disease. However, recovery will be slow because bats have only one pup per year, and it is unlikely that their populations will return to current levels.

Anyone visiting any caves – particularly those in eastern North America – should be aware of basic precautions to avoid spreading White-nose Syndrome to new sites. In Alberta, it is illegal to enter a cave where bats are hibernating between September 1 and April 30. Anyone intending to visit a cave in Alberta is encouraged to be well-informed before visiting.

Bats with White-nose Syndrome typically have a white fuzz on their noses, and possibly on their wings, ears or tails. There may also be scarring on their wings.

White-nose Syndrome does not affect other animals or people.

Other preventative measures in Alberta

In Alberta, we are being proactive in informing the public about the concerns over – and in limiting the potential for – the human transfer of the fungus.

Similarly, in 2014, a cooperative effort among Alberta and B.C. government staff, along with input from Alberta and B.C. caving groups, Parks Canada, the Canadian Cooperative Wildlife Health Centre and the U.S. Fish and Wildlife Service resulted in guidelines for limiting the potential transfer of White-nose Syndrome during caving activities in Western Canada.

Following 5 years of temporary access restriction to the Cadomin and Wapiabi caves, the primary known bat hibernacula in Alberta, the situation was reviewed in 2015. Much has been learned about the fungus and about White-nose Syndrome; however, the risk to bat populations remains significant. As a result, access restrictions were extended until there is definitive evidence to support re-opening or limited use of closed caves.

What Factors Determine the Carrying Capacity of an Ecosystem?

By Isabelle Rios | November 20, 2018

Carrying capacity, or the maximum number of individuals that an environment can sustain over time without destroying or degrading the environment, is determined by a few key factors: food availability, water, shelter and space. These key factors have the ability to limit, or even reduce a population by lowering birth rates, increasing the death rate, or encouraging migration. For this reason, these are referred to as 'limiting factors.' When there are no limiting factors a population can grow exponentially.

Abiotic vs. Biotic Limiting Factors

These limiting factors can be further broken down into abiotic or biotic limiting factors. Abiotic factors are non-living physical and chemical elements in the ecosystem, such as sunlight, temperature, soil, water, and oxygen. Biotic factors are living or once-living organisms in the ecosystem, such as food, disease, competition, and predators. As an example, we can look at bison in Yellowstone National Park. They have to compete with elk and other ungulates while foraging for food, a biotic factor. One abiotic factor limiting bison is the weather, as heavy winter snows can drive them out of the park.

Limiting Factors Based on Density

We can also look at factors that determine carrying capacity in terms of their density-dependence. Density-dependent limiting factors make the per capita growth rate decrease as the population increases. Density-dependent limiting factors tend to be biotic, including factors such as food and disease. For example, in a population of panthers, there is access to a fixed amount of food. When the population remains small there will be plenty of food for all panthers. When the panther population gets large enough the food may become insufficient, leading to competition among panthers, from this competition, panthers may starve, or die, and stop reproducing. As such, the per capita growth rate of the panther population may shrink or level off. Food in this case is an example of a density-dependent limiting factor.

Density-independent limiting factors are factors that affect the per capita growth rate regardless of how dense a population is and include factors such as a flood, drought, and habitat destruction. Consider a flash flood occurs in the panther habitat. The flood has the ability to kill any panther that is in the wrong place at the wrong time, independent of how many panthers are in the area. In this case, the flood, or natural disaster, is the density-independent limiting factor.

Limiting Factors and Humans

While food and water supply, habitat space, and competition with other species are some of the limiting factors affecting the carrying capacity of a given environment, in human populations, other variables such as sanitation, diseases, and medical care are also at play. Often, some variables are not equitably distributed among human populations with some consuming more than others, and with affluence on the rise globally, human carrying capacity is neither static nor easy to calculate.

Habitat

A habitat is a place where an organism makes its home. A habitat meets all the environmental conditions an organism needs to survive. For an animal, that means everything it needs to find and gather food, select a mate, and successfully reproduce.

The main components of a habitat are shelter, water, food, and space. A habitat is said to have a suitable arrangement when it has the correct amount of all of these. Sometimes, a habitat can meet some components of a suitable arrangement, but not all.

For example, a habitat for a cougar could have the right amount of food (deer, porcupine, rabbits, and rodents), water (a lake, river, or spring), and shelter (trees or dens on the forest floor). The cougar habitat would not have a suitable arrangement, however, if it lacks enough space for this large predator to establish its own territory. An animal might lose this component of habitat—space—when humans start building homes and businesses, pushing an animal into an area too small for it to survive.

Space

The amount of space an organism needs to thrive varies widely from species to species. For example, the common carpenter ant needs only a few square inches for an entire colony to develop tunnels, find food, and complete all the activities it needs to survive. In contrast, cougars are very solitary, territorial animals that need a large amount of space. Cougars can cover 455 square kilometers (175 square miles) of land to hunt and find a mate. A cougar could not survive in the same amount of space that a carpenter ant needs.

Space is not the same as range; the range of an animal is the part of the world it inhabits. Grassland, for example, is the habitat of the giraffe, but the animal's range is central, eastern, and southern Africa.

Food

The availability of food is a crucial part of a habitat's suitable arrangement. For example, in the northern part of the U.S. state of Minnesota, black bears eat mostly plants, like clover, dandelions, and blueberries. If there were a drought, plants would become scarce. Even though the habitat would still have space (large forest), shelter (caves, forest floor), water (streams and lakes), and some food, it wouldn't have enough to eat. It would no longer be a suitable arrangement.

Too much food can also disrupt a habitat. Algae is a microscopic aquatic organism that makes its own food through the process of photosynthesis. Nutrients like phosphorous contribute to the spread of algae. When a freshwater habitat has a sharp increase in phosphorous, algae "blooms," or reproduces quickly. Algae also dies very quickly, and the decaying algae produces an algal bloom. The algal bloom can discolor the water, turning it green, red, or brown. Algal blooms can also absorb oxygen from the water, destroying the habitat of organisms like fish and plants. Excess nutrients for algae can destroy the habitat's food chain.

Water

Water is essential to all forms of life. Every habitat must have some form of a water supply. Some organisms need a lot of water, while others need very little. For example, dromedary camels are known for their ability to carry goods and people for long distances without needing much water. Dromedary camels, which have one hump, can travel 161 kilometers (100 miles) without a drink of water. Even with very little access to water in a hot, dry climate, dromedary camels have a suitable arrangement in northern Africa and the Arabian Peninsula.

Shelter

An organism's shelter protects it from predators and weather. Shelter also provides a space for eating, sleeping, hunting, and raising a family. Shelters come in many forms. A single tree, for example, can provide sheltered habitats for many different organisms. For a caterpillar, shelter might be the underside of a leaf. For a mushroom fungus, shelter might be the cool, damp area near tree roots. For a bald eagle, shelter may be a high perch to make a nest and watch for food

Common Alberta Wildlife Species and Their Habitat

Badger

The Badger is typically associated with native grasslands and hedgerows but will live in early seral forests or forested corridors that support their preferred prey, the ground squirrel. Badgers are primarily active at night and excavate underground dens where soils are suitable for digging.

Woodland Caribou

Woodland Caribou is strongly associated with large tracts of mature to old, low-productivity, upland and peatland conifer-dominated forests.

These habitats contain lichens—the Woodland Caribou's primary winter food--and provide protection from predation.

Woodland Caribou avoid habitats, such as river valleys and young forests, that are more commonly used by Moose, deer, Elk and wolves.

Black Bear

Black Bears are found throughout the forested region of Alberta, commonly occuring in the Boreal Forest, Foothills, and Rocky Mountain Natural Regions.

Black Bears are typically associated with forests and are common along forest edges and even on occasion in the high alpine of the Rocky Mountains.

Relative abundance is highest in young naturally disturbed white spruce stands. Relative abundance is also high in the treed swamp vegetation type. Black Bear relative abundance is lowest in agricultural footprint types in the forested region.

Black Bears are well adapted to human settings, largely attracted to abundant food in residential areas and the emergent vegetation where forest habitats have been modified.

Deer

Deer are large herbivores found at all times of the year throughout Alberta, especially in the Grassland, Parkland and Boreal Forest Natural Regions.

Deer will live wherever there is enough food and shelter. They like both forest openings and grasslands where shrubs, woodlots or river valleys provide shelter.

Coyote

The Coyote is found throughout Alberta, but is most common in the southern Boreal Forest Natural Region and Parkland and Grassland Natural Regions.

Coyotes are habitat generalists and, while they prefer open areas, can be found from the prairies to the boreal forest. Perhaps the only limit to their distribution is the presence of competitors such as the Gray Wolf.

Coyote relative abundance is predicted to be highest in agriculture footprint types (crop, tame pasture and rough pasture), followed by the other human footprint types in the forested region.

Among vegetation and forest types, Coyote predicted relative abundance is highest in grass habitat, followed by recently harvested pine forest as well as shrubby fen, graminoid fen, marsh and shrub vegetation types.

The Coyote is highly adapted to human settings such as residential and urban areas as well as cultivated areas. As habitat generalists, they can live in a wide range of human-modified landscapes and are thought to be expanding their range north in Alberta (Bayne et al. 2008).

Cougar

Cougars can be found throughout Alberta but are most common in the Foothills and Rocky Mountain Natural Regions.

The Cougar is a highly adaptable, secretive predator that typically preys on large mammals, such as deer. They will alter their habitat use in response to prey density but Cougars prefer forests or wooded river valleys that provide hunting cover.

Moose

Moose are found throughout Alberta but are most common in the Boreal Forest, Foothills, and Parkland Natural Regions

Moose are generalist browsers of woody deciduous shrubs and use a wide variety of open habitats in the summer for foraging, such as burns, harvested areas, riparian areas, and shrublands. These habitats are often in close proximity to forest edges or water to minimize heat stress. Moose also frequent wetlands and lake margins where they forage for salt-rich, submerged vegetation. In the winter, mature/old forests with good snow interception interspersed with open areas with extensive shrub growth jointly provide bedding sites, thermal cover, security cover, and foraging habitat.

Moose preference for early successional habitat for foraging and their use of forest edges means that they are positively impacted by development activities that create these habitats, such as forest harvesting.

Beaver

Beavers live in rivers, streams, lakes and ponds that they build themselves. Their favorite habitat is a water body that has lots of shrubs and aspen trees close to shore.

Canada Lynx

The Canada Lynx is found throughout Alberta's forested natural regions; it is most abundant in the Boreal Forest Natural Region.

