

# The Dam Dance



This three part lesson utilizes the stream simulator and stakeholder role-plays to engage participants in a dialogue about the various benefits dams provide their community as well as the impacts dams have on stream ecosystems, particularly in the Willamette Valley. Participants will be divided into groups that rotate between three stations. At one station participants will construct a dam to represent one near their home and discuss how the dam is a part of their lives. At another station participants will learn about the benefits and impacts of dams through a role-playing, discussion activity. At the third station participants will be asked to draw a before and after picture of a river that was dammed. Finally, all participants will come back together discuss the importance of weighing the benefits and impacts of dams, especially when considering dam restoration and removal in the future. This activity is designed to get participants thinking critically about how when it comes to dams, it really is a dance.

**Levels:** Grade 5

**Subjects Areas**

- Science
- Social Science

**Group Size:** 20-28 participants

**Concepts**

Dams generate electricity and control floods, but also have harmful effects on streams and rivers. They are intricately linked to life in the Pacific Northwest, so it is important to understand both their benefits and impacts.

**Materials:**

Stream simulator and simulator props, role-playing cards, sheets of white paper labeled 'before' and 'after', markers, 2 pictures of a river before and after dam construction

**Time:** 45-60 minutes

**Key Terms**

dam, river, stream, ecosystem, benefit, impact, reservoir, stakeholder

**OR State Standards**

- SS.05.GE.07.02 Understand how human activity can impact the environment.
- SS.05.GE. 07.01 Understand how and why people alter their physical environment.
- SC.05.SI.02 Design a simple scientific investigation to answer questions or test hypotheses.

**OBJECTIVES**

By the end of this activity, participants will be able to:

- 1) Construct a visual model of how dams have affected a river near their town.
- 2) Name two important services dams provide to human populations.
- 3) Describe two impacts dams have on stream ecosystems.

**RATIONALE**

Seventy percent of the Oregon population lives in the Willamette River watershed and most of these residents live within twenty miles of the Willamette River (Willamette Riverkeeper, 2009). Because of the close connection between residents of the Willamette Valley and the Willamette River it is essential to understand the difference between the historical river and the river as it is now. A series of several dams obstruct the historical flow of the Willamette, the thirteenth largest river by volume in the US (Willamette Riverkeeper, 2009). Dams are a vital source of energy, water, and recreation for various populations along the Willamette River and its tributaries. Dams also create major problems in river ecosystems by altering the natural flow of water, and changing the up/downstream habitat along the river and its tributaries. As residents of the Willamette Valley it is crucial to think critically about both the benefits provided by dams for humans and the impacts dams have on stream ecosystems.

**BACKGROUND**

The Willamette River is the third largest river in Oregon (by volume) and the thirteenth largest in the United States (Willamette Riverkeeper, 2009). It is one of the only rivers in North America that runs from south to north (WRWC, 2009). It originates just south of Eugene, Oregon, and flows north through the cities of Eugene, Corvallis, Salem, and then it combines with the Columbia River in Portland. Historically, the Willamette River's banks would overflow in the spring and winter creating massive floods that stretched out for miles in certain areas of the Willamette Valley (Willamette Riverkeeper, 2009). The wide, braided channels offered an array of habitats for native species and the floods distributed nutrient rich sediments across the floodplains of the Willamette Valley. Dams that have been constructed on the Willamette River and its tributaries have

impeded the natural flow of the river and reduced it down to one single, deep channel. The construction of dams allowed major cities (such as Eugene and Portland) to nestle up against the river because dams produce hydropower and control the floods which historically contributed so much diversity to the river ecosystem.

A dam is a barrier which blocks the downward flow of water in a river or stream. Many dams create a large reservoir upstream, which can serve as water supply or recreation for nearby communities. Historically beavers, landslides, or volcanic activity naturally created dams. In the past century, human construction of dams has greatly increased due to an increased need for water, electricity, and flood protection for growing populations. More than half of the energy generated in the Pacific Northwest comes from hydroelectric dams in both Oregon and Washington (Bothun, 2009). There are thirteen dams constructed by the US Army Corps of Engineers on the Willamette River (not including privately owned dams), eleven of which produce hydropower (Willamette Riverkeeper, 2009).

