

Oceans for Life Lesson Plan

Hawaiian Hot Spots

OVERVIEW

This lesson is a follow-up to [Natural Disasters—Exploring Plate Tectonics](#). This lesson will focus on the interaction of hot spot volcanism and plate tectonics and will build upon basic knowledge of plate tectonics gathered in the previous lesson. Students will explore the ways in which the unique hot spot environment has contributed to the richness of the environment at Northwestern Hawaiian Islands Marine National Monument and Hawaiian Islands Humpback Whale National Marine Sanctuary.

First, students will be introduced to Hawaiian volcanic activity while watching the [Hawaiian Hot Spots video](#). Then, they will learn how plate tectonics plays a role in volcanic activity. Students will then examine maps and photographs of the Hawaiian Islands, and through a class discussion will share their ideas about the origin of the Hawaiian Islands (they were formed as a result of hot spot volcanism on the seafloor—literally built up from the bottom by repeated lava flows). They will then visit several sites to learn about hot spots and how they relate to the formation of the Hawaiian Islands. Finally, they will research the two marine protected areas in Hawai'i to learn about their physical and biological environments and consider the relationship between the physical environment (volcanoes) and the biological richness of the area.

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

Interaction of hot spot volcanism and plate tectonics

FOCUS QUESTIONS

- How does plate tectonics play a role in volcanic activity?
- How has hot spot volcanism contributed to the richness of two marine protected areas in Hawai'i?

LEARNING OBJECTIVES

Students will:

- define "hot spot" as it relates to plate tectonics;
- describe the origin of the Hawaiian Islands;
- research the Northwestern Hawaiian Islands Marine National Monument and Hawaiian

Islands Humpback Whale National Marine Sanctuary to determine how their physical environments affect the biologic richness of the Hawaiian Islands;

- describe the relationship between volcanoes and the biodiversity of the surrounding area; and
- determine whether plate tectonics plays a role in other regions' biodiversity.

GRADE LEVEL

6-8

MATERIALS

- Computer with internet access (Note: all information can be pre-downloaded and printed)
- Blank index cards



AUDIO VISUAL MATERIALS

- [Hawaiian Hot Spots Video](#)

TEACHING TIME

Two to three hours

SEATING ARRANGEMENT

Whole-class instruction and small group activities

MAXIMUM NUMBER OF STUDENTS

No limit

KEY WORDS

Plate tectonics, Hawai'i, Volcano, Biodiversity, Hot Spot

PREPARATION

- Download and prepare video clips

LEARNING PROCEDURE

Opening:

Show students the [Hawaiian Hot Spots video](#). As students watch, have them look for information explaining the difference between volcanoes caused by shifts in the Earth's plates and those caused by "hot spots." Have them also look and listen for information about how the Hawaiian Islands have been affected by the very way in which they were created (biodiversity).

After they have watched the video, ask the students to define "hot spot" (an exceptionally hot area where a plume of magma comes to the surface forming a volcano).

Development:

Explain to the students that in order to fully understand hot spots and their effect on the environment, they need to further understand how volcanoes are formed.

Have students work in pairs to review how volcanoes develop by exploring:

[National Geographic's Forces of Nature](#)
[NOAA Ocean Explorer: What is a Hotspot?](#)
[Volcano World's Hot Spot](#)
["Hotspots": Mantle Thermal Plumes](#)
[Submarine Ring of Fire](#)

As students work, have them answer the following questions:

- How many volcanoes are currently active in the world today? (About 1900)
- What is the "Ring of Fire?" (A region in the Pacific Ocean that is particularly active with volcanoes)
- How do volcanoes form? (They can form from one plate sliding under another and releasing magma at the rift; they can also form when magma shoots to the surface through a "hot spot" in the surface of a plate.)
- What are the five types of volcanoes? (Cinder cone, caldera, composite, shield, submarine, lava dome)
- What effect do plates have on volcanoes? (Most volcanoes are caused by shifting of plates and, therefore, are found where plates meet.)
- How are the Hawaiian volcanoes different than those in the "Ring of Fire?" (Hawaiian volcanoes are caused by "hot spots" rather than shifts in the Earth's plates.)
- How do the volcanoes in Hawai'i contribute to the island's land and biodiversity? (They provide valuable mineral deposits, fertile soils, and geothermal energy. Lava flows can build new land as they have in Hawai'i.)

