

THINKING AND ACTING  
LIKE A  
SCIENTIST

TEACHER'S GUIDE

**Natural Hazards  
Exploration**

How has the occurrence of natural hazards influenced human activity?

**GRADES 9–12**

**Earth & Space**





# Natural Hazards Exploration

<b>Grade Level/Content</b>	9–12/Earth and Space Science
<b>Lesson Summary</b>	Students work in small groups to research evidence of how natural hazards have influenced human activity and present their findings during a guided gallery walk.
<b>Estimated Time</b>	4, 45-minute periods
<b>Materials</b>	scissors, glue, markers, 3-panel poster board, <a href="#">Investigation Plan</a>
<b>Secondary Resources</b>	<a href="#">National Oceanic and Atmospheric Administration</a> <a href="#">U.S. Geological Survey</a> <a href="#">Landscapes on the Edge: Chapter 1: The Importance of Earth Surface Processes</a>
<b>NGSS Connection</b>	<b>HS-ESS3-1.</b> Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
<b>Learning Objectives</b>	<ul style="list-style-type: none"><li>• Students will describe characteristics of natural hazards.</li><li>• Students will classify natural hazards as interior processes, surface processes, or severe weather.</li><li>• Students will identify human activity at the location of a natural hazard event before and after the event to determine how the occurrence of natural hazards has influenced human activity.</li></ul>

## How has the occurrence of natural hazards influenced human activity?

Stories about natural hazards appear in the news day after day. A volcanic eruption decimates the surrounding wildlife and nearby homes. Sinkholes swallow cars and buildings. Tsunamis sweep away entire villages in minutes. But what happens afterwards? What is the longer term impact of natural hazards on human activity?

The Next Generation Science Standards separate natural hazards into three types: “interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts).” In this lesson, students will work in small groups to identify and research an example of one of these three types of natural hazards and its effect on human society. Each group member will investigate one topic from a chosen natural hazard event and each group will share its combined knowledge with the class during a guided gallery walk.

**Investigation is based on the Van Andel Education Institute (VAEI) Instructional Model for Inquiry-Based Science.**  
**In all investigations:**



Students don't know the “answer” they are supposed to get.



Students play a driving role in determining the process for learning.



Teachers and students construct meaning together by journaling.



Students are working as hard as the teacher.

## Part 1

### INVESTIGATION SETUP

To collect, process, and present their data, students will need access to a computer connected to the Internet.

Student groups will present their findings during a guided gallery walk. To create their gallery display, each group of three students will research, compile, write, print, and display their work on a 3-panel poster board.

Groups will need the following materials to construct their displays for the guided gallery walk:

- scissors
- glue
- markers
- 3-panel poster board
- [Investigation Plan](#)
- journal

## Part 2

### INVESTIGATION FACILITATION



#### Secondary Knowledge

*Students use secondary sources to understand how natural hazards have influenced human activity over time.*

- Describe to students one or two recent natural hazard events covered by mainstream media.
- Make sure students understand the term *natural hazard*. Explain that natural hazards can result from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), or severe weather (such as hurricanes, floods, and droughts).

#### CONSTRUCTION OF MEANING

Provide an example of each type, and ask students to identify how they are alike and different. For example, an earthquake is an interior process that can destroy habitat and soil quality that negatively impacts wildlife in the surrounding area. Soil erosion is a surface process that can negatively impact soil quality and farmland quality. A tornado is a type of severe weather that can destroy farmland, homes, and businesses.



#### Question

*Introduce the investigation question.*

**How has the occurrence of natural hazards influenced human activity over time?**



## Personal Knowledge

*Students capture what they already know about natural hazards and how their occurrence has influenced human activity over time.*

- Ask students if they have witnessed a natural hazard or seen videos of recent events on television or the Internet. Provide an opportunity for students to share stories about what they already know.
- Ask students to describe what they already know about natural hazard events in their journals. Encourage them to identify positive and negative effects on human activity that resulted from these events.



## Investigation Plan

*Students identify a plan to conduct research on a chosen natural hazard.*

- Ask students to determine which type of natural hazard (interior processes, surface processes, or severe weather) they are interested in exploring.
- Based on student choices, assign three students to a common natural hazard type group.
- Provide a copy of the [Investigation Plan](#). Remind students to read the entire plan before they begin working.
- Once grouped, students will conduct preliminary research to select an event from their chosen natural hazard type that will provide them with enough data for their poster board presentation. Monitor the choices of student groups and encourage them to choose different events to ensure variety during their guided gallery walk.
- Each student will identify and investigate one topic of the chosen natural hazard event (the science behind the event, or the impact on local infrastructure, economy or human population, etc.) to combine with the research of their group on a poster board for display during the guided gallery walk.