The various benefits provided by human constructed dams include flood protection, electricity generation, water supply for agricultural or domestic use, and recreation offered by the reservoir, such as boating, fishing, jet skiing, or swimming.

Impacts of human constructed dams include flooding of upstream habitat, decreased sediment and nutrient flow downstream, obstruction of the migration of salmon or other fish, and alteration of timing/intensity of peak-river flows. All of these negative impacts have an effect on the overall character and health of the river ecosystem. Several dams on the upper tributaries of the Willamette River have severely altered the historic flow patterns and ecosystems of the Willamette Valley (Willamette RiverKeeper, 2009).

Many stakeholders are involved with the issues that concern dams: farmers dependent on water for irrigation, power companies who depend on dams for electricity generation, environmental organizations concerned with the impacts of dams, and all the people who get their drinking water from a reservoir or own land that is protected by floods from dams (this list is far from complete...). It is important to include all perspectives when exploring issues that have arisen from dam construction and their subsequent impacts.

## ACTIVITY DESCRIPTION

### Set-Up

\* Set up Stream Simulator (15-20 minutes). Find a detailed description of stream simulator set up at the beginning of the unit.

\* Have classroom or area arranged so that there



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are three separate stations. The stations where participants will not be using the stream simulator should have a circle of chairs.

\* Each station should be equipped with all the materials on the list.

### \*Note for Facilitators

For large groups, three facilitators should each guide 1/3 of the class at each station. Have students rotate every 15 minutes. A fourth person is helpful. This person tracks time, acts as an observer to help with evaluating the lesson, and fills in where help is needed. If possible, this person also has references ready to accurately answer questions posed.

### Brief Introduction (5 minutes)

With the group as a whole, introduce the overarching theme of the unit (relationships to the local watershed). Explain that our community has a complex connection to the watershed we live in (the Willamette). Describe to them the connection between dams and the local watershed. The many dams on the Willamette River have had an adverse effect on the river habitats and population structure of the Willamette Valley (i.e. cities are nestled up against the river due to dams flood control mechanisms). Lastly highlight the learning objectives, and tell the participants what they are expected to gain from this activity [see learning objectives above].

Ask the participants to answer the following questions with a raise of hands:

“Who likes to fish for salmon or trout?”

“Who has gone boating or jet skiing on a reservoir?”

“Who has been white water rafting or tubing down the McKenzie or Willamette rivers?”

“Who lives near a river?”

"Who has seen salmon migrating upstream to their spawning grounds?"

"Who has swam in Dexter Lake or Fall Creek Reservoir?"

"Who thinks dams are beneficial?"

Who thinks dams are harmful?"

After all of the questions have been asked, explain we are all affected in some way or another by dams in the Willamette Valley and talk about how important it is for participants to be able to weigh out the benefits with the impacts. Tell the group that they will be the ones making future decisions regarding dam removal, and it is important for them to know about the issues so they can be dealt with in the most educated way

### **Split up the Class (1 minute)**

Have the participants count off in threes. Assign all of the 'ones' to station one, all of the 'twos' to station two, and all of the 'threes' to station three. After everyone has organized at their assigned station they will begin their activities. It is important for every student to make it to each station, so one of the facilitators should be designated as a 'timekeeper' (presumably the facilitator that is the observer). The timekeeper should give each station a five minute warning before the participants rotate, and about thirty seconds should be allowed for the participants to rotate between stations.

### **Station #1: Let's build a dam (15 min)**

\*Note: at the beginning of this activity have the simulator powered off so it won't be distracting and they can build on it before the water is running.

-Step 1 (2 minutes) Intro.

First and foremost explain the 'hands in, hands out' rule for the simulator. "When I say hands in, you can get your hands in and get them wet, but when I say hands out everyone needs to take a step back and take their hands out of the simulator."

Ask students to name a nearby dam (Hills Creek, Fall Creek, Dexter). Ask the students what river the dam is constructed on (Middle Fork Willamette River). Ask them if they know what larger river the smaller one dumps into (Willamette River).

Tell them they are going to model a dam on the Middle Fork Willamette River (or a river near their town) and their town or city using the stream simulator.

-Step 2 (5 minutes): Hands in!

