



Colorado Flood Lesson - Teacher Guide

Setting the Stage

Floods have destroyed peoples' homes and taken their lives throughout history. Flooding is the most common and costly natural hazard, with an average cost of \$1.9 billion dollars annually in the United States ([Pew Research Center](#)). The causes of floods are well known, yet they are difficult to predict. The way that we choose to design our communities can increase or decrease the risks of damage from floods.



Flood debris after the 2013 Boulder flood. Photo Credit: AlmanacManiac, Wikimedia.

Lesson Overview

Students will build understanding about floods in Colorado through the following learning activities:

- *Part 1 – Engage (20 minutes) Introduction to Flood Concepts and Case Study*
As a class, watch news clips about floods in Colorado and have a brief class discussion.
- *Part 2 – Explore (60 minutes) Flood Data Analysis Jigsaw*
In groups, analyze flood information and data to build understanding of the causes, impacts, locations, and frequency of floods. Additionally, students use GIS to identify areas in their community in the 100 year floodplain that may be at risk of flooding.
- *Part 3 – Explain and Evaluate (90 minutes) Community Outreach for Flood Preparation*
New student groups (with a student from each group in Activity 2 jigsaw) will present information to each other, and begin writing an outline for a Letter to the Editor. Next, students write a Letter to the Editor answering the driving question: What can we learn from past flood events to prepare for future floods?

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| Instructional Overview | |
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| Grade Level | High School |
| Instructional Time | 170 minutes |
| Unit Driving Questions | How can we make our community more resilient to flooding? |
| Lesson Driving Question | What can we learn from past flood events to prepare for future floods? |
| Building Toward | NGSS: HS-ESS3-1 CDE: HS3.ESS.GLE10 |
| Three Dimensions | <p>Science and Engineering Practices:</p> <ul style="list-style-type: none">Analyzing and Interpreting DataObtaining, Evaluating, and Communicating Information <p>Disciplinary Core Ideas:</p> <ul style="list-style-type: none">ESS3.B: Natural Hazards <p>Crosscutting Concepts:</p> <ul style="list-style-type: none">PatternsCause and effect |
| What Students Will Do | <ul style="list-style-type: none">Analyze flood data to identify patterns of flood history and risk in Colorado.Communicate information about historic causes and effects of floods in your community. Explain what community members should do to be safe in the event of a flood. |
| Materials | <ul style="list-style-type: none"><input type="checkbox"/> Flood Student Worksheet<input type="checkbox"/> Lesson Slides |
| Material Preparation | <ul style="list-style-type: none"><input type="checkbox"/> Computer and internet access are essential for this lesson. Ideally each student will have access to a computer or tablet.<input type="checkbox"/> Post the Flood Student Worksheet to the class website. Students will need digital access to the worksheets to access the links for each activity.<input type="checkbox"/> Print copies of the Letter to the Editor Outline (pages 8-13 of the Flood Student Worksheet) for each student.<input type="checkbox"/> Optional: Download your Local Hazard Mitigation Plan from here: https://www.colorado.gov/pacific/mars/approved-plans Find the sections that students will need (the Flood Past Events section within the Risk Assessment section). Write down the page numbers so students can easily find the sections they need. <i>*Note: Though there are a general set of guidelines for local hazard mitigation plans, not all plans are organized the same way. We recommend spending some time exploring the document before teaching the lesson to avoid confusion.</i> |



