



New Jersey School of Conservation

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Beaver Ecology

This field investigation of the beaver (*Castor canadensis*) concentrates on adaptations, ecological relationships, and the general life history traits of this species. Participants will have the opportunity to get a close-up look at a preserved beaver specimen, to discuss a brief historical overview of beavers in New Jersey, and to hike to a former beaver pond where beavers once lived. In the field, evidence of the beavers' influence on the natural landscape will be observed. In conclusion, participants will compare the beaver's impact on the environment to human impact on the environment.

OBJECTIVES:

1. To give students a comprehensive overview of a unique wildlife species and its influence on the environment.
2. To demonstrate how the natural history of the beaver governs not only its own survival, but also the survival of other species of wildlife.
3. To compare the ecological influence that the beaver has on its environment with that of human populations and suggest ways that humans might alter their living habits to enhance existing biodiversity.

PREPARATION:

The teacher should review the attached *Beaver Fact Sheet*. During or before class, help students understand meanings of the following key vocabulary words:

Adaptation, biodiversity, carrying capacity, conservation, density, ecosystem, edge effect, environmental impact, habitat, herbivore, home range, niche, renewable resource, succession.

MATERIALS NEEDED:

- Preserved beaver specimen and skull
- *Beaver Fact Sheet*
- Logs and sticks that exhibit evidence of beaver activity

PROCEDURE:

1. Have the students gather around the preserved beaver specimen and share what they know about beavers or ask questions about beavers. Supplement the discussion with information from the *Beaver Fact Sheet*.
2. Hike to the remnants of our local beaver pond communities along the Spring Cabin Trail and the Green Darter Trail.

3. On the way to the beaver pond, point out as many features of the natural landscape as possible. Potential examples will include twigs browsed by deer, nuts carried and chewed by squirrels and chipmunks, burrows dug by voles, holes bored into trees by woodpeckers, etc. The SOC instructor will help to familiarize you with these sightings.
4. Once at the old beaver pond, have students locate the features typical to a habitat transformed by beavers, such as dead trees, a stream, and a meadow-like field. Then encourage students to comprehend the magnitude of the changes the beaver has created in the area. Finally, begin to point out some features that show how the beavers' activities have enhanced the environment for a variety of other species. The pond environment established by the beaver is home for a much greater and diverse population of wildlife than existed before the pond was created. In addition, the sequence of ponds that beavers create along a stream watershed help to moderate the flow of water during periods of heavy precipitation to prevent flooding and soil erosion. Discuss all the wildlife species that are impacted by the beaver's activity, including those species that continue to benefit long after the beaver has abandoned the site.
5. Review and summarize before returning to campus. On the way back, look for examples of human changes and discuss the impact that these types of changes might have on the environment (i.e., paved roads, woods trails, tree-cleared areas, etc.).

WRAP-UP:

- The highly evolved behaviors that govern the survival of the beaver are generally those that *sustain* the ecological integrity and harmony of the natural community in which it survives. The beaver *perpetuates* rather than destroys the environment in which it lives.
- Conclude with a discussion of how humans alter their environment just like the beavers do; however, our alterations to the environment usually have a negative effect on other species. Discuss the importance of creating ecologically responsible human communities and setting aside natural areas, such as Stokes State Forest, for other species.

VARIATIONS:

If time permits, while at the pond site, have small sub-groups try to construct miniature *models* of beaver dams or lodges using small dead twigs and mud gathered from the immediate locale. This activity can impress upon the students the adaptive skills needed by the beaver to build its various structures as well as the recyclable nature of all of the materials that it uses.

FOLLOW-UP:

Have students look for evidence of beavers in their own home communities or areas and determine: 1) the *impact* they are having on the surrounding environment and 2) public *perception* of that impact (i.e., is it perceived as positive or negative impact?)

GLOBAL EXTENSIONS:

Have students research the kinds of human activities on the planet that have adversely affected native species.