Have students work in pairs to draw diagrams of how plate tectonics contribute to the development of a volcano. The diagrams may contain some of the following labels:

- Core
- Mantle
- Vent
- Lava flow
- Ash



- Branch Pipe
- Fissure

Then, have students examine [maps](#) and [videos](#) of the Hawaiian archipelago. Explain that the Hawaiian Islands are home to a volcanic "hot spot" and that it has greatly affected the biodiversity of the region.

Ask students to describe the Hawaiian Islands habitat based on the video, maps, and photographs they've examined. Explain that the Northwestern Hawaiian Islands Marine National Monument contains thousands of species, including marine mammals, fish, sea turtles, birds, and invertebrates. Many are rare, threatened, or endangered. And, that at least one quarter are endemic, meaning they are found nowhere else on Earth. Explain, for example, that the [Hawaiian monk seal](#) is only found in the waters around the Hawaiian Islands. Visit the [NOAA Hawaiian Monk Seal](#) information page and the [NOAA Fisheries' Pinnipeds](#) page for more information. Have students think about and discuss why certain species might only be found in this area.

With the whole class, generate a list of characteristics of the Hawaiian Islands environment. Then, ask them to try to determine what kind of plants or animals might flourish in that environment.

Then have students write the names of other organisms they would expect to find in this habitat on index cards. Then have them sort the cards by type of animal (mammals, birds, plants, etc.).

Next have them explore the range of wildlife in the Hawaiian Islands by visiting the [Northwestern Hawaiian Islands](#) and [Hawaiian Islands Humpback Whale](#) Web pages. Assign

groups of students each a different type of organism (mammals, fish, birds, plants, invertebrates, reptiles) to research and report back to the class. Students should note:

- Where the organism is found.
- What relationship the organism has to others in the ecosystem.
- Whether the organism is endemic to this area, and why.
- Whether it is threatened or endangered.
- In what ways the Hawaiian Islands "hot spot" creates a perfect environment for this organism.

Then, have students write the name of, and describe, an environment different from the Hawaiian Islands on an index card. Then, shuffle the cards and hand one to each student. Explain that they will be writing a story about the organism they researched being moved to the environment they were given on the card. Tell students to include the following in their stories:

- A detailed description of the new environment
- Hardships the organism encounters in the new environment
- Ways in which the new environment does not share the characteristics of the main Hawaiian Islands or the Northwestern Hawaiian Islands.

Closing:

Have students explore these Web sites and describe how volcanic activity has affected the growth or decline of species currently or previously found in that geographic region.

[National Geographic Magazine: Once and Future Fury—Related Links](#)
[Volcanoes in the North and Central American Region](#)



SUGGESTED STUDENT ASSESSMENT

Have students locate a place they have been to (or are familiar with) which has been affected by volcanic activity in the past. Then, have them create an "organism" web of the plants and animals, which thrive in that region.

EXTENDING THE LESSON

- Student can examine current volcanic activity by going to Volcano World's [Current Volcano Activity](#) page. Then, have them create their own maps of volcanic activity based on a certain theme (recent activity, local activity, types of volcanoes, affect on the environment, etc.).
- Students can build their own volcanoes by following the instructions found on National Geographic's [Forces of Nature](#) Web site. Click on *build your own volcano*.
- Have students research what geological factors affect their local region (volcanoes, glaciers, changing shorelines, etc.). Then, have students create a "timeline" of what organisms have existed in their geographic region over time.

RELATED LINKS

[NOAA National Marine Sanctuaries](#)
[NOAA Encyclopedia of the Sanctuaries](#)
[NOAA Hawaiian Islands Humpback Whale National Marine Sanctuary](#)
[NOAA Northwestern Hawaiian Islands Marine National Monument](#)
[National Geographic: Forces of Nature](#)
[National Geographic: Once and Future Fury](#)
[National Geographic: Animals—Mammals](#)
[National Geographic: Critter Cam](#)
[National Geographic EdNet: Oceans for Life](#)
[Volcano World](#)

CONNECTIONS TO OTHER SUBJECTS

Geography, ecology, biology, language arts

NATIONAL SCIENCE EDUCATION STANDARDS

- Earth and Space Science: Structure of the Earth System

NATIONAL GEOGRAPHY STANDARDS

- Standard 7: "The physical processes that shape the patterns of Earth's surface"

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

- Principle 1: Earth has one big ocean with many features
- Principle 2: The ocean and life on the ocean shape the features of Earth
- Principle 4: The ocean makes Earth habitable
- Principle 5: The ocean supports a great diversity of life and ecosystems

FOR MORE INFORMATION

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