Canada Lynx are wary animals that prefer early to mid-successional forested habitats with a dense understory consisting of shrubs and deadfall. These habitat requirements closely follow that of their preferred prey, the Snowshoe Hare.

While recently disturbed (i.e. < 5 years old) forest stands do not provide suitable habitat for the Canada Lynx, they benefit from young to mid-seral forests that have originated from either fire or logging because these stands provide sufficient cover and prey. Canada Lynx were observed to have a lower probability of occupancy along the southern edge of their range in Alberta, likely due to the interaction of three factors (Bayne et al. 2008): lower habitat quality as a result of human development (e.g., conversion of boreal forest to agriculture and increased road densities); increased competition with Coyotes; and, lower availability of their dominant prey species, Snowshoe Hare.

Grizzly Bear

Grizzly Bears are typically associated with alpine and forested subalpine and foothills environments in Alberta. They avoid dense human settlements. As hibernators, they seek mountain winter denning sites on or under ground, usually on/in a steep north-east facing slope.

Grizzlies are adapted to living in open areas but are intolerant of most human habitat alteration. They have become restricted to relatively intact forests and alpine habitats away from dense human habitation.

Porcupine

The Porcupine is found throughout the forested region of Alberta but is most common in the Parkland Natural Region and southern portion of the Boreal Forest Natural Region.

The Porcupine is commonly associated with mixed deciduous and coniferous forests, preferring stands with low densities of trees. Active year-round, Porcupines will use caves, hollow logs, rock piles, or buildings where available as winter and summer dens.

Red Fox

Red Foxes are most commonly found in the Grassland and Parkland Natural Regions but also occur in the Foothills, Boreal Forest and Canadian Shield Natural Regions.

Red Foxes are habitat generalists, but are associated with open or semi-open habitats, sparse woodlands, and urban and rural human-settled areas. Pups are born in litters of four to nine between March and May each year in burrows created by other animals such as marmots and ground squirrels.

Red Foxes are adapted to human settings such as residential, urban and settled rural areas, and benefit from human habitat alteration.

Pronghorn

Pronghorn are found in Alberta's open grasslands; occasionally in the Parkland Natural Region, but most frequently in the Grassland Natural Region.

Pronghorn are exclusively found in open, grassland habitats and, in particular, native rangeland where preferred forage—such as Silver Sagebrush, Pasture Sagewort and Western Snowberry—is abundant.

Gray Wolf

The Gray Wolf is found throughout the forested region of Alberta.

Gray Wolves are habitat generalists and tend to be found in areas where prey populations are most abundant or where prey are most vulnerable. Although Gray Wolves are currently restricted to forests away from urban areas, they have ranged historically throughout Alberta wherever suitable, large mammal prey was available.

Although wolves avoid human settings such as residential, urban and agricultural areas, they are tolerant of disturbance in forested areas that facilitates access to large mammalian prey. Anthropogenic linear features, such as seismic lines, may be important travel corridors for wolves (Latham et al. 2011).

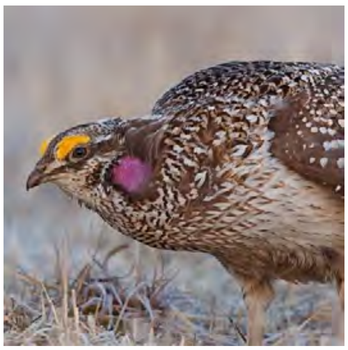
Red Squirrel

The Red Squirrel defends a territory year-round to maintain exclusive access to food resources, specifically conifer seed, which is the staple of its diet. Conifer seed production increases with tree size and age and therefore the Red Squirrel is typically most successful in older White Spruce-dominated conifer stands in Alberta (Wheatley et al. 2002). But the Red Squirrel can be found in variety of forest types as well as urban, rural, and agricultural areas, provided there are enough conifer cones to support individual territories.

Striped Skunk

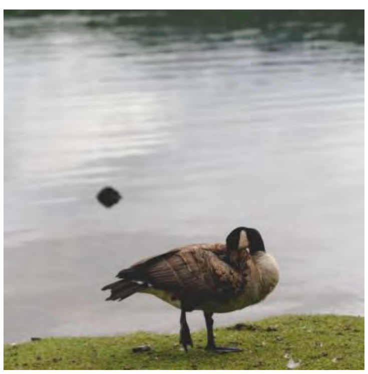
The Striped Skunk is found throughout Alberta but is most common in the Parkland and Grassland Natural Regions and parts of the Boreal Forest Natural Region.

The Striped Skunk is typically associated with open grasslands and roadside ditches but will live in woodlots, forests, or even urban areas if food is available. Striped Skunks occupy underground dens in the winter and spring, but live above ground the rest of the year.



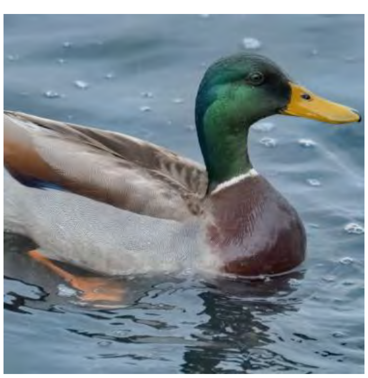
Sharp Tailed Grouse

Sharp-tailed Grouse is found throughout the non-forested region of Alberta but is most common in the Grassland and Parkland Natural Regions. The Sharp-tailed Grouse is strongly associated with native prairies, but it will live in agricultural pastures, shrublands, and even woodlands with open structures. Sharp-tailed Grouse nest on the ground, most often under shrubs or small trees if available, or in thick grassy cover if not.



Canada Goose

Canada Geese breed in a wide range of habitats. They prefer low-lying areas with great expanses of wet grassy meadows and an abundance of ponds and lakes that serve as refuges from foxes and other land predators. Below the treeline, the geese nest in the open boreal forest, with its scattered stands of stunted spruce and tamarack. In southern Canada, nesting Canada Geese are at home in many places, from sheltered mountain streams and prairie pothole ponds to golf courses and urban parks. During fall and winter, Canada Geese favour agricultural land where vast fields of cereal grains and other crops provide abundant food and relative safety from predators.



Mallard

Mallards are one of the first ducks to arrive back on the breeding grounds in spring. They are adaptable and may nest near a lake, pond, river, or even woodland pool. Their preferred habitats, however, are the natural grasslands that surround little reed-ringed sloughs, or marshy areas, and potholes on the prairies.

Even in the heart of many major cities, half-tame Mallards waddle ashore from park lakes to take food from the hands of visitors.

Sandhill Crane

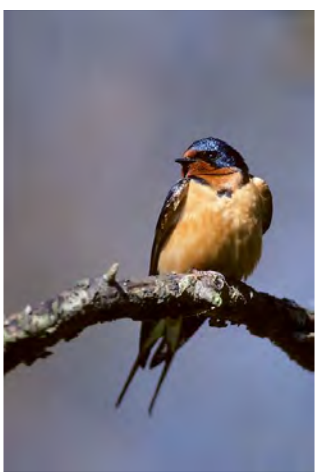
Sandhill Cranes breed in open marshes, fens and bogs in Alberta's boreal forest, foothills and Rocky Mountains. They especially like wetlands surrounded by shrubs or trees—the edge habitat is attractive for breeders. They are often seen in agricultural fields and other open areas throughout the province during migration.

They migrate to the southern US and northern Mexico.

American Robin

The American Robin is a very adaptable bird that can be found in a range of habitats from natural settings such as forests and riparian areas to urban areas, agricultural areas, and campgrounds. They generally prefer edge habitats that can be naturally or anthropogenically created.

The distribution of the American Robin was found to be associated with both higher levels of human development (e.g., campgrounds, well pads and roads) as well as the availability of non-native earthworms (Cameron and Bayne 2012).



Barn Swallow

The Barn Swallow is most common in the Grassland Natural Region and portions of the Parkland Natural Region.

The Barn Swallow is typically associated with human settlements, but it will also nest in caves and tree holes in natural settings. They forage in open habitats including open water, pastures, cultivated fields, and swamps.

The Barn Swallow is a human-dependent species nesting almost exclusively on or in buildings on farms and in urban and residential areas. It tolerates habitat disturbance, but is sensitive to activities that affect flying insects.

Boreal Capped Chickadee

The Black-capped Chickadee is commonly found in all of Alberta's forested natural regions; it is most common in the Parkland, Foothills, and Boreal Forest Natural Regions.

In northern Alberta, the Black-capped Chickadee prefers stands with deciduous trees. In southern Alberta, it is likely to be found in wooded coulees and valleys as well as urban and rural areas. Old or dead deciduous trees with softer wood are essential for cavity nest excavation.

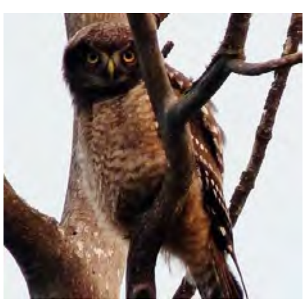
Downy Woodpecker

The Downy Woodpecker is found in all natural regions in Alberta, but is most common in the Boreal Forest and Parkland Natural Region.

The Downy Woodpecker is associated with deciduous and mixedwood forests, but will live in urban areas, orchards and is a common visitor to backyard feeders. It commonly nests in snags or dead branches of living trees within a forest stand.

Peregrine Falcon

Peregrines nest mostly on steep cliffs as well as man made structures and are common to the Foothills and Canadian Shield. In fact, an extraordinary feature of these birds is their traditional use of certain ledges for nesting. They also choose steep slopes, river cutbanks, and even low rocks and mounds.



Northern Hawk Owl

Northern Hawk Owls find suitable habitat in the Boreal forest. They often live in coniferous forests and prefer areas with some open spaces, such as forest clearings, for hunting. Northern Hawk Owls nest in cavities of dead trees and stumps.

Great Horned Owl

These owls do not migrate. They reside all year in forests, open woods, and river valleys of all natural regions. They are typically found in forested and semi-forested regions of Alberta. Hollow trees are occasionally selected as nest sites. In mountainous or rough terrain, especially where trees are sparse, Great Horned Owls will nest on ledges and high points such as headlands.