NJ Student Learning Standards

This field lesson touches upon the following NJ Science Performance Expectations and can be tailored to focus on any of the following standards

MS-LS2: Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

- MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-ESS3: Earth and Human Activity

Students who demonstrate understanding can:

- MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Climate Change

- MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Social Studies

- 6.1.8.Civics.PI.3.c Distinguish the powers and responsibilities of citizens, political parties, interest groups, and the media in a variety of governmental and nongovernmental contexts.
- 6.1.8.Econ.NE.4.a Explain how major technological developments revolutionized land and water transportation, as well as the economy, in New Jersey and the nation.

Comprehensive Health and Physical Education

- 2.2.8.MSC.7 Effectively manage emotions during physical activity (e.g., anger, frustration, excitement) in a safe manner to self and others.
- 2.3.8.PS.1 Assess the degree of risk in a variety of situations, and identify strategies needed to reduce deliberate and non-deliberate injuries to self and others

Scientific and Engineering Practices / NGSS

This field lesson can be tailored to have students directly involved with

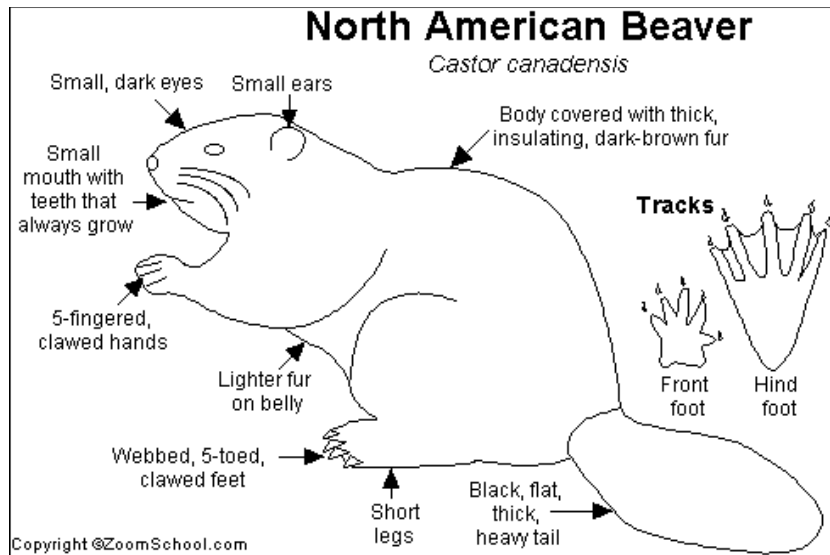
- Asking Questions and Defining Problems
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information

Social and Emotional Learning

All of our field lessons integrate the concepts of self-awareness, self-management, social awareness, responsible decision-making, and relationship skills found in the [New Jersey's Core Social and Emotional Learning \(SEL\) Competencies](#).

Beaver Fact Sheet

The Body of a Beaver



- Beavers are mammals and give birth to live young, have hair or fur, and nurse their young. They are members of the order of mammals known as rodents.
- North American beavers are 3-4 feet long, including the tail, and weigh from 40 to 95 pounds. One beaver, trapped in Canada, weighed over 100 pounds! Female beavers tend to be larger than male beavers of the same age. Unlike most mammals, beavers keep growing throughout their lives. Most beavers look larger than they really are because of their humped backs and thick fur.
- Beavers are the largest rodents (gnawing animals) in the world, except for the capybara of South America.
- Thousands of years ago, some beavers of North America were about 7.5 feet long, including the tail—almost as long as grizzly bears! These giant beavers may have disappeared due to overhunting when humans arrived in North America.

