# Beavers, Nature's Engineers
## Los castores: ingenieros de la naturaleza
## 3-5th

Themes: Ecosystem Engineers, Co-Existence

### Location:
We encourage you to take students on a field trip to find beavers! If you live near Seattle, you can use this map to find beaver locations. If you live elsewhere, please see our supplementary resource, "Beaver Locations" to find your closest public land where you can potentially view beavers.
**Remote learning modification:** Lesson can be taught over Zoom or Google Classrooms.

The PowerPoint, brainstorming, and assessments can be done in the classroom with student computers.

### Standards:
**NGSS**
3-LS4-4
Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

**WA OSPI**
ESE Standard 2:
Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.

### Modifications, Adaptations:
For COVID-19 distance learning, or other remote learning modification, look for **remote learning modifications** throughout the lesson plan.

### Materials:
WDFW PowerPoints, rocks, sticks of varying sizes, leaf litter, dirt, sand, mud, and plastic containers for diorama. Your containers may vary, but we recommend something this size. You may also choose to use clay, Play-Doh and other craft materials for the students' dioramas.

### Objectives:
Students will..
1. Explain why beavers are ecosystem engineers with their classmates.
2. Demonstrate how beavers alter ecosystems by creating a diorama.
3. Brainstorm three ways people can co-exist with beavers.
4. Judge whether beavers benefit them by role playing as a member of an ecosystem.

### Vocabulary:
**English**
**Ecosystem:** All the plants and animals that live in a particular area together and their relationship with the non-living environment.
**Engineer:** A person who designs, builds, and maintains structures like dams, bridges, buildings, or roads.
**Engineering:** The application of knowledge in order to design, build, and maintain structures.
**Resilience:** The ability to recover from disturbance or difficulty.
**Riparian:** Habitats that are along river and stream banks and near wetlands.

**Spanish**
**Ecosistema:** Todas las plantas y los animales que viven juntos en una zona particular y su relación con el ambiente no vivo.
**Ingeniero**: Una persona que diseña, construye y conserva estructuras como presas, puentes, edificios o caminos.
**Ingeniería:** La aplicación del conocimiento para diseñar, construir y conservar estructuras.
**Resiliencia:** La capacidad para recuperarse de trastornos o dificultades.
**Ribereño:** Hábitats a lo largo de las orillas de ríos y arroyos, cerca de pantanos.

### Procedure:
**Introduction to nature's engineers**
Open the WDFW PowerPoint, "Beavers, Nature's Engineers". Make sure presenter notes are on. This PowerPoint will introduce students to beavers and how they alter environments to create habitat for themselves as well as a myriad of other species. If you need background information, please see the other resources section of the lesson plan. Lead students through slides two through five. On slide six you will find a link to a three-minute video about how beavers make dams. Instruct students to write down three things they learned or found interesting while watching the video. Share as a class when the video is finished. Slides seven through 11 show how beaver dams and ponds create and enhance habitat and help ecosystems be more resilient to disturbance (such as fire). The last slide asks students to reflect on what they learned to themselves, with a partner, and then with the class. You will write these answers down and then share them with students so they can use them as a reference for their dam building project.

**Building like a beaver**
In this activity, students will engineer like a beaver. Ask students to remind you what materials beavers use to build dams and lodges. Write these materials down on the board. Tell students they are going to try and create a mini-size version of either a beaver dam or a lodge.

Next, have students collect natural materials (such as sticks, mud, dirt, sand, leaf litter, conifer cones, pebbles, and rocks) during class or after school. Students will build a 3D diorama of a beaver lodge or a dam, their choice. The materials should

be able to stand up to water, just like a beaver's. You can choose to do this activity without adding water, but the water makes it a more authentic experience. Pass out plastic containers as the scene for their dioramas.

**Lodge**
If building a lodge, students should consider how they might create a cross-section of the lodge to show how beavers get in and out. Students should also consider what type of water body the lodge is built on, such as a river, lake, or stream. This might change what materials make up the foundation. Accompanying the diorama should be a small one-page report about why lodges are important to beavers, how they use them, and what materials beavers use to make them.