Common Raven

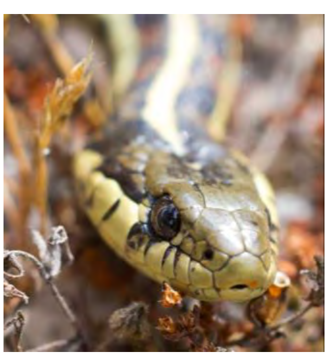
Although detected throughout Alberta, the Common Raven is most often found in the central part of the province, especially in the Parkland, Foothills and southern Boreal Forest Natural Regions.

The Common Raven is a habitat generalist living in a broad range of habitat types; however, it prefers forests or even urban areas over prairies. Common Ravens nest and roost in a range of microhabitats such as trees, snags, cliffs and utility poles, preferring elevated locations.

Northern Leopard Frog

Northern Leopard Frogs commonly live close to a source of water – such as a river, wetland, pond or lake. It's also commonly found in meadows, hence its other popular name, 'meadow frog'. As an amphibian, Northern Leopard Frogs will spend part of their life as fully aquatic tadpoles and later grow legs to spend more time on land. Hunting can take place during the day or night, but they are primarily nocturnal. Staying still or fleeing to an aquatic refuge are two of its defense mechanisms.

During the winter, Northern Leopard Frogs hibernate deep in ponds or mud. To survive the coldest months, their chosen hibernation site cannot freeze for more then eight hours and must have enough oxygen.



Western Garter Snake

The western garter snake tends to inhabit open forest and grassy areas, preferring meadows and estuaries. Found in habitats ranging from desert riparian areas to mountain lakes and meadows, it is rarely found far from water where it both hunts and hides if disturbed.

The best time of day to spot one in early or late summer is mid-day when it is basking in the sun, whereas during the heat of mid-summer your best bet is to look in the early morning. It is a diurnal snake, active only in the warm hours of the day. This species hibernates communally in colder areas, sometimes with the common garter snake. The length of its inactive period varies with the local climate.

Painted Turtle (and other freshwater turtle species)

Freshwater turtles can be found in a great variety of habitats, including most wetlands (even inhospitable bogs!), lakes and rivers. Still, most prefer shallow waters and slow currents, with soft mud at the bottom and aquatic vegetation where they can hide. One exception is the Wood Turtle (*Glyptemys insculpta*), which prefers hard substrate and clear waters. Not all freshwater turtles are good swimmers, so a substrate on which they can walk at the bottom of the water, is a necessary element for some species.

Wolves and the Food Web

Wolves play a very important role in the ecosystems they inhabit, affecting not only prey population and health, but impacting everything from the trees and streams to the birds singing in the trees. When wolves are removed, their role as ecosystem engineers cannot be easily replaced.

Ecosystems are made up of a complex web of relationships between plants, animals, fungi and bacteria. Food chains are one important type of these relationships and there are many overlapping food chains in an ecosystem making up the food web. Wolves are an apex predator that occupy the top niche in the natural food chains they occur in; as such, they are not hunted by any other species within the chain for food.

Changes in a food chain can have ripple effects across the whole ecosystem and broader food web. For example, inland wolves often hunt deer which graze on grass and young shrubs. Through their connection with deer populations, wolves affect the vegetation and other characteristics of natural landscapes by changing the dynamics of other species in their ecosystems.

Wolves have a varied diet which changes depending on the landscape they inhabit. Today, wolves can be found in diverse environments, including mountain areas, tundra, woodlands, deserts, grasslands, forests and coastal areas. Across these habitats wolves have a notable impact on biodiversity and biomass in the areas they occur.

Wolves Affect Interior Habitats

In top-down controlled ecosystems, the populations of the organisms in lower trophic levels (birds, small mammals, ungulates etc) are controlled by the organisms at the top, the predators. As a keystone species and apex predator, wolves apply top-down pressure to the ecosystems they inhabit, initiating interactions that can control entire ecosystems. Known as a trophic cascade, this phenomenon can occur when wolves limit the density and/or behavior of their prey, enhancing the survival of the next lower trophic level and so on.

Left unchecked, ungulate species like deer, elk and moose can reduce the diversity of life in forests and riparian areas, lower native plant richness and abundance, benefit some invasive plant species and affect river systems. In turn, this has a domino effect throughout the ecological community. When wolf populations recover or are reintroduced into areas where they have been removed, their presence can have profound effects on a wide diversity of plant and animal life as they reinstate top-down pressure to the ecosystem by eating ungulates.

For example, In Olympic National Park (Washington State) an overabundance of elk has damaged the rainforest ecosystem and has likely caused substantial changes in riparian plant communities, leading to riverbank erosion and channel widening, thus reducing rearing habitat for salmon, steelhead, and other fish species. The extermination of wolves in similar regions, which left elk populations unchecked, set off a cascade of changes affecting forest vegetation and stream dynamics. In some areas where wolves have disappeared, forest vegetation and biomass decreased, became less diverse, and plants rarely reached maturity before being grazed. As a result, soil and fine sediments along stream beds which would have otherwise been held in place by the forest root system, eroded away, changing the form and flow of rivers. Several fish species, like salmon and trout rely on gravel free of fine sediments to be able to spawn effectively. Wolves were exterminated in the early 1900s from Olympic National Park, and many of these similar vegetative and stream dynamics have been observed there.

Conversely, in Yellowstone National Park the reintroduction of wolves led to an increase in vegetation, primarily willow and aspen trees, by limiting browsing pressure on vegetation by elk. Following the reintroduction of wolves to the landscape, there were approximately double the sapling densities of aspen trees in areas with higher wolf presence than in areas with persisting lower wolf presence. In addition, the grazing intensity and removal of willow trees is, on average, seven times higher in areas with lower wolf presence than in areas where wolves thrive. The more wolves in an area, the fewer elk there were and the more aspen and willow trees were able to grow and mature. The increase in tall willow heights, greater canopy cover, newly vegetated streambanks, and the recent development of inset floodplains helped to initiate the recovery of riparian plant communities and stream channels as ecosystems were left to mature and develop in the absence of overbrowsing by elk.

Additionally, by both supporting (via the recovery of riparian plant communities and stream channels) and controlling populations (via predation) of beavers, wolves may have a long-term impact on riparian ecosystems, wetland creation, and watersheds by generating diverse habitats and patchiness that help support many species across the landscape.

As plant communities recover from overbrowsing, the availability of usable habitat space and food availability for other species increases. For example, riparian songbird abundance and diversity approximately doubles in areas where wolves exist. In Yellowstone National Park riparian songbird species including the American redstart, Tennessee warbler, orange-crowned warbler, and least flycatcher are not detected in areas with low wolf density. Bird diversity and populations are a leading indicator of overall ecosystem health.

Wolves Affect other food chains

Wolves help to create conditions that support a more robust diversity of predators and mesopredators, by maximizing the niche spaces available in an ecosystem and controlling some mesopredator populations, like coyotes. In the absence of top-down control by wolves, coyotes (a prominent mesopredator) may be released and dominate the landscape, outcompeting smaller-still predators and lowering the overall diversity of the ecosystem. The reintroduction of wolves to Yellowstone National Park resulted in a 50-90 percent decline in coyote density throughout the park and reduced the size of coyote packs. A wide diversity of smaller mesocarnivores (such as weasels, marten, badgers, fishers, wolverines, red fox, lynx, bobcat, and otters) thus increase in population size as the competition and predation risk from coyotes declines.

At least 12 species of scavengers have been observed utilizing wolf kills for a source of food. Wolf reintroduction in Yellowstone National Park has increased the quantity and timing of carrion available to scavengers. In the wake of a warming climate, the number of elk killed by winter conditions in the park is decreasing. Scavengers that once relied on winter-killed elk for food are now dependent on wolf-killed elk to sustain themselves. Ravens, bald eagles, golden eagles, magpies, coyotes, grizzly bears, and black bears are frequent visitors at wolf kills and are highly reliant on carrion in winter months for survival and reproductive success. By providing a reliable source of carrion in winter months, wolves in Yellowstone are buffering the effects of climate change by allowing scavengers to adapt to change over a longer time scale more consistent with natural processes.

A healthy wolf population may also play a supporting role in maintaining a healthy population of other iconic, keystone species in B.C, like grizzly bears. By partitioning their dietary niche, wolves and grizzly bears have evolved to coexist and thrive alongside one another. Research indicates that wolves improve the availability and diversity of plant and berry food sources that grizzly bears rely on for survival by regulating population sizes of plant browsing animals, like deer, elk and moose.

As omnivores, a grizzly’s diet is made up of both plant and animal foods. In addition to enhancing the amount of vegetation available to grizzly bears, wolves also play an important role in supplementing their diet with meat. In the early spring, after den emergence, scavenging on wolf-killed ungulate carcasses is particularly important to grizzly bears in some areas. Bears will scavenge on wolf-killed carcasses year-round where their ranges overlap, and wolf presence may contribute to the proportion of meat within a grizzly’s diet where they share habitat space.

Wolves Affect Species Health

As a keystone species, wolves have a dynamic relationship with and influence on their various prey species. Studies have indicated that wolves can even contribute to the health of ungulate populations by weeding out sick animals and improving the genetic structure of breeding populations. The selection of individual prey takes place through a sorting process that includes wolves testing a herd, identifying weak individuals and pursuing the inferior animals as targets. Removing unhealthy, aging, and post reproductive-age individuals from the population helps to ensure that the younger, healthier and more fecund individuals have less foraging competition. Recent research indicates that wolves can substantially reduce the prevalence of both infectious and genetic diseases in caribou, deer, elk and moose.

Research suggests that wolves could substantially reduce the prevalence of chronic wasting disease (CWD) in deer and elk populations with more efficiency than hunting and culling by humans. Through the use of a mathematical model, this study predicted that selective predation by wolves would result in a more rapid decline and natural limitation of CWD in ungulate populations when compared to human-intervention efforts to control the spread of the disease. Wolf predation plays a key role in disease control without leading to an overall reduction in prey populations. Mortality due to predation is compensated by a reduction in mortality by disease and may even help to eradicate disease from prey populations naturally over time.

When hunting moose, wolves display strong selection preference for aging individuals and tend to avoid adults in their prime. Research conducted in Isle Royale National Park – an island cluster in Lake Superior, near Michigan's border with Canada – shows that prey selection of moose by wolves may also be influenced by a chronic disease affected by genetic factors: osteoarthritis. In Isle Royale National Park, wolves tended to avoid healthy prime-aged moose or those with mild or moderate osteoarthritis, but would target prime-aged moose with severe osteoarthritis. These findings indicate that wolf predation may act as a selective force against the genes associated with developing severe osteoarthritis as a prime-aged adult in moose and displays how wolves naturally regulate healthy prey populations.

