



Truckee River: From Mountains to Desert

Grade Level: 6th - 8th

During this 60-minute classroom lesson, students learn about the causes of flooding events in the Truckee River watershed by creating watershed models and simulating different flooding events. Then, they will analyze the causes and effects of historical floods. The students will return to their watershed models to design and test solutions that reduce the risk of flooding.

Materials

Invitation

- Truckee River Handout

Explore

- Spray bottle
 - Water
 - Heat source (heat lamp, blow dryer, the sun on a hot day)
- 1 set of each per group:
- Rocks
 - Tray/container that can hold water
 - Sheet of foil
 - Ice

Concept Invention

- Computer for each student

Application

- Clay for each group
- Spray bottle or heat source
- Water
- Ice

Essential Questions

- What causes flooding in the Truckee River watershed?
- What solutions can I design to reduce the risk of flooding in the watershed?

Objectives (Integrated Content and Practice)

1. Students will identify the causes of flooding in the Truckee River watershed, test and design solutions to reducing flood risk.

NGSS

- 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.

Key Vocabulary

- Watershed

Introducing the Lesson (5 minutes)

1. Explain to the students that they are going to work as scientists by making observations after different flooding events have occurred on their watershed models. Then, they will design and test solutions to reduce the risk of flooding in their watershed models.
2. Tell the students they will be recording their ideas on a few handouts throughout the lesson (these may be kept in their notebooks).

Invitation (10 minutes)

1. Show students the Invitation Images. Have them independently respond to the questions in the Invitation section of the Truckee River Handout.

Invitation

What do you notice? What could have caused this to happen?

2. Have students share their responses with a partner. Ask for a few volunteers to share their responses with the whole class and write them down on the board or poster paper.
3. Tell students they are going to be hydrologists. Ask them what they think hydrologists study. Ask if they recognize parts of the word hydrologist such as hydro. Have they seen this word in other contexts?
4. Tell them a hydrologist is someone who studies how water moves across the Earth's surface. Hydrologists might study the different parts of the water cycle, the effects of flooding or different ways to help keep our water clean.
5. Tell students that hydrologists use models to learn about natural events that are large or take place over long periods of time.

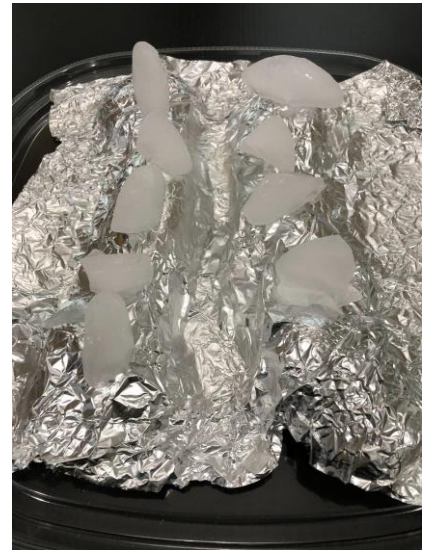
Exploration (20 minutes)

Tips and Tools:

Show students how to create a flattened peak on top of the rocks, this will help keep the ice in place and prevent it from falling down the sides.

1. Tell students they will create models of watersheds in their groups to learn about the effects of natural events on the watershed. Tell students a watershed is an area of land where water flows and is stored.

2. Demonstrate for the whole class how they will set up their watersheds using containers, rocks, foil, and ice. Place the rocks in two rows in the container, place the foil over the rocks, and put the ice on top of the rocks.

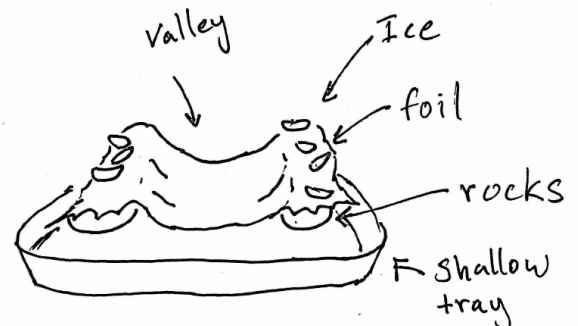


3. Explain to students that they will create this model three times and study it under

different conditions - without rain or heat, high temperature and heavy rainfall.

The foil over the rocks represents their watershed, the ice on top of the foil represents snow on the mountains, water from the spray

bottle represents rain and heat represents high temperature.