**INVESTIGATION PLAN**  
**NATURAL HAZARDS EXPLORATION**

1. Circle the type of natural hazard you would like to investigate:  
Interior process    Surface process    Severe weather
2. As a group, research and select a natural hazard event that will provide enough data (information and images) to answer the investigation question and create a poster board for a guided gallery walk. Identify your natural hazard event below.  
Our natural hazard event: \_\_\_\_\_
3. Identify a specific topic or aspect of this event that you plan to investigate individually. Make sure it is separate from topics being investigated by your fellow group members. Identify the topic of interest from your natural hazard event below.  
My event topic: \_\_\_\_\_
4. Collect enough data (information and images) to answer the investigation question and present your chosen topic from the group's natural hazard event on one panel of your group's poster board. Record this data in an organized way in your journal.
5. After collecting your topic data, meet with the members of your group to share and analyze each of the three data sets (one from each group member's topic).
6. Construct an explanation (Claim, Evidence, Reasoning) for the investigation question using data from the three topics researched by your group for the chosen event.
7. Compile your data (information and images) to create a panel on your group's poster board for the guided gallery walk.
8. Present your research to the class as a group during your portion of the guided gallery walk.

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### Investigation Plan

### STUDENT CHOICE

Encourage student choice within set parameters. This is a great way to increase student engagement and motivation while meeting the learning objectives of this lesson. Students are likely to pick types of natural hazards that are of interest to them or their families based on a variety of factors.

### CRITICAL THINKING

Use the [Fair Test](#) checklist to help students think critically about the investigation plan. Help them understand that a good investigation plan must include a process that is repeatable, results in the collection of high quality data, and minimizes error. The more critically students think about their investigation plan, the more confident they can be in their results.



## Observation

*Students research and record how their chosen natural hazard event has influenced human activity.*

- Students should research and collect enough data (information and images) to communicate key details and data from their event on a single poster board panel.
- During their research, students should routinely check in with the other two members of their group to compare notes and share ideas.

*Continued*

### SELF-DIRECTION

As students work in small groups to investigate a past natural hazard event, each student will be responsible for their chosen topic based on the event. Each student will gather the data (information and images) to combine with the observations of their fellow group members.

### ADAPTABILITY

Students may find that the natural hazard event they want to research will not provide them with enough data for analysis and display during the guided gallery walk. If this is the case, the group will need to identify an alternative event of the same type that provides more data. Another possibility that may require adapting to is the discovery that one natural hazard event led to another (as shown in the sample Explanation below). A natural hazard can set off a chain of events in Earth's interconnected ecosystems. Nature influences nature, not just human activity.



## Secondary Knowledge

*Students use secondary sources to explore how natural hazards have influenced human activity over time.*

Introduce secondary sources to provide a deeper understanding of the science behind natural hazards and the interconnected ecosystems on Earth. Some good examples include:

[National Oceanic and Atmospheric Administration](#)

[U.S. Geological Survey](#)

*Landscapes on the Edge: Chapter 1: The Importance of Earth Surface Processes*

## Part 3

### INVESTIGATION ANALYSIS AND DEVELOPMENT OF CLAIM



## Data Analysis

*Students make sense of their compiled data by organizing it and representing it visually.*

Have students analyze their data. They may wish to use the [Data Analysis](#) prompt as a guide.

- After collecting and compiling data (information and images) to create their panel of the group's poster board, students should share this data with the other two members of their group.
- For each set of data collected by an individual group member, have the group **evaluate** its trustworthiness.
- Then, have them analyze each data set to find patterns and trends. Encourage them to suggest ways to **organize** and/or **represent** the data visually to construct meaning.
- Have students **interpret** what the identified patterns or trends from each data set mean for inclusion on their poster boards.
- Ask students to determine whether changes resulting from their natural hazard event demonstrate a clear change in human activity. If so, encourage them to dig deeper to identify or estimate how many people were affected; to estimate the scope and depth of economic impacts; or to identify if the event resulted in other changes (such as building code updates).
- Ensure that each group has enough data for use as evidence to support a claim.

*Continued*

## COLLABORATION

To interpret patterns in their data, students must work together to share and analyze the data they collected individually. Students must work together and review all of their data prior to moving on to developing their individual explanations.



## Explanation

*Individually, students write a claim and provide evidence and reasoning to support it.*

- Have each student use what they've discovered from the analyzed data to write an explanation that answers the investigation question. Have them write their claim in their journal. Students may wish to use the [Explanation](#) prompt as a guide.
- Have students develop a **Claim** to answer the question: How has the occurrence of natural hazards influenced human activity?
- Then, have them add **Evidence** (the analyzed data) to support their claim.
- Finally, have them add **Reasoning** to their claim. Reasoning should include the information obtained from this investigation as well as science principles they have learned during the course of the investigation.