The impact of wolves on ecosystems is large relative to their population size within ecosystems. Recent research indicates that wolves may even affect the carbon balance in the regions they inhabit through their control of grazing species. The indirect effects of wolves on yearly carbon fluxes (via carbon sequestration of vegetation) are estimated to be comparable with the fossil fuel emissions of 6–20 million passenger cars per year. **The global literature is clear, on a broad-scale, wolves overwhelmingly benefit the ecosystems that they inhabit, the species they share habitat space with and play an important role in regulating the natural balance.**

For hundreds of years, the systematic extermination of wolves from the landscape across several continents has largely disrupted this balance. As wolf populations begin to recover in large areas across North America and recolonize areas they were previously extirpated from, public attitude needs to shift to align with the bulk of the evidence recognizing wolves as an essential part of a healthy landscape.

NCF-Envirothon 2025 Alberta
Wildlife Study Resources

Key Topic #3: Wildlife Conservation and Society

10. Explain the distinctions between species designations (provincial and federal) in Alberta (such as common, rare, endangered, threatened, endemic, extirpated, and extinct) and provide examples of each type.
11. Describe the role and history of hunting in wildlife management.
12. Define invasive and exotic species, describe their characteristics, name examples in Alberta, describe how they are spread, and explain their impact on local ecosystems.
13. Describe the impact of changes in climate on wildlife and their habitats.
14. Recognize important issues facing wildlife on a local, state/provincial, national and international scale, propose solutions to current problems, and evaluate viability of solutions.

Study Resources

Resource Title	Source	Located on Page
Alberta's Species at risk strategies	*Government of Alberta, 2024*	59
About COSEWIC and the Species at Risk Act	*COSEWIC, 2024*	61
Changing Animals: The Legacy of Hunting in Alberta	*Nature Alberta, 2017*	62
Alberta encourages wild boar hunting as population skyrockets	*City News, 2022*	67
Feral Rabbit	*Alberta Invasive Species Council, 2024*	69
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Alberta's species at risk strategies

The Government of Alberta employs a number of strategies to monitor and protect the province's at-risk wild species.

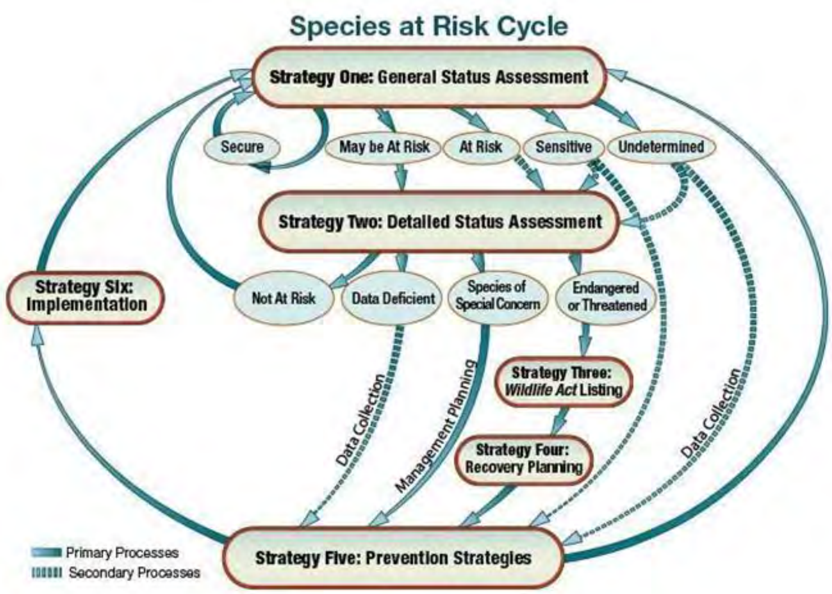
Risk status: To help us understand the stability of Alberta's wild species and the level of monitoring and protection they may need, each species is assigned a status.

How wild species receive a risk status:

To receive a status, species go through a dynamic cycle of assessment and status designation. Species re-enter the cycle for assessment when new information becomes available.

The cycle forms the basis for management actions to prevent our wild species from becoming at risk or to recover populations that are at risk.

Image 1. The 6-step, or strategies, species at risk cycle:



The General Status of Alberta Wild Species is a report that gives a broad overview of the well-being of each vertebrate wildlife species in the province.

The general status of Alberta's fish and wildlife is reviewed and updated every 5 years, using the most recent knowledge and research results available.

In the general status exercise, information about population size, distribution trends and threats are analyzed. The exercise helps wildlife biologists understand when a species might be vulnerable and in need of intensified management to prevent future decline.

General status ranks

General status ranks are used by government departments and non-government organizations to set priorities for conservation and to alert industry to species that require special consideration when making land-use decisions.

In the General Status of Alberta Wild Species, each vertebrate species is given one of the following rankings:

At Risk - Any species known to be “At Risk” after formal detailed status assessment and designation as “Endangered” or “Threatened” in Alberta.

May Be At Risk - Any species the “May Be At Risk” of extinction or extirpation, and is therefore a candidate for detailed status assessment. Sensitive - Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.

Secure - A species that is not “At Risk”, “May Be At Risk”, or “Sensitive”. Undetermined Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.

Not Assessed - Any species that has not been examined.

Exotic/Alien - Any species that has been introduced as a result of human activities.

Extirpated/Extinct - Any species no longer thought to be present in Alberta (extirpated) or no longer believed to be present anywhere in the world (extinct).

Accidental/Vagrant - Any species occurring infrequently and unpredictably in Alberta (i.e., outside its usual range).

When the information about a species in the General Status of Alberta Wild Species exercise indicates that a species may be at risk, that species becomes the focus of a detailed status assessment, which includes the development of a detailed status report.

The determination of general status ranks also occurs in all the provinces and territories of Canada in a similar exercise

In that exercise, ranks are generated for many other species groups in addition to the vertebrates. Provincial and territorial ranks are incorporated into a national status rank, which is used to set priorities for detailed status assessment at the national level.

About COSEWIC and the Species at Risk Act

COSEWIC was established in 1977 to provide Canadians with a single, scientifically sound classification of wildlife species at risk of extinction. COSEWIC began its assessments in 1978 and has met each year since then to assess wildlife species. COSEWIC uses a process based on science, Aboriginal Traditional Knowledge and community knowledge to assess the risk of extinction for wildlife species. Its process is thorough, independent and transparent.

In 2003, the Species at Risk Act (SARA) was proclaimed. The purpose of SARA is to protect wildlife species at risk in Canada. Within the Act, COSEWIC was established as an independent body of experts responsible for identifying and assessing wildlife species considered to be at risk. This is the first step towards protecting wildlife species at risk. Subsequent steps include COSEWIC reporting its results to the Canadian government and the public, and the Minister of the Environment's official response to the assessment results. Wildlife species that have been designated by COSEWIC may then qualify for legal protection and recovery under SARA.

It is up to the government to legally protect wildlife species designated by COSEWIC. COSEWIC's assessments do not take into account political, social or economic factors. The potential impacts of legal listing are for the Government to analyze, and the Act applies only to wildlife species on the SARA legal list.

Changing Animals: The Legacy of Hunting in Alberta

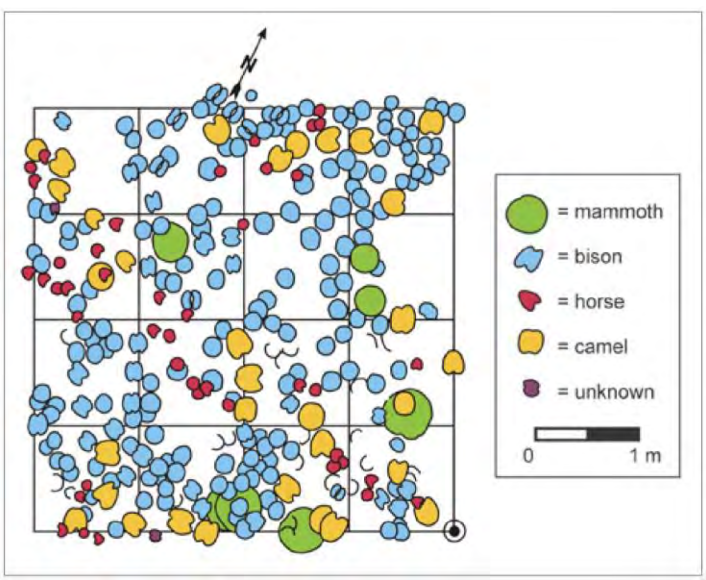
By Todd Kristensen and Chris Jass
Nature Alberta
VOLUME 46 | NUMBER 3 | FALL 2016

Locals say that southern Alberta winds can blow the freckles off a frog and paint off a post. That wind came in handy when the bottom of St. Mary Reservoir, near the Montana border, was recently exposed during maintenance.

Prairie gales scoured away several feet of sediment and exposed one of the world's richest collections of extinct animal tracks. This unique record of life from 13,000 years ago has drawn international attention and is informing us about the role humans played in the extinction of Alberta's megafauna, like camels, mammoth, and horse. Archaeologists and paleontologists are discovering that human hunting patterns may have changed animal communities for millennia here in the province and across North America. Those winds have not changed their course. New genetic research in Alberta's Rocky Mountains reveals that modern hunters are continuing to influence the evolution of our animals.

BIGHORNS AND SMALLER HORNS

David Coltman, a professor of molecular ecology at the University of Alberta, shares one important trait with sheep trophy hunters: an interest in the biggest horns. Dr. Coltman is involved in a 40 year study of bighorns at Ram Mountain near Nordegg – one of the longest big mammal monitoring projects in the world. He and Dr. Marco Festa-Bianchet of Sherbrooke University in Québec are leading a team that uses genetics and horn measurements to track long term human impacts on wildlife.



This trample ground diagram reveals the density of tracks preserved at Wally's Beach. Adapted from Paul McNeil.

Until 1996, male sheep on Ram Mountain were regularly hunted from late August to October if their horn curl met a minimum dimension. After that time, regulations tightened, and rams were rarely taken. Hunting stopped in 2011. The changes in regulations offered an intriguing mountain top mini-laboratory to investigate how human selection of specific traits (large horns) influenced the evolution of an animal population. Coltman notes of trophy sheep hunting that "you couldn't craft a better experiment to see how fast humans can change an ungulate population". Bighorns have mating patterns that favour dominant, larger horned males who battle for access to large groups of females. Biologically, horns are not shed each year like antlers of elk and deer, which means that changes in horn size can be a reliable canary in a coal mine for long-term impacts of trophy hunting. The results of the Ram Mountain research (a major article was published in January, 2016 in the journal Evolutionary Applications) has spurred global debates that rage on in genetic labs and meeting rooms of wildlife managers.