You may distribute materials according to the needs of your students. You may have a helper hand out materials or have a representative from each group go to a designated area to get their materials.

If your students are unfamiliar with making detailed observations, you may want to spend time before this, going over how to make observations that are detailed, accurate and include labels or descriptions if they are drawings.

You will need a bucket or container to collect the water if you do not have a sink in your classroom.

4. Distribute materials to the groups and have them set up their watersheds. After they have set up their initial watersheds they may draw or write descriptions of how their watersheds look after no rain or heat has occurred on their handouts. Have students share their observations with each other in their groups.

Watershed Models

Draw or write descriptions of how the watershed looks after each event.

No rain or heat	High temperature	Heavy rainfall

5. The groups should be able to use the same ice since it is unlikely that the ice has melted at this point. Depending on the availability of materials for your class you may have half the class using the spray bottles for heavy rainfall while the other half of the class uses the heat source for high temperatures. Then the groups may switch materials. If there are enough materials for each group to have their own spray bottle and heat source then they may complete each section at the same time. Have students draw or write descriptions of how their watersheds look after each event has occurred on their handouts. Have students share their observations with each other in their groups.
6. Have the groups clean up their watersheds by pouring out the water and setting their watersheds aside since they will be returning to them towards the end of the lesson.
7. Ask for a few volunteers to share the observations from their groups for each natural event. Record the responses on the whiteboard or poster paper. Students should have observed that both the high temperature and heavy rainfall had more ice melting than the watershed without rain or heat.

Concept Invention (15 minutes)

Tips and Tools:

1. Have students go to the [Truckee River story map](#) which can also be accessed from <http://nevadafloods.org/index.php/education-resources/C7> and click “Truckee River Flooding.”
2. Review the instructions for the Concept Invitation section of the handout. Read about one the historical flood events together as a class and model how to complete the first row of the table.

Concept Invention

Choose 3 historical floods to analyze and record the cause and effect of that flood. Choose from the following sections: The Great Flood of 1862: A Month of Rain, The Flood of 1907, Thanksgiving Flood of 1950, The Flood of December 1955, 1997 New Year’s Day, A Local Perspective: The Flood of 2006

Date of Event	Cause What caused there to be flooding?	Effect What effect or damage did the flooding cause?

Students may also work in pairs to complete the assignment, have a shortened assignment or be assigned specific sections to read.

3. Have students independently read the sections and complete the table as well as the question at the end of the table.
4. Tell students to share their responses to the last question at the end of the table at the groups before asking for a few volunteers to share with the whole class. As a whole class, read the sections “Why Does Flooding Happen?” and “Flash Floods: A Quick Moving Hazard”. These sections reiterate what the students discovered in the sections they analyzed and what they observed in their watershed models. Remind students that when they added heat or rain to their watershed models there was more ice melting which is flooding in their models.

Application (15 minutes)

Tips and Tools:

You may want to include photos of levees if students are unfamiliar with them.

1. Explain to students that they will be returning to their watershed models to design and test solutions to reduce the risks of floods.
2. Read the “What Can Help Reduce the Flood Risk” section of the story map together as a class. Discuss the solutions mentioned in the reading such as levees and dams and share observations of the photos of the dams.

Go around to each group and ask about their design to make sure they understand the task and that their design will be feasible on their models with the given materials.

3. Within their groups, tell the students to discuss possible solutions to reducing flood risk and to choose one they would like to try on their watershed models. It may be one they just read about or a design of their own choosing.
4. After groups have decided on a design, they may build it on their watersheds. Have the groups choose and mark a location on their watershed models that represent an area they are trying to prevent from flooding. This could represent a town or agricultural area. Some groups may be able to manipulate the foil to create their designs or you can give them clay to add to their watersheds.
5. Once a group has their modified watershed built, they may add ice to the top. Groups may choose the cause of their flooding event by using either the spray bottle for rain or heat source for high temperature. Have students record their observations in the “Flood Risk Solutions” section of the handout and answer the follow up questions about their designs. Have students share their responses to these questions in their groups.

Flood Risk Solutions

Write or draw a description of your watershed after testing out your solution.

How does your watershed with your solution compare to the watershed after a flooding event without your design? How effective was your design at preventing flooding in the watershed? What improvements would you make to your design?

6. Have the students pour out the water, take apart and return all the materials from their watersheds.

Reflection (5 minutes)

1. Review the recorded responses from the invitation and concept invention.
2. What do we know about flooding and flood risks?
3. Do we have any new questions?