

## Oceans for Life Lesson Plan

# Natural Disaster

### OVERVIEW

This lesson focuses on plate tectonics. Students will be introduced to the concept of plate tectonics and the natural disasters that can occur when plates shift. They will then explore the ways in which the plate tectonic settings of various national marine sanctuaries have contributed to the rich biodiversity of each. After discussing what they know about plate tectonics and geologically-based natural disasters, students work through an [online tutorial](#) to gain a greater understanding of plate tectonics. Groups of students will then focus on one of five national marine sanctuaries, completing poster displays that present their sanctuary's geographic location, its plate tectonic setting, information about the biodiversity it supports, and information about how the plate tectonic setting may have contributed to the richness of the ecosystem.

This lesson is one in a series exploring the history, biology, and ecology of the [National Marine Sanctuaries](#). It was developed for National Geographic's [Oceans for Life](#) program, in collaboration with and with support from the [National Oceanic and Atmospheric Administration](#).

### FOCUS

Plate tectonics

### FOCUS QUESTIONS

- What is plate tectonics and what effects does it have when plates shift?
- How does the plate tectonic setting contribute to the richness of the ecosystem?

### LEARNING OBJECTIVES

Students will:

- define and describe plate tectonic activities including earthquakes and volcanoes;
- explore different plate tectonic settings;
- examine the biodiversity and ecosystems supported by various tectonic settings; and
- determine the tectonic settings and related ecosystems of the Olympic Coast, Cordell Bank, Gulf of the Farallones, Monterey Bay, and Channel Islands national marine sanctuaries.

### GRADE LEVEL

6-8

### MATERIALS

- Computer with internet access (Note: all information can be pre-downloaded and printed)
- Writing/drawing materials/chart paper

### AUDIO VISUAL MATERIALS

- [Natural Disaster Video](#)

### TEACHING TIME

Three to four hours

### SEATING ARRANGEMENT

Whole-class instruction and small group activities

### MAXIMUM NUMBER OF STUDENTS

No limit

### KEY WORDS

Tectonic Plates, Natural Disaster, Earthquake



## PREPARATION

- Download and prepare video clips
- Gather materials

## LEARNING PROCEDURE

### Opening:

Have students brainstorm a list of natural disasters that have occurred over the past several years (or historically) and look for news articles and information describing the causes and effects of the events.

### [National Geographic News](#)

[National Geographic: Forces of Nature](#) (For Case Studies, open the interactive and select any of the four choices; then select "Case Studies" from the tabbed navigation menu.)

### [Time for Kids](#)

### [USA Today Storm Center](#)

When students have found information on several events, have them categorize the events into primarily geologically based (e.g., earthquakes, volcanic eruptions, tsunamis), or primarily meteorologically based (e.g., hurricanes, tornadoes, or typhoons).

Focus student attention on the geological disasters and ask them to brainstorm a list of adjectives that can be used to describe the events. Remind students to consider all the outcomes of the disasters.

### Development:

#### **Activity 1:**

Refocus student attention on the geological disasters they researched, and ask them if they know what caused the events. Write the term "plate tectonics" on the board and ask if any students are familiar with the term (most likely several students will be familiar with the concept). Allow students to briefly share what they know about plate tectonics and then direct student attention to this online tutorial

from the PBS Savage Earth website, [Hell's Crust: Our Everchanging Planet](#) to gain a greater understanding of plate tectonics. Have students create a table in their notes and make an annotated diagram for each of the types of tectonic settings described in the [Hot Zones](#) animation section of the tutorial:

- Subduction Zone
- Collision Zone
- Spreading Center/Mid-Ocean Ridge
- Magma Chamber

Annotations should include information about how the plates of the earth move in each scenario, and what the resultant land formations or shifts are.

Have students share their table and diagrams in small groups and then review as a whole class.

#### **Activity 2:**

Explain to students that the shifts in plates on Earth's surface are responsible for much of the incredible variety of land formations, including volcanoes, mountains, and valleys. Ask students how different landforms on the Earth's surface have an impact on the living creatures and plants that inhabit those areas. Make a list of the environmental factors that affect ecosystems (students should list factors including climate, temperature, shelter, landforms, plant life, minerals, water, etc.). Ask students how these factors influence the types of animals that inhabit a given area. Then explain that the same is true of undersea ecosystems. The formations of land on the ocean floor have an impact on the types of plants and animals that will survive there. Explain to students that they will be studying the influence that tectonic systems have on the ecosystem biodiversity in a given area— in this case, in several [national marine](#)



[sanctuaries](#) maintained by the [National Oceanic and Atmospheric Administration](#) (NOAA). Have students watch a [Natural Disasters video](#) to get an overview of plate tectonics along the West Coast and the relationship between activity of Earth's plates and life in the ocean. Then have students learn more about how tectonic activity and systems influence the diversity of life in different areas by visiting these web pages and reading these news articles describing undersea life near hydrothermal vents (vents caused by activity in the Earth's crust):

[Unrivaled Submersible Pilot on a Life in the Deep](#)  
[Giant Tubeworms Probed for Clues to Survival](#)  
[Hydrothermal Vents—Vent Basics](#)  
[Vent Biology](#)

Have students answer the following questions as they explore the Web sites:

- What did this expedition focus on?
- How did the geology affect the biology in this area?
- What was something that you learned that surprised you?