The research team discovered that rams with the biggest horns were hunted before they achieved reproductive success (eight to twelve years old), which drove long-term declines in horn length. Within three to four sheep generations, human hunting played a large role in the alteration of sheep populations' phenotypes (physical expressions of a gene). Horn size decreased by 30% over 20 years with over 20% of that decline attributed to genetic change. Hunting sharply dropped in 1996 but horn size has been slow to recover. Doubters suggest that environmental variables and demography can explain the drop in horn size. For example, a decrease in harvesting of female sheep drives populations up, which decreases food availability, and in turn, drops the quality of environmental input that at least partially influences horn size (Coltman notes that horn size is like human height: it is partially influenced by genetics and partially influenced by environmental conditions). In other words, according to density dependence models, if you stop hunting females, male health will drop along with horn size. But this hasn't panned out in National Parks or elsewhere in Alberta and B.C. where Dr. Festa-Bianchet and Dr. Coltman have studied sheep: across Western Canada, intense hunting leads to rapid changes in horn length, and, in places where hunters are removed from the equation, horn size stays big.

Horn curl is a key factor that determines which bighorns are targeted by hunters. According to Alberta Environment and Parks, roughly 2500 Albertans and 70 non resident hunters pursue bighorn sheep every year. Alberta Culture and Tourism.

The implications are twofold:

1) humans can alter the evolution of wildlife in short time frames and

2) wildlife managers need to balance the economic gains of trophy hunting (which are particularly high in Alberta where a sheep hunting package offered by outfitters can exceed $40,000) with its potential impacts on conservation goals.

David Coltman explains: "Horn size may be an honest indication of the healthiest males so if you are removing the healthiest males before they reproduce, there are potential long-term negative effects on population quality". If other traits, like body mass, are linked to horn length, we may be driving the evolution of sheep and other big game in directions that threaten their survival.

ANCIENT ECOLOGY AT WALLY'S BEACH

It's a long step back to human hunting patterns 13,000 years ago. Archaeologists at the University of Calgary, under Dr. Brian Kooyman, have learned that humans at a site complex called Wally's Beach on St. Mary Reservoir dined on camel, horse, and other big game on an ancient island in St. Mary River. Over 500 beautifully preserved tracks and trackways of mammoth suggest that these shaggy elephants could have been on the menu as well. The 9,200 acre St. Mary Reservoir was built and filled in the early 1950s. Wally's Beach was exposed in the 1990s when the reservoir was lowered in order to build an adjacent spillway. Ensuing droughts further exposed the lake bottom to some of the harshest winds in Alberta. Shayne Tolman, a teacher from Cardston, who is responsible for drawing archaeological and palaeontological attention to Wally's Beach, estimates that 1.5 to 2 m of sediments have been scoured away in the past 15 years. Imagine a magician pulling the cloth from a set table. Now imagine the act being performed ten times and each time the cloth is pulled, the plates and utensils fall on top of another set table. Hundreds of years of ancient meals and tools have become compressed on to one surface at Wally's Beach.

Over six thousand artifacts have been discovered including conclusive evidence that people were hunting Late Pleistocene populations of megafauna at a time when these animals were likely struggling to cope with climate change. While the evidence for camel and horse consumption in ancient Alberta is generally accepted, the role of humans in megafauna extinctions is not. Many researchers argue that pre-contact human populations were too small to impact big game. In addition, of the 33 genera of animals (over 40 species) that went extinct in North America at the end of the Pleistocene, humans only conclusively hunted five.

OVERKILL

Dr. Todd Surovell of the University of Wyoming has ironically become a champion of the human 'overkill' hypothesis of megafauna extinction despite spending much of his time attempting to disprove the idea that humans overhunted animals like mammoth.

At a distinguished lecturer series in Edmonton in February, Surovell noted: "Each line of evidence that I use to try to prove that humans didn't drive mammoths to extinction fails". The inability to reject hypotheses has in turn driven Surovell to become a world renowned expert of the overkill idea. Surovell has mapped the global overlap of humans and proboscideans, constructed detailed chronologies of megafauna extinction, and conducted mathematical models to extrapolate the potential impact of early humans in North America. All lines of evidence point to a simple observation: "Outside of Africa, when humans arrive, elephants disappear". At the other end of the research spectrum, some argue that climate change from the last ice age (which peaked around 17,000 years ago) to the Holocene is the culprit that leveled the majority of Alberta's big game animals. Warming temperatures were fostering new plant communities, wreaking havoc on mammal gestation rates, and stressing breeding patterns of big game. Most archaeologists have found a middle ground and suggest that humans delivered the final blow to some animal populations that were already weakened by habitat fragmentation and warming temperatures.

Paul McNeil, a Calgary-based paleontologist who studied the mammoth trackways at Wally's Beach, notes that they were left by older animals with very few juveniles: a sign of a stressed population. In this state of decline, Surovell argues that if humans culled 3% of the mammoth population per year, they would've been driven to extinction in a few centuries. This could've been greatly abbreviated if hunters targeted specific demographics like calves or fat-rich females (which we know First Nations preferred when it came to buffalo hunting on the plains). Either way, ancient hunters may have been killing mammoths at rates that were sustainable under past conditions but quite unsustainable against a backdrop of rapid climate change. The same pattern may have played out for other big game animals like horses and camels but confirmation must await further archaeological and palaeontological research.

HUMAN-DRIVEN EVOLUTION

What are the modern implications for the official mammal of Alberta (the bighorn) and other big game? Are Alberta's megafauna extinctions a valid warning bell for current practices?

There are significant differences from modern hunting and pre contact times. First Nations populations were small and did not have the ability to monitor animal communities across the province. However, modern populations and hunting regulations can create much stronger (narrowly targeted) forces of artificial selection that drive real evolutionary change. If twenty years of trophy hunting alters a sheep population's phenotype, what will one hundred years do? The pace of modern climate change may also be much faster than that experienced during the Late Pleistocene/Holocene transition. Agronomists are already concerned that grass productivity will decline across the northern prairies as temperatures warm, while conservationists worry that climate change in mountain landscapes will threaten the already fragile existence of fragmented animal populations (like sheep and caribou). Archaeological, palaeontological, and genetic records can reveal long-term impacts of humans on animal populations that can't be witnessed in a single generation and those records indicate that hunting patterns (particularly of specific demographics) on a backdrop of climate change can be a devastating one-two punch for some species. Humans have influenced animal populations in the province for thousands of years with no sign of stopping. To ensure that practices like trophy hunting are sustainable and that economically important species are not driven to local extirpation, biologists and wildlife managers should recognize the powerful ability of hunters to drive short-term evolution of big game animals.

CHANGING LANDSCAPES

Paul McNeil poetically notes the power of wind: it created Wally's Beach by blanketing immense trampling grounds with silt; 13,000 years later that wind exposed the trackways for our discovery and it is now slowly eroding it away. These winds bring change. Overlapping footprints of caribou, musk-ox, mammoth, camel, and horse at Wally's Beach tell of a diverse and biologically productive landscape in Alberta: not unlike a modern African savannah, according to Paul. It didn't last. Bison survived dramatic transitions at the end of the Ice Age and swamped the ecological void that became our modern prairies. Up to 60 million bison lived in North America at European contact. It didn't last. Within a few hundred years, a modest population of hunters plummeted the bison population to a few thousand. Prairie landscapes are still evolving in response to changes at the end of the Ice Age and more recent bison extirpation. Grazing patterns, carcasses, dung and urine, wallow pits, and hoof marks all created heterogenous microenvironments that supported other fauna and flora. Some of this diverse landscape manipulation is being replaced by cattle but Albertans, from farmers and ranchers to biologists and bird watchers, will continue to experience changes as the prairies stabilize from the Ice Age and disappearance of bison. Not all of the dynamic changes that occur in the natural world can be controlled by humans, but it is clear from both prehistoric and modern evidence that Albertans can have both direct and indirect impacts on animals and ecosystems around us. The decisions we make, whether about hunting, conservation, or climate change, will have impacts on what Alberta looks like for centuries to come.

Alberta encourages wild boar hunting as population skyrockets

By Laura Krause
City News Edmonton
Posted April 6, 2022 3:30 pm. Last Updated April 6, 2022 7:18 pm.

An invasive pest is making its way through the province, and officials say it could put Albertans and the environment at risk if it isn't brought under control.

Wild boars are not new to Alberta, but their population is spreading like wildfire – and they do damage along the way.

"They tear up fields and pastures, and can potentially spread disease to humans, pets, livestock, and other wildlife," said Ryan Brook with the Canadian Wild Pig Research Project (CWPRP).

Wild boars in Alberta. (Credit: Ryan Brook)

"They destroy water quality and they end up spreading E. coli, salmonella."

That is why the province is expanding its wild boar trapping and control program, with the goal of eliminating the animals.

This includes compensation for farmers and two separate bounty programs. Hunters who turn in wild boar ears will receive $75 per set. Government-approved trappers will receive the same amount per set of ears per sounder. The program ran until March 2023.

"We are taking action to get rid of this menace and help those affected by it before it gets worse," said Nate Horner, Alberta's minister of agriculture, forestry and rural economic development.

While Brook is happy to see Alberta taking steps to control the problem, he says a bounty might not be the solution.

"Sport hunting actually breaks up groups and spreads them across the landscape. It's a bit counterintuitive, but unfortunately, it does not help and actually has actually been a major problem," he said.

Brook says trapping is more effective.

“Traps have a lot of positives, but they are limited in their mobility and take a lot of time, whereas in a helicopter you can cover in a few days the southern half of Alberta and find pigs and remove them rapidly, so those together is a dream combination.”

Wild boars have been spotted in 28 rural municipalities across Alberta and they’ve been inching their way closer and closer to Edmonton.

If their population isn’t controlled, they could soon call Edmonton’s River Valley home.