**Dam**
The dam should be able to hold most of the water. If building a dam, students should also create a shoreline. Students should use their class reference to include components of how dams alter ecosystems and create riparian habitat that allows for: pools/ponds of water, slower moving water, cooler temperatures, and fire resistance (adult supervision required!)

Giving students at least one week to create and complete their dioramas, whether in class or as an at-home assignment. We recommend setting aside some time in class for students to show off their work. One way you could do this is to create a time for a dam and lodge viewing (just like an art viewing) where students (possibly family members) can browse through the different dams and lodges.

**Logistical notes**

- You may want to create your own diorama before this assignment to give students a visual idea of what you are talking about. This will also help you with logistical problems that students might encounter when building.

- Students should create their dams or lodges first, and then add water either in the "gallery viewing" or when they virtually present it. This is the true test of their structure's strength. Slowly pour the water with a pitcher or large jar.

- If the dam or lodge fails, be encouraging with the student. Use this as an opportunity to appreciate the engineering capabilities of beavers and an opportunity for reflection. Inform students that beaver dams are not perfect and they may not hold back all of the water. Some water flows though the dam, and downstream. If student dam fails you can talk about how it's important for water to flow downstream as well.

After everyone has looked at another's diorama, talk about:

- How are beaver dams similar to dams that humans make?
- How are beaver dams different than dams humans make?
- What was the most fun about making the diorama?
- What was most difficult in creating the diorama?
- What is one thing you learned about beavers when creating the diorama?

**Remote learning modification:** You can introduce the activity over your online platform. You may want to set up a time where students could pick up craft materials for the dam/lodge building. You will need to instruct guardians about the project as they will be essential to helping students find materials for and complete their dioramas. Students can share their dioramas virtually. You can choose to use breakout sessions for the analysis questions at the end.

**Co-existence with beavers**
Open up the "Co-Existing with Beavers" PowerPoint
In the first slide, ask students to recall how beavers alter ecosystems. They should relay things like creating riparian areas and ponds. Slides three through five introduce some problems people may have with beavers living close by. Slide six asks students to brainstorm creative ways they could help people co-exist with beavers. Slides seven through 11 review all of the ways that individuals and organizations can still reap the benefits of beavers while preventing costly and sometimes hazardous problems.
**Remote learning modification:** Use breakout rooms for the think-pair-share questions.

**Stakeholder activity**
The last part of this lesson plan features a stakeholder activity from Beavers Northwest. Open up this supplementary lesson plan. Instructions to the activity can be found on pages three and four of the document. In this activity, students play different roles in an ecosystem, from humans to dragonflies! Please follow this lesson plan for more details.
**Remote learning modification:** Use breakout rooms to assign student roles. Then you can have a larger discussion about stakeholder roles as a class when you bring everyone back.

**Idea:** Show off your students' work! Share student projects from this lesson with WDFW.
Facebook:@WashingtonFishWildlife
Instagram:@TheWDFW
Twitter:@WDFW
#WildWashington #WildWa

**Did you teach this lesson? Give us your feedback.**

## Additional Resources :

*We encourage you to use the following resources as either a supplement to this lesson, or to share the resources with students for their project.*

**Supplemental activities:**

- Beaver ecology- Upham Woods Outdoor Learning Center

**Other resources:**

- Beaver species page-WDFW
- 3D Beaver Skull exploration- Oregon State University
- Beavers 101 Infographic (Could be used as a poster)- PBS Nature
- Beaver-NatureWorks

**Articles:**

- About Beavers (This article explains more in-depth beaver benefits)- Beaver Believers
- Understanding Ecology, Envirokids-Spokane County
- Coastal Beavers Help Salmon Recovery-National Geographic
- Benefits of Beavers-King County

**Videos:**

- Beaver Lodge Construction Squad- BBC Earth
- Dam It: Why Beavers Matter- Ben Goldfarb
- American Beaver-National Geographic Kids
- Beavers-PBS classroom
- Beavers, The Smartest Thing in Fur Pants-It's Okay to be Smart
- Video library- Beavers, Wetlands, and Wildlife