



# Beaver Ecology

## Program Purpose:

The purpose of this program is to introduce students to beaver adaptations, the beaver life cycle, and to explore the effects of beaver behavior on ecosystems.

**Length of Program:** 1½ hours

**Age:** Grades 2<sup>nd</sup> – 8th

**Maximum Number of Participants:** 20

## Objectives:

After completion of all activities, students will be able to:

- Identify the physical and behavioral adaptations that help beavers survive in their environment.
- Recognize beaver signs in the natural world.
- Compare and contrast how beavers influence the ecology of both forest and aquatic ecosystems.

## Preparation:

Before the class arrives:

- Obtain the “Beaver Ecology” kit from the storage room.
- Set up Beaver Jeopardy

## Basic Outline:

- I. Introduction (5 minutes)
- II. Beaver Dress-up (20 minutes)
- III. Beaver Signs (10 minutes)
- IV. Beaver Ecology (20 minutes)
- V. Beaver Jeopardy (20 minutes) OR Hike in search of Beaver Signs (20 minutes)
- VI. Conclusion (5 minutes)

## Other activities for 4<sup>th</sup> grade and under:

### See Appendix B

- *Beaver Life Cycle* (15 minutes)
- *“Beaver Jive” song* (5 minutes)

## Materials:

Beaver parts (front & hind feet, skull, pelt)  
Beaver signs (chewed sticks and stumps, wood chips)  
Beaver Dress up (goggles, clothespin, ear muffs, webbed hind feet, fur coat, foam pad, tail, teeth, rubber gloves with fake nails, plastic comb, deodorant, WD40 can)  
Beaver Information sheet (Appendix A)  
Beaver Ecology cards  
Beaver Jeopardy - Paper and pencils

## Introduction:

Introduce yourself and the class. Explain that this class will focus on beavers. The students will learn about beaver physical and behavioral adaptations, the life cycle of beaver families, signs they leave behind, and the ways in which beaver behavior affects the ecology of different habitats.

Introduce beavers as the largest North American rodent, scientific name *Castor canadensis*. Explain that in the next activity, the students will learn about beaver adaptations. Ask the students to define “adaptation.”

- *An **adaptation** is a characteristic that helps a plant or animal survive in its environment.*

There are two types of adaptations: physical and behavioral.

- *A **physical adaptation** is a characteristic that a plant or animal HAS (is born with) that helps it survive in its environment.*
- *A **behavioral adaptation** is something that an animal DOES (a behavior) that helps it survive in its environment.*

Ask the students to think of human adaptations that allow us to survive in our environment.

## Beaver Dress-up:

The beaver has many physical adaptations that help it thrive in its aquatic environment. In this activity, a volunteer from the class will be dressed up as a beaver. Ask the class for some physical adaptations of beavers. If available, pass out the real beaver parts representing each adaptation, and dress up the volunteer using representative props (beaver feet, teeth, tail, etc.). Talk about the functions of each physical adaptation as you add it to the volunteer beaver. Incorporate questions about the beaver’s behavioral adaptations and use beaver sign props when possible (chips, chewed sticks and logs, etc.)

- **TEETH (cardboard cutout):** teeth have two layers: a hard orange enamel on the front side and soft white dentine in the back. Beaver teeth grow constantly (like all rodents), so they must constantly chew to keep their teeth the proper length. Beaver teeth are self-sharpening; the dentine wears away faster than the enamel as the lower jaw works against the upper jaw.

**Behavioral adaptation:** Beavers use their sharp teeth to cut down trees small branches. They gnaw vertically on trees, parallel to the trunk, leaving large chips around a fresh cutting. A beaver can cut down a four inch tree in less than 10 minutes. A large tree may take several days to cut. Beavers eat pond plants, ferns, buds, and leaves in summer, and the bark of aspen, willow, birch and alder trees and shrubs in winter.

- **TAIL (cardboard cutout):** tail has two physical functions: to store fat in the winter (enlarges up the three times its normal thickness!) and act as a kickstand to balance the beaver as it chews trees upright.

**Behavioral adaptation:** The tail is used as a rudder for steering in the water, and as a paddle to slap against the water as a warning signal. It is NOT used to pack mud as seen in cartoons.

- **WEBBED HIND FEET (cardboard cutouts with Velcro comb):** Webbing between the toes helps to push water as the beaver swims. The fourth toenail on each hind foot is split and has a special purpose. **Behavioral adaptation:** The fourth toenail is used as a comb to spread waterproofing oils through the fur.
- **FRONT FEET (gloves with fake fingernails):** front feet have long nails, which give the beaver traction in mud. Front feet are similar to human hands, except the thumb is weakest and the pinkie is strongest.