ALBERTA Invasive species COUNCIL

abinvasives.ca
info@abinvasives.ca

Feral Rabbits

Oryctolagus cuniculus (aka European rabbit)

ALBERTA REGULATION:
Not Regulated

Last Updated: April 2024

Nicki Perdue, City of Calgary

Rebekah D. Wallace, University of Geogia, Bugwood.org

Overview:

Feral rabbits are native to Europe and northwestern Africa but have been introduced to every continent except Antarctica.[1] They were first introduced to North America in the 18th century by European settlers bringing them as food and fur. Now they can be found in the wild from introduction by pet owners who can no longer care for them. Their presence can be very harmful to environments. Many native species in the Leporidae family can be mistaken for feral rabbits, like mountain cottontails, snowshoe hares, and white-tailed jackrabbits.

Rabbits can spread and reproduce rapidly as females, known as does, can have up to 3 litters each year and begin breeding as young as 3 months old.[1,2] A single litter can consist of 4-12 kits (baby rabbits), with an average litter size of 5. Rapid reproduction is a significant factor in the population explosion of feral rabbits. Feral rabbits can live up to 10 years in captivity, but many only live about 12-15 months in the wild. Due to outdoor conditions, released rabbit populations deal with diseases, predators, malnutrition, and extreme weather. While many survive long enough to reproduce, they live a much shorter and more dangerous life in the wild than if they had been kept as pets.

Distribution:

Feral rabbits have been reported across Alberta in both urban and rural environments.

Habitat:

Thrive in urban areas, parks, farmlands, and grasslands. They prefer areas with thick cover to hide in and soft ground to create shallow burrows for shelter but are highly adaptable.

Identification:

Feral rabbits come in a variety of colours from white, black, brown to a combination and do not change colour with the seasons. Typically have a beige ring around the eyes. Ears are smaller and legs are shorter than hares. Usually weigh between 2-5 lbs and measure 35-50 cm in length.

Economic Impact:

Overgrazing can become an issue in areas where feral rabbits are present. This can impact agriculture from crop revenue losses, as well as urban gardens and landscaping maintenance costs from rabbits gnawing on trees and shrubs and stripping bark. Due to their high rate of reproduction, once they have been established it is very hard to control rabbit populations, and control methods require large amounts of time and money to achieve. The Town of Canmore spent up to $50,000 per year hiring contractors to trap and euthanize feral rabbits.[5]

Environmental Impact:

Feral rabbits can have a detrimental impact on native flora by overgrazing, leading to soil erosion and biodiversity loss. They gnaw on the bark of woody plants in the winter when no green growth is available and can do significant damage by girdling young stems or nipping off all the buds and shoots. Their burrowing can cause land degradation and erosion. These adaptable herbivores have become

Feral Rabbits *(continued)*

invasive in the local ecosystem, outcompeting native herbivores for food resources and altering vegetation dynamics. Their prolific breeding exacerbates the problem, leading to overgrazing of plant species. This disruption can result in the loss of biodiversity, affecting not only plants but also the insects and animals dependent on them. Their large numbers often support increased populations of predators that can then harm native prey species, and they experience higher than normal predation.

Sociological Impacts:

Feral rabbits can carry diseases such as tularemia and myxomatosis, which may pose a risk to other wildlife and domestic pets. Alberta populations have been dealing with outbreaks of rabbit haemorrhagic disease[3], a highly lethal and infectious virus that could begin to spread to native rabbit and hare species. If you see a potentially diseased rabbit, please report it to your local veterinarian or the Goverment of Alberta Wildlife Disease Unit.

Prevention:

Don't Let It Loose! The best way to prevent further spread of feral rabbits is to spread awareness about the dangers of releasing pets into the wild. Releasing a pet of any kind into the wild is illegal in Alberta and can be subject to a fine. Report feral rabbit sightings and issues to your municipality or on EDDMapS.

Areas can also be modified to discourage and exclude rabbits.[4] By removing unnecessary undergrowth, a key area for shelter, it will discourage rabbits from moving in. Mechanical barriers are most effective at protecting vegetation. Mesh fences should be at least 1m high for vegetation, and 1m above the potential snow line for protecting trees or shrubs. Fences should also be set 7-10 cm into the ground to prevent rabbits from digging underneath. Hardware cloth can make a good barrier as well and should follow the same guidelines. Avoid placing any barriers directly against vegetation as rabbits can reach through the holes to feed.

Control:

Native rabbits and hares can be hunted at any time of year in appropriate hunting areas of Alberta without a license.[4] It is illegal to poison rabbits or use leg-hold traps to catch rabbits in Alberta. Live trapping can be used to remove rabbits from an area but must be done humanely. Wooden box traps work well and should be placed in areas sheltered from the weather and should be checked regularly (at least once per 24 hours if food and water are provided in the trap). Repellents can be used to make plants distasteful to rabbits with varied success depending on how much competition there is for food in your area. Animals and humans cannot consume repellent-treated plants. Two chemical repellents are registered for use in Alberta, both sold under the name SKOOT.[4]

Nicki Perdue, City of Calgary

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Last Updated January 2014

Norway Rat

Rattus norvegicus

Provincial Designation:
Pest

Kim Lutz

Kim Lutz

Overview:

Norway rats travelled to North America on ships that sailed from Europe in the 1700's. Some sources say they may have originated from Asia and have since infiltrated the rest of the globe except the north and south poles, Alberta, and a couple of small islands that are working to eradicate rats in New Zealand and the Aleutian Islands. In Alberta, Norway rats and any species with the Genius "*Rattus*", are listed as "Pests" in the Agricultural Pests Act and its Regulations. This means land owners and local government shall work to prevent infestations, and control or destroy invasive rats in the province.

Norway rats are non-native species that spread and reproduce at a rapid rate because females can produce offspring every 21 to 23 days in litters of up to 12 young. In one year a female rat can have up to 15,000 offspring. Norway rats can live up to 4 years of age. Alberta has maintained a "rat-free status" since 1937 because there are no residential populations of Norway or Roof rats in the province. Any rat infestations are controlled and eradicated. Along the Southeast corner of the Alberta border there is a 30 km long "rat control zone" where the province and local government work to control any Norway or Roof rats from entering into Alberta from Saskatchewan. Their movement is also blocked by the Rocky Mountains on the west border and sparse human distribution on the north and south borders where farms are spread out from one another. In 2004 the Alberta Research Council determined that Alberta saved $42.2 million/year in economic and environmental damages from invasive rats by maintaining a Provincial Rat Control Program that costs about $300,000 in toxicants and labour each year.

Economic Damage: Norway rats will forage on small livestock (poultry and sometimes young swine). They also eat agricultural crops or grain in storage bins which results in loss of revenue for farmers who are to not be able to sell contaminated grain containing rat feces. If rats get inside buildings where food is kept they can decimate food stores in homes, businesses, or on farms. Rats have the ability to chew 2 to 3 inch holes through walls, floors, doors, etc. made of different materials. They are very destructive to buildings and infrastructure as they weaken structures piece by piece by creating small holes in large numbers when rat populations are high.

Sociological Damage: Norway rats can carry diseases, parasites, and pathogens which can directly and indirectly affect human health. Direct contact includes rat bites or contaminated food and water sources. Humans that have been bitten by rats are susceptible to being infected with a bacterial infection called rat- bite fever. Human food or water sources that have been contaminated with rat urine, feces, or saliva can transmit the following diseases to humans: Salmonellosis, Leptospirosis, Trichinosis, Hemorrhagic fever with renal syndrome, and Lassa fever. Indirect spread of diseases to humans comes from mites, fleas, or ticks that have been in contact with rats. Some examples of these diseases are the Plague and Murine Typhus Fever. Rats also cause stress for humans because of their threat of carrying diseases and their destruction of property (chewing of electrical wires, walls, etc.).

continued next page

Norway Rat (Continued)

Environmental Damage: Norway rats are omnivores meaning they eat vegetables and meat. Their goal is to eat as much protein as they can access such as fish, birds, insects, and small mammals when living away from humans. They can be destructive to desired native wildlife populations and therefore must be controlled to prevent this from happening. They have decimated a native bird population in the Aleutian Islands on Rat Island. Rats tend to live close to water sources that can provide them with drinking water as they need at least 1 tablespoon of water per day. They also need about a 0.5 lb. of food per day to survive. This means they typically live on shorelines or near water sources used by humans.

Habitat:

Norway rats will live anywhere they can find food, water, and shelter where they are safe from cold winters. They are capable of living in the wild or among humans as long as they have tall grass or buildings and debris that provides them with cover so they can remain unseen. Invasive rats are most commonly found in landfills, grain storage bins or hay bales, and in basements of buildings.

Identification:

Weight: Adult male Norway rat's average weight is 1 lb.

Length: 17 cm tail. Longer body and head than tail length.

Colour: Coarse sandy brown to gray hair on body, grey to yellowish belly, and hairless and leathery light brown tail.

Characteristics: Hairy body. Leathery looking cylindrical tail with short wiry hairs.

Similar Looking Species[1]: Roof rat (*Rattus rattus*). Shorter head and body than tail which is longer than both. They also prefer to eat more of a vegetarian diet compared to the omnivore Norway rats.

Prevention:

The best way to prevent an infestation of rats is to report it to local authorities as soon as possible, especially in Alberta where we are trying to maintain our "rat-free status". Invasive rats move into an areas for one or all of the following reasons; food (grain, garbage), shelter, and water. There are a number of things you can do to prevent them from finding your home and yard desirable habitat. Make your home or farm less desirable place for them to live by storing food or grain in sealed containers, construct warehouses and grain bins with cement flooring that they can't chew through, dispose of garbage in animal proof bins, clear your yard of debris that they can hide in or under, rotate hay bales or grain on site so they cannot establish themselves within them, and clean up spilled grain or garbage that may lure them into the area.

Report Sightings:

In Alberta all rat sightings should be reported to the following agencies starting from top to bottom if you cannot get a hold of the first contact in this list:

1. Call 310-FARM (3276) and the Alberta Agriculture & Rural Development switchboard will direct you to the correct contact for the Rat Control Program.
2. Or call your Municipal District or County Agriculture Department. Contact their Agricultural Fieldman who work in conjunction with the Provincial Rat Control staff.
3. Or call your local Municipal Bylaw Officers or Peace Officers. They will know who to get a hold of the correct provincial contact or may even have their own protocol.

Control:

Some registered anticoagulant products in Alberta are Warfarin, Chlorophacinone, Diphacinone, Bromadiolone, Brodifacoum, and Difethialone. Other registered lethal toxicants in Alberta include: Bromethalin, Rodetrol, and Zinc Phosphide. Strychnine is also available to farmers which is to be placed in rat bait stations. Farmers must contact their local Agricultural Fieldman at their County or Municipal District office to register and obtain Strychnine for rat control. Infestations in cities or towns should be reported to municipal authorities.