### Claim

*Natural hazards influence human activity when they damage infrastructure that humans create such as bridges and roads.*

### Evidence

*After a bridge on the only thoroughfare in the area was damaged by a mudslide, the residents of a popular tourist destination on one side of that bridge were unable to reach the other side without hiking 30 minutes through the forest on a steep trail. A natural hazard has isolated them from the rest of the world and changed their way of life.*

### Reasoning

*Investigation: Big Sur is a popular tourist destination on Highway 1 in California. Deep in the redwood forest overlooking the Pacific Ocean, the only way to reach this location is to travel on Highway 1 along the coast. After a series of atmospheric events brought more than 60 inches of rain, the ground under the Pfeiffer Canyon Bridge on Highway 1 in Big Sur began to slide in February 2017. The highway department closed the road and then determined that the bridge was damaged beyond repair. It would have to be demolished and replaced. The residents of Big Sur were stranded. Tourists did not want to take the 250-mile detour, so they cancelled their visits to the area, and many local businesses closed. To cross the area that the damaged bridge had covered, Big Sur residents had to hike on a steep, two-foot wide firefighters trail through the forest near the bridge, a 30-minute walk each way. After that hike, they still had to go past the end of the bridge by bus or car to go to work or school or to buy groceries. Local businesses lost \$300,000 a day in revenue.*

*Science: In this case, one natural hazard led to another. Severe weather resulted in a surface process change. The first natural hazard was severe weather in Big Sur that was caused by a series of atmospheric rivers. As each river of water vapor in the sky reached the coast, these long, flowing columns of water vapor rose over the mountains along the coastline. This rise in elevation caused the water vapor to cool, and large amounts of rain or snow were released. The first natural hazard, severe weather, caused the second natural hazard, a surface process change. The slide under the Pfeiffer Canyon Bridge occurred because the large amount of rainfall caused soil erosion. As the ground under the bridge began to erode, the pier of the bridge began to move, causing the bridge to become unstable.*

## Part 4

### INVESTIGATION ASSESSMENT AND EXTENSION



#### Application

*Students demonstrate understanding of how the occurrence of their natural hazard influenced human activity.*

- Once the explanation is written, have students create their poster boards for display during a guided gallery walk.
- Instruct students to place their completed three-panel boards around the classroom for a gallery walk.
- Determine if you want groups to present to each member of the class. It may make sense to assign natural hazard groups to two or three presentation groupings to minimize the time needed for the guided gallery walk.
- To get started, explain that a natural hazard group representative will introduce the key details and background for the group's event.
- After that, each student in a natural hazard group provides a short summary of the event's topic that they researched. Each student in the audience listens and asks clarifying questions, challenges and/or supports the arguments made, and even presents alternative explanations as appropriate. Individuals and group members respond to questions with evidence and sound reasoning.
- This continues for each member of the natural hazard group before moving on to the next group's poster board.

#### DISCOURSE

The *Guided Gallery Walk* provides an opportunity for students to display their oral presentation skills and engage in active audience participation by asking informed questions and responding to clarification questions. Choose two groups to model this process and set the tone for your class. Work with each group to explain how to present as well as ask clarification questions. Have these two groups start the process for the whole class while highlighting good examples of presenter and audience interactions.

#### Assessment

Use students' poster presentations to determine their understanding of and ability to:

- describe characteristics of natural hazards.
- classify natural hazards as interior processes, surface processes, or severe weather.
- identify human activity at the location of a historical natural hazard event before and after the event to determine how the occurrence of natural hazards has influenced human activity.

For additional lessons or to customize this lesson, go to [www.nexgeninquiry.org](http://www.nexgeninquiry.org).



Empowering Teachers. Engaging Students.

# INVESTIGATION PLAN

## NATURAL HAZARDS EXPLORATION

1. Circle the type of natural hazard you would like to investigate:

Interior process

Surface process

Severe weather

2. As a group, research and select a natural hazard event that will provide enough data (information and images) to answer the investigation question and create a poster board for a guided gallery walk. Identify your natural hazard event below.

Our natural hazard event: \_\_\_\_\_

3. Identify a specific topic or aspect of this event that you plan to investigate individually. Make sure it is separate from topics being investigated by your fellow group members. Identify the topic of interest from your natural hazard event below.

My event topic: \_\_\_\_\_

4. Collect enough data (information and images) to answer the investigation question and present your chosen topic from the group's natural hazard event on one panel of your group's poster board. Record this data in an organized way in your journal.
5. After collecting your topic data, meet with the members of your group to share and analyze each of the three data sets (one from each group member's topic).
6. Construct an explanation (Claim, Evidence, Reasoning) for the investigation question using data from the three topics researched by your group for the chosen event.
7. Compile your data (information and images) to create a panel on your group's poster board for the guided gallery walk.
8. Present your research to the class as a group during your portion of the guided gallery walk.