The Head

- The beaver has a broad head with large, powerful jaws. The beaver's three main senses are hearing, smelling, and touch. The beaver's ears, nose, and eyes are all located on the upper third of its head, which is the only part of the beaver's body that is not submerged when swimming.
- The beaver's rounded ears and small nostrils can close tightly to keep water out—they have valves in their ears and nose that close automatically when they submerge.
- A beaver has three eyelids on each eye. Two outer eyelids—one upper and one lower—fit around the eye, as in humans. A transparent inner eyelid slides down over the eye, like goggles, to let the beaver see underwater. On land, this inner eyelid protects the beaver's eyes from sharp twigs when the animal cuts trees.
- Beavers cannot see well, and they depend on their keen hearing and smell to warn them of danger.

The Teeth

- A beaver has 20 teeth: 4 strong, curved front teeth for gnawing and 16 back teeth for chewing.
- Beavers, like all rodents, have incisor teeth that grow for their entire lives. These teeth have a hard outer enamel and a soft inner dentine. The outer enamel is bright orange.
- When a beaver gnaws, the back part of its incisors wears down much more quickly than the front covering. As a result, their incisors have a sharp, chisel-like edge. The incisors never wear out because they keep growing throughout the animal's life.
- The back teeth have flat, rough edges and stop growing when the beaver is about two years old.
- There are large gaps between the beaver's incisors and its back teeth. Flaps of skin, one on each side of the mouth, fold inward and meet behind the incisors. These skin flaps seal off the back of the mouth. They allow the animal to gnaw wood on land or in the water without getting splinters or water in its mouth. The flaps open when the beaver wants to eat or drink.

The Fur

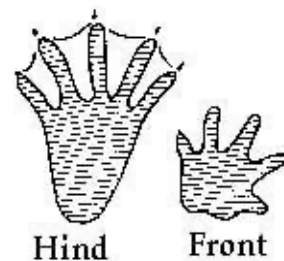
- Beaver fur varies from shiny dark brown to yellowish-brown. It looks black when wet.
- Beaver fur is composed of two kinds of fur. The short, soft underfur traps air and holds it close to the animal's skin, helping to insulate the beaver even in cold water. The long, heavy guard hairs cover the underfur to protect it and keep it dry.
- Beavers help others in their families to rub oil over their fur to waterproof it. This oil comes from a small balloon at the base of their tails.

The Tail

- The tail of a beaver is one of the animal's most interesting features. The stiff, flat tail looks like a paddle. It is about 12 inches long, 6 to 7 inches wide, and 3/4 inch thick.
- A small part of the tail nearest the beaver's body is covered with the same kind of fur as is the body. The rest is covered with black, scaly skin and has only a few stiff hairs.
- Beavers store fat in their tails to help survive the winter.
- The tail is used as a prop, for balance, when the animal stands on its hind legs to eat or to cut down trees.
- The beaver uses its tail to steer when it swims.
- The beaver slaps its tail on the water, making a loud noise, to warn other beavers of danger in the area.

The Feet

- The beaver's legs are short. The beaver's hind feet are webbed and much larger than the front feet at about 6 to 7 inches long. These webbed feet serve as flippers, making the beaver a powerful swimmer and diver.
- The toes of the hind feet end in strong claws. Two claws on each foot are split, and the beaver uses these claws to comb its fur.



- The feet are covered with tough skin and small hairs.
- Each front paw ends in five toes that have long, thick claws. These claws are used to dig up the roots of bushes and trees for food. The front paws are also used when constructing dams and

lodges.

- When swimming, the beaver makes tight fists with its front paws and holds them against its chest. When swimming through underwater brush or grass, the beaver will use its front paws to push the plants aside.