Links for more information:

Alberta Agriculture & Rural Development – Rat Control Program

http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/com14443

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Potential impacts of climate change on the habitat of boreal woodland caribou

17 October 2018
Ecosphere
Volume 9, Issue10

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Wildlife species are undergoing range shifts and facing extirpation as climate change erodes historical habitat and simultaneously opens up new environments to migrant species (Parmesan and Yohe 2003, Colwell et al. 2008). Accelerating climate change (IPCC 2013) thus presents a challenge for land managers seeking to conserve habitat, especially as climate change often acts in concert with anthropogenic modifications to land cover to reduce available habitat (Forister et al. 2010). Although the impacts of climate change are frequently assessed, the interaction between disturbance and climate change is rarely considered. This is particularly important in biomes such as the boreal forest, where wildfires are strong determinants of landscape structure (Burton et al. 2009). As such, habitat models that incorporate climate change and disturbance can be a powerful tool for informing long-term conservation decisions (Cáceres et al. 2013).

The Canadian boreal forest (hereafter, the "boreal forest") covers approximately 3.09 million km2 and is characterized by recurrent large wildfires. Climate change is likely to raise the mean annual temperature of the boreal forest by at least 2°C by the 2050s and up to 5°C by 2100 (Price et al. 2013), particularly if greenhouse gas emissions approximate the relative concentration pathway (RCP) 8.5 emission scenario (IPCC 2013). Climate change in the boreal region will also lead to earlier snowmelt, moderate increases in summer precipitation, and greater drought frequency (especially in western regions; Lemke et al. 2007, Price et al. 2013). These changes will likely translate into widespread increases in fire frequency and annual area burned (Flannigan and Van Wagner 1991, Flannigan et al. 2013, Boulanger et al. 2014), which may lead to persistent changes in boreal forest ecosystems (Price et al. 2013, Johnstone et al. 2016). Wang et al. (2017) have projected increases between 50% and 100% in the incidence of days with fire-conducive weather in the western boreal forest, and up to 150% elsewhere in Canada.

The response of boreal forest ecosystems to climate change will be complex and likely lead to the emergence of novel ecosystems (Schneider et al. 2016). It is often assumed that vegetation types will track the movement of historical climatic niches, although this represents a long-term outcome that does not account for time lags in ecosystem transitions (Schneider et al. 2009). The boreal forest in Alberta, Canada, is comprised two dominant terrain types: uplands characterized by a mixture of aspen (Populus tremuloides), white spruce (Picea glauca), and jack pine (Pinus banksiana), and lowlands characterized by extensive peatlands, tamarack larch (Larix laricina), and black spruce (Picea mariana). In upland areas, resistance to vegetation change is largely due to the resilience of mature trees to climatic variation. Therefore, vegetation change will occur primarily where disturbance events, including wildfire and insect outbreaks, cause widespread tree mortality (Johnstone et al. 2016, Schneider et al. 2016, Hogg et al. 2017). This change may occur rapidly (Foster et al. 2006, Frelich and Reich 2010), and a shift from late-successional conifers to early-successional conifers and broadleaf species is already occurring in the wider Canadian boreal (Searle and Chen 2017).

Compared to uplands, peatlands are relatively resilient to climate fluctuations due to their ability to retain large volumes of water (Waddington et al. 2015). Negative feedbacks with peat decomposition, moss productivity, and moss surface resistance moderate water table decline in these systems (Waddington et al. 2015). The water table feedbacks inhibit vegetation change, which may allow peatlands to act as hydrologic refugia in spite of significant climatic warming (Price et al. 2013, Schneider et al. 2016). While peatland vegetation transition will undoubtedly occur in areas of shallow peatland depth (Kettridge et al. 2015), widespread vegetation regime change will likely take centuries (Schneider et al. 2016). This will be important for the Alberta boreal woodland caribou (Rangifer tarandus caribou), who depend on peatlands for foraging and predator avoidance (Bradshaw et al. 1995, Stuart-Smith et al. 1997, McLoughlin et al. 2003, James et al. 2004).

Boreal populations of woodland caribou are threatened throughout their Canadian range and protected under the federal Species at Risk Act (Festa-Bianchet et al. 2011, Government of Canada 2017). In Alberta, populations of boreal caribou are demonstrating relatively steep declines in abundance (Hervieux et al. 2013). Rapid and widespread industrial development, including oil-and-gas exploration and extraction, forestry, and mining, results in the displacement of caribou, a reduction in habitat, and an increase in the distribution and abundance of predators (McLoughlin et al. 2003, Latham et al. 2011b). Changes in the predator–prey dynamic are the result of apparent competition (Holt 1977) between caribou and other ungulates, where early-successional habitats resulting from industrial activities increase the distribution and abundance of white-tailed deer (Odocoileus virginianus) and moose (Alces americanus; Alberta Sustainable Resource Development and Alberta Conservation Association 2010, Festa-Bianchet et al. 2011). Greater numbers of deer and moose lead to an increase in wolf (Canis lupus) populations, the primary predator of caribou (McLoughlin et al. 2003, Latham et al. 2011a). In addition to more wolves, industrial activity in the form of roads and seismic lines facilitates an increase in the distribution and movement of wolves, leading to incidental predation of caribou (Latham et al. 2013, DeMars and Boutin 2017, Dickie et al. 2017). Black bears (Ursus americanus), a secondary predator of caribou in western Canada, also benefit from early-successional plant communities and greater biomass of deer and moose (McLoughlin et al. 2003, Latham et al. 2011c). Caribou also encounter greater insect harassment in these early-successional forests (Raponi et al. 2018), and expansion of these habitats could have unpredictable consequences on caribou insect-avoidance behavior.

A warming climate has a number of potentially negative consequences for caribou, including loss of forest habitat (Schneider et al. 2009), increased predation (Bergerud and Luttich 2003, Latham et al. 2011b), and increased prevalence of diseases (Pickles et al. 2013). Whereas white-tailed deer were historically at the northern limit of their range in the study area, vegetation change in conjunction with decreasing winter severity and snow depth could greatly increase their distribution and population density (Dawe et al. 2014, Dawe and Boutin 2016). A greater number of white-tailed deer would likely increase the abundance and distribution of wolves. Furthermore, the northerly expansion of white-tailed deer has the potential to expose caribou to new pathogens, including meningeal worm (Parelaphostrongylus tenuis) and chronic wasting disease, both of which could greatly increase caribou mortality (Cumming 1992, Pickles et al. 2013).

Boreal caribou in Alberta and other areas of western Canada strongly select for peatland complexes, in particular fens and bogs (Bradshaw et al. 1995, Stuart-Smith et al. 1997, James et al. 2004, Mumma et al. 2017). This is likely a strategy to mitigate predation risk associated with the distribution of deer and moose (Stuart-Smith et al. 1997). Although caribou generally avoid uplands, caribou in Alberta are sometimes found in upland coniferous forests (Bradshaw et al. 1995, McLoughlin et al. 2005, Muhly et al. 2015). This may be a response to seasonal limitations in nutrition or an inability to assess increased predation risk in those areas (McLoughlin et al. 2005, Denryter et al. 2017). Climate-induced changes in the distribution of wetland or upland communities could have implications for rates of predation and the availability of forage for boreal caribou.

Wildlife Study Resources

Key Topic #4: Wildlife Field Techniques

15. Identify common local wildlife species from preserved specimens, skulls, skeletons, pelts, tracks, scat, and other animal signs without the use of a key.

16. Explain how the wildlife monitoring practices below are conducted and how they inform conservation and management decisions in Alberta:

    a. Bat Surveys

    b. Bird Nest Sweeps

    c. Camera Traps

    d. Audio Recordings

    e. Population Estimates

    f. DNA Sampling

17. Use a field guide or dichotomous key to identify uncommon wildlife species.

Study Resources

Resource Title	Source	Located on Page
Inside Alberta's biggest bat cave, *VIDEO*	*CBC News, YouTube, 2025*	77
Using Camera Arrays to Measure Effects of Management Responses in Alberta	*Herdman, Emily, InnoTech Alberta, WildCam Blog Post, October 2023*	78
Can you hear me now? Using remote technology to record birds and other wildlife	*NCC staff, Nature Conservancy of Canada (NCC), 2017*	81
Inventory and Monitoring	*Government of Canada, 2021*	84
Snow DNA Reveals New Way to Track Animals in Winter | Short Film Showcase, *VIDEO*	*National Geographic, 2018*	86

Video – Inside Alberta's biggest bat cave

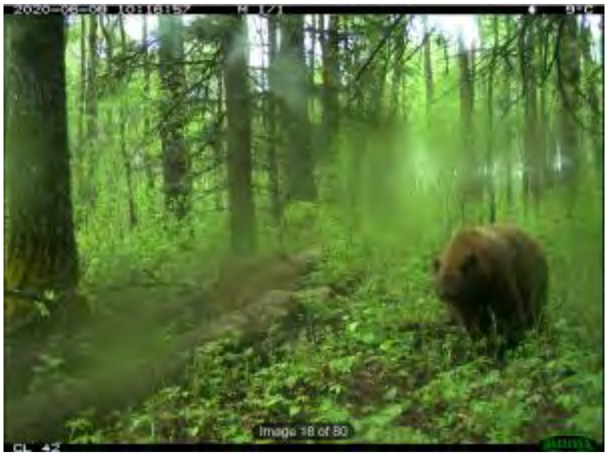
https://youtu.be/xD41n2LKWwU?si=FGVQCpLzy3tCD69H

Using Camera Arrays to Measure Effects of Management Responses in Alberta

This spring, InnoTech Alberta wrapped up a 4-year project that used remote camera arrays placed across Western and Northern Alberta to collect long-term data on a broad range of species to acquire insight into the impacts of development and recreation on wildlife. With over 250 camera locations, 4 arrays, and thousands camera images of a broad range of species, this project required a lot of days in the field for staff and students! One of the key intentions of the project was to assess how we can use camera-trap arrays to understand how wildlife changes its behaviour in relation to development and recreation pressures and wildlife management initiatives.

