



Volcanoes' Effect on the Biosphere

Grade 5

Earth Science

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BIG IDEAS

Planet earth consists of spheres that all interact with one another- no sphere exists alone. There are many ways these spheres interact, one of which would pertain to volcanic eruptions interacting with the ecosystem. This is one of many ways in which the geosphere interacts with the biosphere. This interaction does not cease after the volcanic eruption, but it continues through nature's rebuilding process known as succession. The story is not over for the ecosystems as great things are still to come! This entire cycle might repeat many times over the course of planet Earth's existence in the beautiful cycle of the interaction of earth's major spheres.

EDUCATION STANDARDS

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

5.RI.IKI.7 Locate an answer to a question or solve a problem, drawing on information from multiple print or digital sources.

5.W.TTP.2 Write informative/explanatory texts to examine a topic and convey ideas and information.

5.SL.PKI.4 Report on a topic or text, or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas.

NGSS Performance Expectation(s)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts:
<ol style="list-style-type: none"> 1. Asking questions: Students will ask questions about how the geosphere and the biosphere will interact through a volcanic eruption. 2. Developing and Using Models: Students will create visual models to represent the ecosystem (biosphere) near a volcano before, immediately after, and years later after a volcanic eruption. 	<p>ESS2.A: Earth Materials and Systems Earth’s major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth’s surface materials and processes.</p>	<ol style="list-style-type: none"> 1. Patterns: Students will analyze data about the world’s location of volcanoes and will recognize the patterns of the location of volcanoes. 2. Cause and Effect: Students will be able to recognize and predict effects of the interaction between the geosphere and the biosphere that take place when

<p>3. Analyzing and Interpreting Data: Students will analyze the location of volcanoes using interactive NASA satellite data.</p> <p>4. Constructing Explanations: Students will explain how the geosphere and the biosphere interact through volcanic eruptions.</p> <p>5. Obtaining, evaluating and communicating information: Students will obtain information about a specific volcano through their research. Students will evaluate the information when creating their visual models. Students will communicate their learning through both a written essay and a formal presentation to their classmates.</p>		<p>volcanos erupt.</p> <p>3. System Models: Students will create a visual model of an ecosystem (biosphere) before, immediately after, and years after a volcanic eruption.</p> <p>4. Energy and Matter: Students will identify the cycles that occur in the biosphere as the geosphere interacts through natural phenomena suchy as volcanic eruption. Students will recognize that the cycles may repeat themselves many times.</p> <p>5. Stability and change: The interaction of the geosphere and the biosphere through volcanic eruptions create change in the ecosystem. Stability returns after the process of succession.</p>
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ELA:

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ITEEA Standards

Other Standards

MEASURABLE STUDENT LEARNING OBJECTIVES

- 1.) Students will be able to develop models to show the changes that occur to the biosphere through the eruption of volcanoes. (This will be assessed through the student created drawing models created throughout the unit)**
- 2.) Students will be able to locate and analyze an answer to the question, “How do the geosphere and the biosphere interact through volcanic eruptions?” (This will be assessed through the readworks.org passage, the Analyze Volcanic Ash activity, the written essay as well as the culminating presentation.)**
- 3.) Students will be able to write a four paragraph essay evaluating the effect of volcanoes on the ecosystem. (This will be evaluated through**

the completion of the four paragraph essay using the Tennessee explanatory writing rubric.)

- 4.) Students will be able to report on a volcano and the ecosystem surrounding the volcano in the event of a volcanic eruption. (This will be assessed through the final presentations.)**

STEM INTEGRATION

Science- This lesson addresses the science concepts of volcanoes, ecosystems, two of the earth spheres, the interaction between Earth's spheres, and secondary succession.

Technology- Much of the students' research is completed using one on one technology, though this lesson does not inherently address the nature of technology, in that students are not designing technology to make life easier. However, students are utilizing technology that is available to them to aid in their research of the scientific concepts of which they are building conceptual knowledge. Students will use satellite data provided by NASA to analyze the patterns of the locations of volcanoes on planet Earth as well as videos produced using satellite imagery which helps deepen students' understanding of the interaction of two of Earth's spheres: the geosphere and the biosphere.