**Behavioral adaptation:** Nails are used to grasp wood and as a comb for grooming. The will also use their front feet to dig canals between streams, through which they can float branches to add to dams or lodges.

- **FUR (coat):** has two layers: long outer guard hairs and a soft inner layer of felt. Felt is made up of tiny, interlocking hairs that stick together and hold their shape.
- **FAT LAYER (foam pad):** Insulates the beaver in 32 ° F water in the winter, and streamlines the body for faster travels in water.
- **OIL GLAND (WD40 can):** Located near the base of the tail is a waterproofing oil gland. **Behavioral adaptation:** Beavers spread the waterproofing oil through their fur, similar to the preening of ducks.
- **CASTOR GLAND (deodorant):** Located near the tail on the abdomen, this gland contains castoreum. Castoreum was and is still used as a fixative in expensive perfumes. It is NOT related to castor oil, which comes from the castor bean.

**Behavioral adaptation:** From spring-time to mid-June, beavers build mounds of mud with their hands and squirt castoreum on top of them to mark territory and attract mates.

- **NICTITATING MEMBRANE (GOGGLES):** Clear third eyelid that beavers can close, but still see

through, while swimming in the water. Protects the beavers eyes and helps them see.

- **SPECIAL INTERNAL FLAPS (NOSE, EARS, MOUTH) (clothespin attached to the goggles, earmuffs):** Keep water out of the beaver's nose and ears while diving. The mouth flap is a special inner mouth membrane BEHIND the teeth. Beavers can carry a stick in their teeth and close this membrane so they don't swallow the whole pond while swimming.
- **GOOD LUNGS:** Ask the volunteer beaver to hold his or her breath for 15 minutes! Beavers' lungs can remove 75% of the oxygen in air, compared to humans' measly 15%. They can also tolerate a high build-up of carbon dioxide in the blood, which we cannot.

**Other behavioral adaptations:** Dam and lodge building, and food caches.

- Beavers are stimulated to build **dams** by the sound of rushing water. Dams provide a protective pond and a constant water depth. Water 5-6 feet deep is important to avoid exposing an underwater lodge entrance, and to keep the pond from freezing solid in winter.
- The lodge protects a beaver family from predators and the winter's cold. Snow cover on a lodge is very important for insulation; interior temperatures must remain about 40° F. Abandoned beaver lodges are often occupied by river otters.
- **Food caches** made up of cut branches are stored underwater in huge piles near the lodge for use in winter. A beaver will chew off about a foot-long branch, like corn on the cob.

When finished, allow time for taking photographs. Let the volunteer beaver strip off the physical adaptations one by one and quiz the class about the function of each physical adaptation.

#### **Beaver Signs:**

Ask the students to review what type of signs might indicate that a beaver is present. Many have already been touched upon and this should serve as a good review.

- 1) Dams and/or lodges
- 2) Chew marks on branches and logs
- 3) Pencil-shaped stumps of cut tree trunks
- 4) Wood chips
- 5) Canals
- 6) Food caches (in winter these can be seen underneath the ice)
- 7) Scent mounds
- 8) Drag marks (a trail leading to the water where branches have been dragged several times)

**Beaver Ecology:**

Ask the students if they know what ecology means.

- *Ecology is the study of how living and non-living things interact in the natural environment.*

Ask the students what it means to study beaver ecology. They will be learning about how beavers affect the living and non-living components of their environment.

Besides humans, beavers are the animals that most greatly impact their environment. Beavers can turn a forest habitat with a fast flowing stream into a floodplain filled with dead trees and cattails. Ask the students how this might affect other plants and animals that live in the same habitat. Explain to the students that during the next activity, they will be role-playing different plants and animals. Pass out the Beaver Ecology cards and give the students a few moments to read their cards silently. Each student will have to decide if the presence of beavers is beneficial or detrimental to them.

Ask the students to form debate groups, and an adult to come forward as the “beaver on trial.” Members from each debate group must come forward to either denounce or applaud the beaver for its damn-building actions.

Who benefits

Ducks	Hérons	Cattails
Wolves	People	Otters
Frogs	Minnows	Muskrat
Water lilies	Mink	Woodpeckers
Water bugs	Dragonflies	

Who suffers

Aspen	Birch	Alder
Trout	People	Voles
Shrews	Mice	Deer
Hawks	Owls	

(These answers are flexible. What is important is to allow the students to come up with arguments for or against the beaver.)