Innotech Alberta

The first study was completed by Gonçalo Curveira Santos, who focused on the impacts of development on mammal populations in the boreal forest, particularly on woodland caribou [Rangifer tarandus caribou]. We first collected data was collected on the main “players” in the mammal community (e.g., gray wolf [Canis lupus], moose [Alces alces], bear [Ursus sp.], Canada lynx [Lynx canadensis], snowshoe hare [Lepus americanus], and white-tailed deer [Odocoileus virginianus]). We then used this data to assess the impacts of disturbance on the use of different sites by predator and prey species, as well as their potential interactions. For instance, wolves’ use of certain locations might change in response to development; if their use increases, it may reduce the time bears spend in the area. These relationships quickly become complex and are further impacted by the fact that relationships appear to vary depending on the cumulative amount of disturbance.



Innotech Alberta

This complexity indicates that wildlife managers should move beyond the narrow focus of threatened species (in this case, caribou) to consider the more complex effects that human disturbances may cause in boreal mammal communities. We believe that the best management strategies to pursue will vary depending on landscape conditions. The fact that there were more effects in the intermediately disturbed landscape suggests that context-dependent responses by wildlife necessitate different management actions in lower vs. higher disturbance areas.

The second study was by Solène Marion, who aimed to understand the impacts of recreation on wildlife site use in the eastern portion of the province. Recently, recreational use of many kinds has increased in this area, particularly since the start of the COVID-19 pandemic. While we found limited evidence for strong or consistent effects of recreation on mammal space use, rather, the interaction between recreation and other factors related to the local context (e.g. trail designation, forest cover). The strongest interaction was between trail density and management type, suggesting that limiting the density of trails may be necessary to reduce the negative impacts on mammals within conservation areas. This study also identified that it is essential to use multiple measures of recreation to have a fuller picture of the impact of human recreation.

Wildlife responses to recreation are complex, and so is the challenge of balancing recreation opportunities with wildlife conservation. It follows that an adaptive management approach that ensures coexistence between outdoor recreation and wildlife should consider multi-species monitoring across landscapes that vary in recreation pressure.

Innotech Alberta

The data collected in this project will be further leveraged by Alberta Environment and Protected Areas in wildlife monitoring work (e.g., wolverine) and by Erin Bayne (University of Alberta) in research looking at the opportunities of leveraging multiple sources of camera data to answer questions at broader geographic scales. We are also open to further use of the data we have collected to date.

Written by Emily Herdman, Supervisor, InnoTech Alberta (emily.herdman@innotechalberta.ca). Research was a collaboration with Cole Burton's lab at the University of British Columbia (cole.burton@ubc.ca) and his postdocs at the time - Solène Marion (solene-marion@orange.fr) and Gonçalo Curveira Santos (gcurveirasantos@gmail.com).

Can you hear me now? Using remote technology to record birds and other wildlife

November 29, 2017 | by NCC staff

In various Nature Conservancy of Canada (NCC) properties across Alberta, the secret lives of wildlife are being discovered using camera traps, sound recording units and other technology. Scientists are generating new and valuable data on wildlife and their behaviour, which may be among our best tools for better understanding the conservation needs of species at risk.

Black bear captured by camera trap (Photo by NCC)

Camera traps and autonomous recording units deliver unexpected results

To capture the sights and sounds of wildlife on NCC's properties in Alberta, Craig Harding, NCC's manager of conservation science and planning, and his team have been setting up camera traps and autonomous recording units (ARUs).

Harding and his team aren't working alone, however. The Alberta Biodiversity Monitoring Institute (ABMI) and the University of Alberta's Bioacoustic Unit are the driving organization behind a project to capture data from across Alberta, using a standardized approach to biodiversity monitoring. They are achieving this by using new technology and partnering with organizations like NCC to collect the data.

An ARU mounted on tree. (Photo bv NCC)

While camera traps are remotely activated cameras typically triggered by a motion sensor or an infrared sensor, an ARU, like the Wildlife Acoustics-brand SM4, SM3 and SM2 units used by ABMI, are sophisticated audio recording devices. "We set them up in a box and program them to come on however many times we want, for as long as we want," says Monica Kohler, regulatory efficiencies unit manager for ABMI. "For example, during the breeding bird season, we can set them to come on in the morning when most birds are singing. Most frogs call in the evening, so we can set the units to start recording at dusk."

Kohler explains that ARUs and camera traps have changed the way conservation scientists monitor wildlife habitats. "We collect data from a network of different organizations using ARUs for their own purposes. That's where NCC fits in — it contributes data so we can understand on a province-wide scale how species are changing over time." Typically, ARU data is used for bird and frog observations, while camera traps are used to track mammals.

Camera traps being set up. (Photo by NCC)

ARUs capture valuable bird data

Harding says ARUs deployed by NCC during 2016 provided an incredible, audible view of bird life. “Some birds will fall silent when anyone is there, so using technologies that allow you to listen to the sounds of nature without physically being there provides you with information you can’t get any other way.”

The information gained from ARU recordings also offers a good baseline assessment, according to Harding. “We get a huge collection of birdsong and some frog identification from the data. While we aren’t trying to target specific species, the analysis of the data by ABMI provides us with a baseline inventory of breeding birds. This information can help to guide our management of the property, and to monitor the health of the habitat.

Recording natural animal behaviour with camera traps

According to Harding, camera traps are used to observe animals in the wild without interference. “This method of gathering data allows animals to be animals. If people are there, they will affect the behaviour of the wildlife. With a camera trap in a strategic location, we can observe animals in their natural habitat. Typically, we capture medium to large mammals in photographs; small animals can be too small to be recorded unless they are close to the camera traps.”

For its part, ABMI uses high-end Reconyx PC900 Professional Covert Cameras for optimal image capture. Since these cameras also work at night, nocturnal wildlife, not often seen during the daytime, can often be observed. “We’ve seen lynx, cougar, fishers, badgers. In the past, we may have seen scat or scratch marks from these animals, but that was all. With camera traps we can better assess the health of the animal and count the number of individuals,” says Harding.

Acoustic data gathered by NCC and ABMI using ARUs is analyzed by the Bioacoustic Unit at the University of Alberta, by a team led by Erin Bayne. It is then returned to ABMI for use in modelling. NCC also receives an annual report of all species identified using these methods. Harding says, “Our role is data collection. ABMI’s is mostly data analysis and mapping.” For NCC staff, part of the reward and excitement is found when unexpected or seldom-seen species are observed.

First time observations – badgers in Collins and elk further east

Located near Red Deer, Alberta, NCC’s Collins property consists of 155 acres (63 hectares) of gently undulating land featuring numerous water bodies, aspen and shrub lands. The area hosts abundant waterfowl as well as mule deer, coyote, moose, raptors and songbirds.

About a decade ago, the NCC team found evidence of what was suspected to be American badgers on the Collins property. Recently, a camera trap confirmed the badgers' continuing presence. It was an exciting observation. "We now have photographic confirmation that badgers are present on that property," says Harding. The 2016 data also showed elk much further east on the Collins property; a new observation for NCC at that location.

Camera trap image
(Photo by NCC)

When camera traps and ARUs capture imagery or sounds of at risk-species on any NCC property, NCC staff are able to adjust their conservation activities to provide appropriate protection. For example, grazing programs can be implemented to help support some species. Or, on properties where hay is cut and baled, NCC could recommend delaying hay collection during the breeding season of the identified species.

Data analysis: the biggest hurdle with camera traps and ARUs

The sheer volume of data collected from ARUs and camera traps that needs to be sorted and analyzed is a major challenge that falls largely to Erin Bayne of the University of Alberta's Bioacoustic Unit, with support from ABMI. For camera images, ABMI uses automated data processing technology that differentiates vegetation from animal pictures, and helps assist human analysis. From there, data is also run through "AutoMoo," a program that removes pictures of cows since they are not animals of interest for ABMI, and there are many of them in Alberta that are caught on camera traps.

Soon, a program called Wildtrax will be used to supplement ABMI and the University of Alberta's Bioacoustic Unit's resources. Kohler explains that Wildtrax can help address the gargantuan task of pulling out viable images and sound files from the data. "Anyone who wants to use cameras or ARUs can upload their data and store it within Wildtrax. With audio recordings, it shows you a spectrogram of the sound, so you can watch visuals at the same time and quickly tag a species. The same is true with the image files. It has batch tagging software, so if you have many pictures of one particular animal, you can tag them all at the same time," says Kohler.

The first release of Wildtrax is now underway, with testing being undertaken by partners such as NCC. When fully ready, Wildtrax will be made available to the public, so that interested people can tag pictures and contribute to data analysis efforts. This crowdsourcing of the large task of data analysis will give the public a chance to get involved in the work of protecting species at risk.

Inventory and monitoring

A Parks Canada staff member setting up trail cameras for monitoring, Grasslands National Park.

Two steps are involved in managing any system:

- knowing what's there
- checking on its status from time to time

…In other words, inventory and monitoring.

Inventory

Each park has a list of the plant and animal species that occur there, and these species are tracked using the Biotics Web Explorer. Specialized inventories take place to keep track of species at risk as well as hard-to-identify groups like insects.

Parks Canada also uses satellites and drones to update maps of plants and landforms. In addition, citizen science activities provide valuable species information that supports inventory work.

A grizzly bear and three cubs, Glacier National Park

Monitoring

Ecosystem monitoring measures changes in ecosystems over time. At Parks Canada, we manage ecosystems to maintain or restore ecological integrity (EI). The Agency reports on ecological integrity in each park to show where more effort is required.

- Ecological integrity of national parks

Each park identifies 2–4 ecosystems (e.g. forest, freshwater, tundra) and selects 5 of the best indicators of how each ecosystem is doing. Each ecosystem must have at least:

- one species indicator (e.g. number of songbirds)
- one process indicator (e.g. fire frequency)
- one indicator of a stress on the ecosystem (e.g. water quality)

Most indicators are measured every year, though some, like forest cover, change slowly and are only revisited every decade.

Eastern hognose snake, Georgian Bay Islands National Park.

Each indicator is judged to be in good, fair or poor condition by comparing it to the relevant feature of a healthy ecosystem. For example, in assessing their species indicator, parks staff might find far fewer songbirds than would be expected for a healthy ecosystem of that region. In that case, the indicator would get a “poor” ranking. The same comparison is done for all indicators, from water quality to fire frequency. Each monitored ecosystem is judged to be in good, fair or poor condition based on the average of its indicators.

Ecosystems that are in better condition than 5 years ago are considered to be improving, while those that are in the same condition are considered maintained. Parks Canada is working to maintain or improve 92% of its ecosystems by 2023.

Video - Snow DNA Reveals New Way to Track Animals in Winter | Short Film Showcase

https://youtu.be/fjSHHCQ-VP4?si=ZrOQ26i8ecQyZ7A4