Ask participants to construct the city, dam, and river (give them a box of combined props which has farms, houses, trees, cars, and other things humans build as well as rocks, logs, and trees). Using the simulator gravel, have them build an earthen dam. Have them to use the PVC pipe (in prop boxes) to act as a 'spillway,' reminding them that dams still let some water through. Ask them what is upstream of a dam. They will need to construct a large open area for the reservoir. The main town should be downstream of the dam, but some homes, mines, or farms could be on the shores of the reservoir. Don't forget to remind them to leave a small channel in their town for the river.

-Step 3 (4 minutes): Hands out!

Turn on the simulator. The water will begin to flood the reservoir. Have the valve at the top of the simulator turned as far toward the ceiling as possible, to ensure it is at its highest flow.

As the reservoir fills up and a small amount of water starts to trickle down through the small channel in their town, ask participants what purposes the dam serves their town:

- \* The dam protects their town from floods.
- \* The reservoir could be used as a water supply.
- \* The dam could generate hydropower for their homes.
- \* The reservoir could serve as recreation, like boating, swimming, fishing, or jet skiing.

Also ask them to think about some of the impacts the dam might have the river ecosystem:

- \* The reservoir floods the upstream environment.
- \* The flow downstream of the dam is greatly reduced.
- \* Less habitat is available for wildlife to occupy



because vegetation or rocks had to be removed and the channel made less complex.

- \* Any home, farm, or mine operation upstream gets completely flooded.

- \* Salmon are no longer able to migrate upstream to spawn.

- \* The stream channel must be made much less complex and smaller.

NOTE: Be careful about starving the simulator pump. If not enough water is getting through the pump will start to make a creaking, loud noise. If this happens release some water from the dam quickly so it does not damage the pump.

-Step 5 (2 minutes): Break the Dam.

If the earthen dam hasn't broken at this point, go ahead and give it a little help by pushing water from the reservoir over the top. When the dam breaks talk about what happens to their town. There is a very good chance that their towns and homes rest in what was once the flood plain of the Willamette River, and if a dam were ever to break this might be what it meant for our town.

Explain this is the case in much of the Willamette Valley and the many dams near their towns and homes are holding back the flow of the thirteenth largest river by volume in the US.

-Step 6 (2 minutes): Conclusion.

- \* Ask the group to name one way the dam affected the river.

- \* Then ask the group how dams affect the flow of the river.

- \* Ask them how the altered flow affects the downstream environment of a dam.

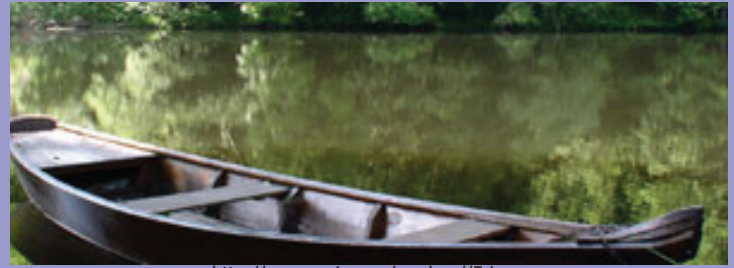
Help the participants make the connections between what they modeled on the simulator and what happened to the Willamette River when it was developed. Explain to them that the Willamette Valley is completely different than it would be if their weren't dams on the tributaries such as the Middle Fork and the McKenzie. It is important for them to understand how dams alter their environments, and how dams are connected to their lives.

## Station #2: Do the Dam Dance (15 minutes)

NOTE: Role-playing cards can be found at the back of the lesson.

-Step 1 (2 minutes): Intro.

Explain to each participant the purpose of this



<http://www.wvic.com/random//5.jpg>

activity. There are many different groups of individuals that are affected by dams. We call this different groups of individuals "**stakeholders.**" Sometimes the dam benefits the individuals, sometimes it does not. It is important for the students to weigh out the two sides of the dam debate. They are each going to represent a different stakeholder in the dam debate. They are going to look at their card and decide whether their stakeholder benefits or is impacted by dams. Then they are going to decide in what way they are benefitted or impacted. Each person will get a chance to present to others.

-Step 2 (1 minute): Give each person a role playing card that tells them which group they represent.

- \* "You are a fish who must migrate upstream to spawn."

- \* "You are a rafter who enjoys long stretches of undisturbed rapids."

- \* "You are a logger who owns property just upstream of a proposed dam site."