**Beaver Jeopardy:**

Use this activity to review what they have just learned. Divide the class into two equal groups. Have them come up with a team name (time permitting) and chose a team speaker (this will be the only person who will voice the answer to the questions). Review the difference between physical adaptation and behavioral adaptation one more time before beginning. Chose team 1 to start the game. Once the question is asked (they are on the back of the point levels) to team 1, they will get approximately 30 seconds to answer. If they answer incorrectly, the team 2 can have a chance to steal the points. Team 2 would then pick the next question. Continue the game until all questions have been asked. Hand out a slip of scrap

paper; each team needs to write the amount of points they are willing to wager on the final jeopardy question. They will then bring them up to you and you will give them another piece of paper, this piece is for them to write their answer to the final jeopardy question.

**Ojibwe Bever Legend:**

If time still remains, read the Ojibwe legend, “When Beaver Was Very Great,” from Appendix C.

**Conclusion:**

To review, ask the students to name different beaver adaptations, both physical and behavioral. Quiz the students on the beaver life cycle. Ask what signs may be found in the forest to indicate the presence of beavers. Ask the students how beavers physically change the habitat they live in.

**References:**

*The Fur Trade: Badger History*, The State Historical Society of Wisconsin, Vol. 28, No. 2, 1974.

*When Beaver Was Very Great*, Ann M. Dunn, 1995, ISBN 1-883953-07-3.

Wolf Ridge “Beavers” lesson plan.

## Appendix A Beaver Information

### **Description:**

- 40-65 lbs. (prehistoric beavers were believed to be as big as black bears, biggest beaver found in WI was 110 lbs. found in Iron County)
- 35-46 inches long, including 10-18 in. tail
- Fur is composed of two types of hairs, guard hairs are long, coarse, and range in color from pale yellow to black

### **Reproduction:**

- Monogamous
- Breed January – February of every year
- Gestation 120 days (4 months)
- Litter size 1-8, average being 4 kits
- Kits are protected until they are 2 years old, then they are driven off

### **Lodge/Dam:**

- The lodge on average is 15 ft. wide and 5-6 ft. tall
- Composed of mud and sticks, and then later hollowed out by beavers
- Walls can be up to 4 ft. thick keep keeping it warm in the winter (45 degrees)
- Two or more entrances under the water
- Multi-leveled for different purposes i.e. eating, grooming, sleeping, raising young
- Largest dam 12 ft. high, 650 ft. long, found in WI
- Reasons for dams: protection from predators, flood area – kill trees, provides ponds for lodges, transportation to trees (canals)

### **Food:**

- Leaves, twigs, bark (Aspen, poplars, alders, willows) sedges, and water lilies
- 6 inches of tree in 15 min.
- 14-20 ounces of inner bark/day
- 200-300 trees/year
- Stockpile in fall for winter months: 5 beavers = 2 tons of food

### **Habits/habitats:**

- “Nature’s greatest engineers”
- Change habitat to suit needs
- Dams, bank lodges, lodges – mud, rock, sticks

### **History:**

- Beaver were the major reason for westward expansion and the opening of northern portions of the U.S.
- Native Americans would trade with the white Europeans for copper kettles, beads, cloth, guns and whiskey
- Beaver pelts were used to make felt top hats that were very much in demand in Europe

- Between 1630 and 1640 some 80,000 beavers were trapped annually
- 1900 almost extinct because of extensive logging and fur trapping
- Beavers would then make a come back because of stricter regulations on trapping, aspen regeneration, and low populations of predators
- 1967 – 1983 4.2 million dollars worth of pelts were trapped in WI, making beaver one of the most economically valuable fur-bearers in the state

### **Predators:**

- Coyotes, wolves, black bear, cougar, mink and otter prey on kits

## Appendix B Beaver Life Cycle

Have the students all stand in a circle. Inform them that they have magically transformed into the outside of a beaver lodge. Ask for a volunteer to step into the center of the circle and be the beaver. Tell the students that in the beaver family, mama beaver is the boss. Females spend more time building dams and lodges, marking territory, and have a more effective tail-warning slap. When mama beaver slaps her tail, everyone dives. When papa beaver slaps, everyone looks around.