A Beaver's Life

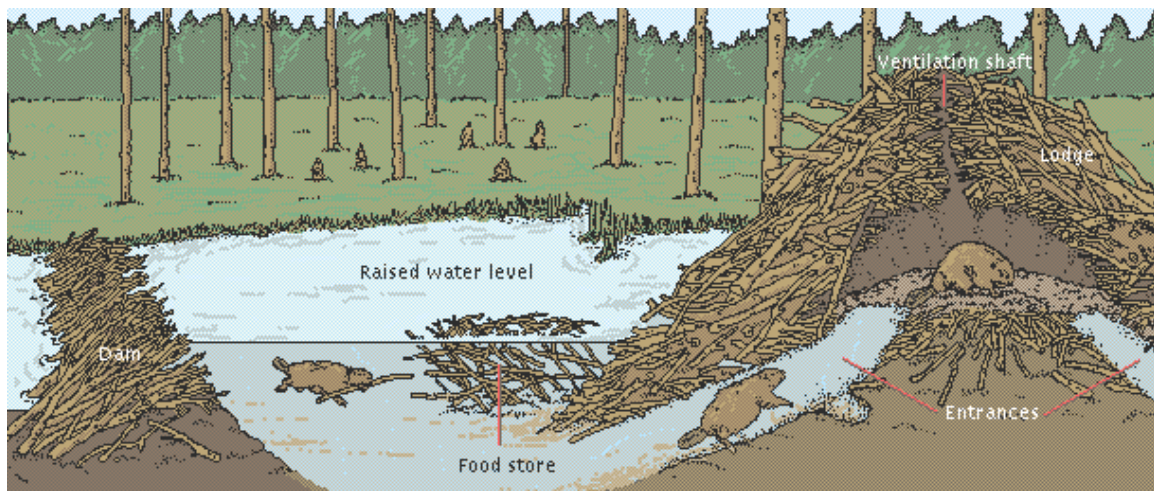
Life

- Beavers live to be about 20 years old.
- Beavers live in family units with a mother and father, new-born infants, and yearlings. There will be up to 12 beavers in a family unit, but normally there are 6 or fewer.
- At the end of two years, young beavers move on to their own territory. They are driven from the family group after two years to make room for the newborn beavers. Beavers rarely fight with each other, except in spring, when the 2-year-olds are driven away.
- A female beaver has a 3-month gestation period. Beavers mate for life. They mate in February and babies are born in April and May. The female will give birth to two to four babies at a time. Young beavers are called kits or pups. A newborn kit is about 15 inches long, including its tail, and weighs .5 to 1.5 pounds. A kit has soft, fluffy fur at birth, and its eyes are open.
- Predators of beavers include bears, otters, wolves, coyotes, fishers, and people. A beaver avoids these enemies by living in the water and coming out at night to eat or work. Beavers are crepuscular—active at dawn and dusk—and may be active at night as well.
- Beavers are strong swimmers and can hold their breath for 8-10 minutes. They will hold their breath for up to 15 minutes when pressed. A beaver can swim underwater for half a mile!

Food

- Beavers are herbivores and eat the inner bark of a tree, called the cambium.
- The cambium is the living tissue of a tree and lies between the bark and the inner wood of the tree. Beavers prefer to eat the cambium from trees like aspen, poplar, cottonwood, willow, alder, birch, maple, and cherry.
- One acre of poplars can support a family of six beavers for one to two years.
- Beavers also eat water plants and sedges. They especially like the roots and tender sprouts of water lilies. In the summer, the beaver will eat a greater variety of plants, including berries.
- Beavers store food for winter use. They anchor branches and logs in an underwater cache near their lodges. In winter, they swim under the ice to reach their food stores.