- \* "You are a fisherman that relies on salmon for food."

- \* "You are a farmer that relies on water for crops."

- \* "You are a homeowner who has a house on a river."

- \* "You are a person who enjoys cheap electricity from hydropower."

- \* "You are a family who enjoys taking a boat out on the lake for the weekend."

-Step 3 (2 minutes): Have participants decide how their stakeholder is affected by dams. If someone is struggling use inquiry to get them to start thinking about how a dam might affect them.

- \* Fish: Dams block the upstream migration of fish, particularly salmon who are coming from sea.

- \* Rafter: Dams can either flood the upstream rapid sites or retain the water for downstream rapid sites. Note that rafters are affected both up and downstream.

- \* Logger: A dam floods the logging operation

upstream and the logger will lose their property.

\* Fisherman: Dams block the upstream migration of fish, meaning there would be no salmon for the fisherman to eat. Make sure students understand that this problem is especially noted in the PNW.

\* Farmers: Dams protect crops and fields from floods and the reservoir has the ability to supply water for irrigation.

\* Homeowners: Dams will protect their homes from floods and the reservoir can supply quality drinking water as well as water for other domestic uses. Tell this group that some of their homes are probably on land that was once a floodplain.

\* Citizens: Dams can be used to produce hydropower which is a cheap and renewable source of energy. Mention that over half of the energy generated in the Pacific Northwest comes from hydroelectric dams.

\* Family: The reservoir created by dams is an ideal place to take the family boating or jet skiing. It also provides opportunities for swimming or fishing which are less expensive and destructive (than boating/jet skiing). Ask this group of participants if any of them have ever swam or boated in a reservoir near their homes.

-Step 3 (7 minutes): Have everyone get back together. Each stakeholder group will present to the others.

The person will read their card aloud, then explain to everyone how their stakeholder is affected by dams.

Make sure the person hold their card up and tells the whole group who they were representing.

After everyone gets to present, engage the participants in a discussion about why it is important to weigh out the benefits with the impacts. Help them make connections between stakeholder groups and consider how some groups can be affected in the same way. Have them discuss how different stakeholder groups can work together to solve dam issues. Explain to them that the dam debate really is a dance because dams are both vital to society (especially life in the Willamette Valley) but they are harmful to riverine environments and have irreversible consequences for the rivers.

-Step 4 (3 minutes): Conclusion.

Ask them to name one benefit provided by dams (have a few students answer).

Ask them to name one impact of dams (have a few students answer).

Ask them why they think it is important to consider both sides of the dam debate.

\*\* Impress upon them that they are the future generation of decision makers so it is important for them to be fully educated about the issues surrounding the dam debate.

Be sure to collect all of the cards before the participants rotate to the next station.

### **Station #3: Before the dams... (15 min)**

-Step 1 (3 minutes): Intro.

Explain to the participants what they are about to do. Ask them to visualize a nearby dam and imagine how the river and valley looked before the dam was there.

What types of things would they expect to see before the dam near their homes was constructed?

\* Their home or maybe their whole town wouldn't be where it was if the dam wasn't there (could be the case).

\* There would be no reservoir.

\* The fish would still be able to migrate upstream

\* Land uses around the river could be different.

See and take note of other things the students come up with.

What types of things would they expect to see after a dam was constructed?

\* Recreation on the Reservoir (swimming, fishing, boating).

\* More farms because of the water supplied from



the dam.

- \* Houses along the river or maybe entire towns (Eugene, Lowell, Oakridge)

- \* The river downstream of the dam would be smaller and maybe less complex.

- \* A reservoir upstream.

-Step 2 (1 minute): The real thing

Show them the pictures of before and after a dam was constructed as an example. Break them into three or four groups (depending on the size of the larger group) and distribute the paper and markers. Make sure the colors get distributed evenly throughout the group.

-Step 3 (7 minutes): Making a map

Have the students draw their picture. While they are drawing go around to each group and ask them about their pictures.

Why are they drawing the certain things in their pictures?

How do their pictures represent the dams near their homes and in what way?

Help them to consider how the dam affects their lives.

Make sure all students in the group are getting an opportunity to draw and give their input.

-Step 4 (5 minutes): Conclusion.