However, mama beaver needs a mate. Ask for a volunteer to step into the circle to be papa beaver. Beavers mate for life, searching for another only after their partner is killed. They usually mate in February, and give birth to 3-9 kits (baby beavers) in May. Ask for 3 volunteers to join mama and papa beaver in the lodge as kits. Kits are born fully furred with their eyes open. They can swim within 24 hours of birth. The kits live in the lodge with their parents the whole year. The following spring, mama and papa have another litter.

Ask 3 more volunteers to enter the lodge as new kits. Ask the kits how they like sharing the lodge. In real life, there may be up to a dozen beavers at any one time in the lodge. However, many times kits will be eaten by predators, including large fish, snapping turtles, mink, fox, coyotes and wolves.

If you feel the group is mature enough, ask for a volunteer to be a wolf and pretend to eat a couple of the baby beavers. Then send the wolf and the eaten kits out of the lodge to join the circle. After the end of the second winter, mama and papa have a third litter, and the first set of kits are kicked out of the lodge (kick out the first litter). These two-year-olds must disperse to find their own territories and mates. (On Isle Royale, dispersing young beavers make up 25% of wolves’ diets during the summer. In Canada one radio-tracked beaver traveled 148 stream miles before finding a suitable

territory.) Each year after the second, a new litter of kits are born and the oldest young are kicked out of the lodge.

Beaver families will stay in the area until most of their food source is wiped out. When they move on, new young trees (usually aspen or birch) will grow and forest succession will create future habitat for other beavers.

### **“Beaver Jive” song**

While still in a circle, teach the “Beaver Jive” song. Each verse has movements to go with it. The chorus is a smacking sound made by sticking out your top front teeth and sucking them against the bottom.

“Beaver one, beaver all  
Let’s all do the beaver call.”

(Chorus)

“Beaver two, beaver three  
Let’s all climb the beaver tree.”

(Chorus)

“Beaver four, beaver five  
Let’s all do the beaver jive.”

(Chorus)

“Beaver six, beaver seven  
Let’s all go to beaver heaven.”

(Chorus)

“Beaver eight, beaver nine  
STOP! It’s beaver time!”

(Chorus)

## **Appendix C**

### **Beaver Legend – “When Beaver Was Very Great”**

It happened in the long, long ago that Beaver was very great. He walked upright and stood as tall as the tallest man. Furthermore, Beaver was highly intelligent and deeply spiritual. Beaver had the ability to improve his environment and make it more hospitable for many other animals, too.

Beaver established communities of families that worked together to build great earthen lodges. Beaver did not have to make robes or clothing of any kind because they were blessed with fur-covered bodies. Beaver had wonderful long sharp teeth, which allowed them to fell large trees with ease. Beaver often cut trees for their human neighbors...whom Beaver had grown to pity. In exchange, Beaver asked only for the tender bark and twigs to store for winter food. During warm weather, Beaver probed the bottom of lakes and rivers for roots and relished many kinds of greens. Beaver made long canals and built fine roads throughout their territory, which made transport and travel easier. They shared the canals and roadways with their neighbors.

The Anishinabe learned many good things by observing Beaver. Beaver bathed several times a day. Soon people adopted these habits of cleanliness and good grooming practices. Beaver were excellent parents and raised respectful, industrious children. So the Anishinabe imitated Beaver’s parenting skills. Beaver worked hard to accomplish good deeds that would benefit the entire community. They did not quarrel and fight among themselves and did not make enemies of their neighbors. They experienced no jealousy when others excelled. Therefore, as time went on, the beaver prospered more than people. So a delegation of men went to Creator and reminded him that he had promised that they would be the greatest of all created beings. Then they pointed out the Beaver had surpassed people in many things. The people demanded that Creator do something to restore their original role and reduce the status and power of Beaver. Creator said, “If people need an advantage over Beaver in order to surpass him, I will limit Beaver’s stature and cause him to desire to live only in and on the water.” The delegates were satisfied and returned to their lodges.

Beaver did not diminish all at once, but each generation became smaller than the one before, and after many years they have become the Beaver we know today. But Creator allowed Beaver to retain all of their previous skills. They are still intelligent, industrious, and generous. They still work together to modify their habitat and build secure lodges, which they share with extended families. They are still affectionate, considerate and kind. They do not fight or quarrel among themselves and have only a few enemies.

Beaver’s greatest enemy is Man. Man...who learned so many things from our brother, but failed to learn the important lesson of building inclusive communities. Because of Beaver’s character and former greatness, The Anishinabe believe that they are still worthy of great respect. Therefore, it is dishonorable to allow a dog to eat Beaver flesh, for the dog has never been as great as Beaver...nor can it ever be.