Dams, Lodges, and Canals



- Beavers alter their habitat substantially and build structures including dams and lodges. Many animals benefit from the habitat that beavers create, including amphibians, wading birds, ducks and geese, and fish. Eventually, the ponds that beavers create will fill in and become rich stream meadows, continuing to benefit other wildlife species.
- A beaver uses its strong front teeth to cut down trees and to cut off the branches and peel off the bark. To cut a tree, the beaver stands on its hind legs, using its tail as a prop. It places its front paws on the tree trunk and turns its head sideways. The beaver then makes two cuts in the trunk, one below the other. These cuts will be farther apart on large trees and closer together on small trees. The beaver will take several bites at these cuts to make them deeper, then pull off pieces of wood with its teeth. It keeps cutting and tearing out pieces of wood around the trunk until the tree falls.
- A beaver cannot control the direction in which the tree falls. It cuts until the trunk starts to break and then runs to safety. The beaver will usually dive into the water nearby and wait there until it is sure that no enemies have been attracted by the noise of the falling tree.
- Once the tree has fallen, the beaver will gnaw the branches off the tree. Then it carries, drags, pulls, pushes, or rolls the log into the water. The logs and branches will either be used to build the dam or lodge, or they will be stored in the cache for the winter months.
- Beavers often work alone, but sometimes several work together.
- A beaver cuts down trees even if it has no place to build a dam or a lodge and even if it has more than enough food.
- A whole beaver family, and sometimes beavers from other families, may join in building a dam. Beaver dams are made of logs, branches, and rocks plastered together with mud. Mud and stones form the base of the dam, and brush and log poles are placed on top and strengthened with mud and wet plants. The poles are placed so the tips lean in the same direction as the water flows to further strengthen the dam.
- Beavers build their dams with their front teeth and front paws. They bring mud from the river bottom by holding it against their chests with their front paws.
- Beavers build their dams so that the top is above the water. Some dams are more than 1,000 feet long! Beavers will keep their dams in good condition for many years.
- Beaver dams are not waterproof and the beavers will constantly monitor the water level, even dropping the water level under the ice to create breathing pockets.
- A beaver lives in a lodge. The lodge looks somewhat like a teepee. A family of beavers

builds its lodge with the same materials and in much the same way as it builds a dam. The lodge may stand on the riverbank or in the water like an island.

- The tops of most lodges are 3-6 feet above the water. Each lodge has several underwater entrances and tunnels, all of which lead to an inside chamber. Here, young beavers can stay warm and dry in winter, and the adults can dry off after bringing in food.
- Holes between the branches in the ceiling let in fresh air.
- The size of the lodge depends on the size of the family and the length of time the beavers have lived there. The animals enlarge and repair the lodge as long as they live in it.
- Beavers will abandon their lodge only if they have eaten all the food in the area or if there are too many predators nearby.
- Beavers that live in large lakes or in swift rivers may dig dens into the banks. These dens, like the lodges, also have underwater entrances and tunnels.
- A beaver marks its territory with castors, small piles of mud mixed with the beaver's scent. The castor glands of beaver are used in making perfume.
- Beavers sometimes build canals to move logs to their dams or lodges easily and quickly. The canals are 12 to 18 inches deep, 18 to 24 inches wide, and may be more than 700 feet long. A beaver canal may extend from a wooded area to a lake or riverbank, or it may cut across a piece of land that sticks out into the water.

The Natural History of a Beaver



The range of the beaver

- Beavers live in rivers, streams, and freshwater lakes near woodlands.
- There are more beavers in the United States and Canada than anywhere else in the world, but beavers are also found in Asia and Europe.
- Beavers were a primary reason that much of North America was explored and settled by Europeans. At the time of European arrival, there were about 60-100 million beavers in North America.
- Beavers were trapped for their fur, which was shipped to England and France to make expensive hats, coats, cuffs, and collars. The fur was so valuable because it was soft, shiny, and durable.
- Beavers were probably the most hunted animals in North America from the late 1500s through the 1800s. The early settlers and Native Americans ate beaver meat and traded furs for items they needed. In the late 1600s, a person could trade 12 beaver skins for a rifle. One beaver skin would buy four pounds of shot, a kettle, or a pound of tobacco.
- Hunters and trappers killed so many beaver that hardly any were left in North America by the late 1800s; the species was nearly extinct. US and Canadian governments passed laws to protect the animals.
- Today, beavers, like many other wild animals, can only be trapped at certain times of the

year.

- Today, there about 10-15 million beavers in North America.