Have each group go around and describe one way their picture is different before and after. What effects did the dam have on the river? How does is their picture a representation of how the dam near their town affected the river (the Middle Fork Willamette or the larger Willamette)? It is important that each group gets a chance to present, so make sure to keep their responses short.

Tell the group it is important for them to think about the ways dams impact river environments (floods upstream riparian habitat, reduces downstream flows and vital floods which provide nutrients to soils, fish are no longer able to migrate upstream, dams can ruin rapid runs that are fun for rafters and tubers). It is also important for them to think about the ways in which dams affect them (if they like living next to the river, if they enjoy boating or fishing or swimming, if their families depend on water from the reservoir).

Thank them for their great creative work and rotate them to the next station (or back to the center for a final group wrap up).

### Evaluation(3-5 minutes)

Ask the whole group to answer the questions:

- \* Who can name a positive benefit provided by dams?

- \* Who can name a negative impact dams have on stream ecosystems?

- \* Who can tell me one way dam construction affected the Middle Fork Willamette River?

- \* Why is important to weigh the benefits and impacts of dams?

- \* What was your favorite part of the lesson?

(Have someone take notes during this section to evaluate the effectiveness of the lesson plan).

Explain to the group past decisions made regarding dams were based on the knowledge and information available at the time of decision making. Policy makers did not know how dam construction would alter the Willamette River and Valley composition, or how it would deplete salmon populations. Now our generation is faced with these problems, so it is important for us to understand both the benefits and impacts of dams so we can make the most informed decisions about how to combat problems that have arisen from dam construction. They are going to be the future decision makers in regards to dam repair and removal, so it is important they fully understand the complicated issues surrounding dams.

Last, ask the group these two questions again:

"Who thinks dams are beneficial?"

"Who thinks dams are harmful?"

\*Note to self: Have any of the opinions of the participants changed?\*





<http://www.ohwy.com/or/b/bonnedam.jpg>

Thank everyone and tell them how grateful you are for being able to come and spend time with them today.

**Stream simulator Take down (15-20 min):**

Allow about 15 or 20 minutes to disassemble the stream simulator. Detailed instructions on how to take down the simulator can be found in the additional resources section.

NOTE: Be sure to clean up any spilled water, gravel, or mess.

**ADAPTED FROM /  
ADDITIONAL RESOURCES:**

- Bothun, Greg (2009). Lecture 6, Week 3: "Hydroelectric Power."  
<http://homework.uoregon.edu/pub/class/350/hydro1.html> (Accessed January 23, 2009)
- Milstein, Michael (October 12, 2008). "A man-made solution to salmon's man-made crisis." The Oregonian [on Oregonlive.com].  
<http://www.oregonlive.com/news/index.ssf/2008/10/12-week/> (Accessed 2 March 2009).
- ProjectWILD Aquatic: Blue Ribbon Niche (p52-55)
- ProjectWILD Aquatic: To Dam or not to Dam (p184-87)
- Streams of Thought: Fish and Wildlife Habitat (39-44)
- Willamette River Keeper (2009). "The River."  
<http://www.willamette-riverkeeper.org/WRK/physicalcharacter.html> (Accessed 30 January 2009).  
<http://www.willamette-riverkeeper.org/river1.htm> (Accessed 30 January 2009).
- Willamette River Water Coalition (2009). "About the River."  
<http://www.willametteriver.org/underst/river.php> (Accessed 2 March 2009).
- X-Stream Team 2008. Lesson Plan: "Good Dam Bad Dam."  
[http://envs.uoregon.edu/elp/xstream/doku.php?id=lesson\\_plans](http://envs.uoregon.edu/elp/xstream/doku.php?id=lesson_plans) (Accessed 30 January 2009).

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Lesson #3 of "Relationship to my Watershed"  
2009 Environmental Leadership Program



# Stakeholder Role Playing Cards

**You are a fish who must migrate upstream to spawn.**



**You are a rafter who enjoys long stretches of rapids.**



**You are a fisherman that relies on salmon for food.**



**You are a logger who owns property just upstream of a proposed dam site.**





# Stakeholder Role Playing Cards

**You are a farmer that relies on water for your crops.**



**You are a family who enjoys taking a boat out on a lake.**



**You are a person who enjoys cheap electricity from hydropower.**



**You are a homeowner who has a house on the river.**