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| <p>Vocabulary</p> | <p><u>Natural hazards</u> are naturally occurring phenomena such as flood, wildfire, extreme heat, or drought, which may disrupt or damage a community.</p> <p><u>Flood</u> is a rising and overflowing of a body of water especially onto normally dry land.</p> <p><u>Flash flood</u> is a local flood of short duration generally resulting from heavy rainfall in the immediate vicinity.</p> <p><u>Streamflow</u> is water flow, or discharge, in a natural channel.</p> <p><u>Floodplain</u> the generally flat area next to a river or stream which is prone to flooding</p> <p><u>100-year floodplain</u> is the area of land that can reasonably be expected to have a 1% chance of flooding for a given year.</p> <p><u>Impervious surface</u> is impenetrable by fluid (rain or floodwaters)</p> |
| <p>Instructional Strategies</p> | <ul style="list-style-type: none"> ● Jigsaw: A cooperative learning strategy in which each group is responsible for learning one “piece of the puzzle” and then sharing that information with other groups to complete the whole picture. Use Part 3 for students to present the information they learned at their stations. Teachers can choose to use this strategy if time is limited, and stations can be differentiated for different student abilities and levels of teacher assistance. |
| <p>Opportunities for Bringing Experts into the Classroom</p> | <ul style="list-style-type: none"> ● Part 1: Kick off the lesson with a city or county emergency manager speaking about flood readiness and emergency response plans. ● Part 2: Bring in a civil engineer to discuss how the 100-year floodplain is modeled. ● Part 2: Bring in a city GIS manager to show which areas of the city are impervious, and identify flood mitigation structures |

Activity 1 (Engage) Introduction to Flood Concepts & Case Study (20 minutes)

Why is it important to study floods?

Begin the lesson with a warm-up KWL Chart (Know, Want to Know, Learned) on the first page of the [student worksheet](#). Use Think, Pair, Share for students to share out what they already know and what they want to learn.

Use the news stories [1976: Deadly Big Thompson flood devastates Colorado](#) (3:00) and [Dramatic images show devastating flooding in Colorado](#) (3:02) to get students thinking about floods. As a class, briefly discuss observations and questions about floods. Write down a list of questions to refer back to throughout the unit.



Next, watch the [Flooding in Colorado with Jeff Lukas](#), a flood expert with Western Water Assessment (WWA), **STOP** the video at minute 2:24 (Human Impacts on Flooding) WWA is part of the Cooperative Institute for





Research in Environmental Sciences, which is based at the University of Colorado Boulder.

Part 2 (Explore) Flood Data Analysis Jigsaw (60 minutes)

Part 2 is designed as a jigsaw in which students work in five small groups to investigate a question and then share out with their classmates. Post pages 2-7 of the [student worksheet](#) on the class website so students have online access to the instructions, which contain links to resources.

Note that there is a sixth activity for all groups to complete, that has students identify areas in their community that are at risk of floods.

Give groups 60 minutes to do their research and create their slides. Alternatively, if class time allows, have all students complete all investigations.

Part 3 (Explain) Community Outreach for Flood Awareness (90 minutes)

For Part 3, students will work in new groups, or flood planning teams. Each flood planning team is made up of one student from each of the jigsaw groups, so that the team consists of students that collectively completed each of the Part 2 investigations. The goal is to have an expert from each station in order to communicate key flood information to your community that faces flood risk in the form of a Letter to the Editor in the local newspaper.

Flood Expert Interview (5 min)

Begin by watching the rest of the Jeff Lukas Flood Expert video as a class.

[Flood Expert Video- Jeff Lukas](#)

BEGIN @ 2:24 (Human Impacts on Flooding)



Optional Video

[Tools for Flood Resilience: Lessons from Fort Collins](#)



Letter to the Editor (85 min)

Divide the class into the flood planning teams. Ask students to use the Letter to the Editor Outline on pages 8-13 of their [student worksheet](#). Give students thirty minutes to share their slides from their investigations (5 minutes each). As each team member shares their learning, the other team members should be taking notes in their outline for their letter to the editor.



After students have finished sharing out in groups, have students write a letter to the editor using their outline as a guide. These letters can be collected as a summative assessment. When students have completed the assignment, post the letters on the class website for others to read and give feedback. Consider sending in the best letters to the local newspaper.

Finish the lesson by returning to the KWL Chart on page 1 of the [student worksheet](#), and have students complete the “What I Learned” section.

Find more HEART Force Curriculum here:

<https://cires.colorado.edu/outreach/projects/HEARTForce>