Lead a brief class discussion to have students share what they have learned about life near hydrothermal vents, and how plate tectonics contributes to that type of ecosystem.

### **Activity 3:**

After students have discussed hydrothermal vents and their influence on undersea life, explain that they will now spend some time learning about the tectonic systems of several national marine sanctuaries and how those systems may influence the plant and animal life in and around the sanctuaries.

Have students work in small groups to explore

one of the national marine sanctuary sites below. Each group should locate their chosen sanctuary and then create a poster highlighting the tectonic activity within or near the sanctuary site, illustrating the undersea land formations found there, and including the plant and animal life unique to the area.

[Olympic Coast National Marine Sanctuary](#)  
[Cordell Bank National Marine Sanctuary](#)  
[Gulf of the Farallones National Marine Sanctuary](#)  
[Monterey Bay National Marine Sanctuary](#)  
[Channel Islands National Marine Sanctuary](#)

Student posters should include labels and annotations that focus on the ways in which the tectonic system created or creates the physical environment, and how that physical environment influences the types of creatures that thrive there.

Finally, have students share their posters with the class.

### **Activity 4:**

Explain to students that plate tectonic activity creates land formations and contributes to the environment and ecosystem in numerous ways. Have students research tectonic activity in their local areas, learn how mountains are formed well away from the edges of tectonic plates, and discover what types of ecosystems develop in and around such landforms by visiting these sites:

[U.S. Geological Survey](#) (Visit "Science in Your State" to learn about seismic activity in or near your state.)  
[West Virginia Geological and Economic Survey: Feature Article—Mountains](#)  
[North American Center for Environmental Cooperation: Ecological Regions of North America](#)



As information is collected about your local topography and ecosystems, have students compile and convey the information in a class mural.

As students work, have them summarize what they have learned about plate tectonics and the types of plant and animal populations that can develop in unique topographical areas caused by shifts in Earth's surface. Using the information they have gathered about their own local areas, have students add to their poster annotations from *Activity 3*.

### Closing:

Have students revisit their brainstormed list of adjectives describing geologically based natural disasters. Ask them to consider what other terms they might now associate with geological shifts that cause such events as earthquakes and volcanic eruptions. Also, have students list underwater geological features that are important to the marine life protected by each of the national marine sanctuaries.

### SUGGESTED STUDENT ASSESSMENT

Have each student write a brief summary describing the influence of plate tectonics on plant and animal life in specific geographic locations. Students may write about either the marine sanctuary they studied or their own local eco-region.

Evaluate student participation in each activity from the lesson, as well as their summaries, based on the following:

- Understanding of plate tectonics and how shifts in the Earth's surface create landforms.
- Demonstrated understanding of the influence of landforms and other seismic activity on living things.

### EXTENDING THE LESSON

- Have students visit this [PBS interactive](#) on plate tectonics, and then create a model or diagram illustrating one type of tectonic activity using clay, papier-mâché, diorama, etc. Students should be prepared to explain the process while demonstrating their models/illustrations.
- To help students learn more about the formation of mountain ranges, have them visit this web page from the [National Park Service's Interactive Classroom exhibit](#) explaining the formation of the Sierra Nevada mountain range. Have students use a relief map to look for major mountain ranges on each continent and identify the plates likely to have contributed to that mountain formation by referring to this map of the [Major Tectonic Plates of the World](#).

### RELATED LINKS

[Dive and Discover: Expeditions to the Seafloor Educational Multimedia Visualization Center](#)  
[Monterey Bay Aquarium Research Institute](#)  
[NOAA Channel Islands National Marine Sanctuary](#)  
[NOAA Cordell Bank National Marine Sanctuary](#)  
[NOAA Gulf of the Farallones National Marine Sanctuary](#)  
[NOAA Monterey Bay National Marine Sanctuary](#)  
[NOAA Olympic Coast National Marine Sanctuary](#)  
[National Geographic EdNet: Oceans for Life](#)  
[National Geographic News: \*Earthquake Prediction Remains a Moving Target\*](#)  
[National Geographic News: \*Giant Tubeworms Probed for Clues to Survival\*](#)  
[National Geographic News: \*Unrivaled Submersible Pilot on a Life in the Deep\*](#)  
[National Park Service: Yosemite National Park—Yosemite at a Glance: Geology](#)  
[North American Center for Environmental Cooperation: Ecological Regions of North America](#)



[PBS: A Science Odyssey—You Try It: Plate Tectonics](#)

[PBS: Savage Earth Online](#)

[U.S. Geological Survey](#)

[U.S. Geological Survey: This Dynamic Earth The Story of Plate Tectonics](#)

[West Virginia Geological and Economic Survey: Feature Article—Mountains](#)

#### CONNECTIONS TO OTHER SUBJECTS

Geography, ecology, biology, language arts

#### NATIONAL SCIENCE EDUCATION STANDARDS

- Earth Science: Structure of the Earth System

#### NATIONAL GEOGRAPHY STANDARDS

- Standard 7: "The physical processes that shape the patterns of Earth's surface"
- Standard 8: "The characteristics and spatial distribution of ecosystems on Earth's surface"

[Ocean Literacy: Essential Principles and Fundamental Concepts](#) (PDF, [Adobe Reader](#) required)

- Principle 1: The Earth has one big ocean with many features

- Principle 2: The ocean and life in the ocean shape the features of the Earth

#### FOR MORE INFORMATION

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#### ACKNOWLEDGEMENT

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