Art- Students will use art to create their model drawings of the ecosystem near a volcano both before, immediately after and years after a volcanic eruption. By completing the drawings individually throughout the process of this unit, students will take ownership of the volcano they are studying and the ecosystem that inhabits that part of the biosphere. Students will have an authentic reason to research the scientific skills being acquired through this lesson to identify and analyze how it will affect the drawings of their ecosystem. Students will then have to draw a second model showing the effect of the volcanic eruption and then a final model showing the hope that comes after the recovery of a volcanic eruption through natural succession. Art is often an act of love and will help some students develop an emotional connection to the concepts they are learning.

Literacy- Students will read an article about the effects of a volcanic eruption in Hawaii and answer questions based on their understanding of the passage. This article will create a human side to the natural disaster thus allowing students to form connections to science. Students will conduct research using multiple print and video resources to build on their content knowledge of a particular volcano and the effects its eruption could have on the surrounding biosphere. Students will write a four paragraph essay using the Tennessee explanatory essay rubric to explain their findings of the effect of a volcanic eruption on an ecosystem. By completing the labor of writing, students will become engrossed in the learning since they now have the responsibility to teach the concepts through their writing. Finally, students will use their speaking

and listening standards to deliver a presentation to report on their volcano findings. Delivering a presentation requires ownership and deep understanding of the content.

NATURE OF STEM

This unit of lessons consists of several of the components of the nature of science. To begin with, this lesson is the embodiment of the empirical nature of science. This entire lesson is built around students observing the biosphere near a specific volcano, observing the effects of volcanoes through not only rich text but also through videos and NASA satellite data. In addition to the empirical nature of science this unit of lessons briefly addresses the theory and law nature of science with the idea of the Ring of Fire and slight mentions of the theory of plate tectonics. My favorite component of the nature of science is the creative and imaginative nature of gaining scientific knowledge. Through the completion of the three models of the volcanoes, before, immediately after, and longer after a supposed volcanic eruption, students will use the part of their learning to imagine and be creative in how they represent the interaction of the geosphere with the biosphere. Finally, this lesson is embedded with cultural and social implications of the nature of science. Through the videos, the rich text and even the imagined impact of the volcanic eruption on the students' surrounding ecosystems, students must analyze and evaluate how the eruption will affect the people inhabiting the areas near the volcano. Students will see the effects of volcanic ash and the lava flows and will not be able to ignore the effect this natural disaster has on mankind.

MATERIALS NEEDED

One on one devices, print outs of google documents linked at the bottom, copy paper, art supplies, classroom projection system, index cards, access to google classroom if the teacher desires to link rather than print the google documents

ENGAGING CONTEXT/PHENOMENON

Students will watch a youtube video of various volcanic eruptions. The teacher will use this to grab students' attention and launch a discussion into students' prior knowledge regarding volcanic eruptions.

DATA INTEGRATION

Students will access a volcano database found at the following NASA data website: <https://appliedsciences.nasa.gov/what-we-do/disasters/volcanoes> Students will interact with the data and will analyze it to identify patterns in the location of Earth's volcanoes.

TEACHER BACKGROUND KNOWLEDGE

Teachers need to have a basic understanding of the major Earth spheres and should recognize that the different spheres are constantly interacting with one another. They should understand that the majority of Earth's volcanoes are situated on what is called the Ring of Fire. Teachers should recognize that when volcanoes erupt they affect the biosphere and the ecosystems located in that portion of the biosphere. Teachers should identify secondary succession as the rebuilding of an ecosystem in an area where an ecosystem once existed prior to being destroyed by an event such as a flood, forest fire or volcano. I am including a link that provides much of this needed background knowledge.

<https://mynasadata.larc.nasa.gov/basic-page/volcanic-eruptions>

DIFFERENTIATION OF INSTRUCTION

This lesson is largely accessible to all students but still requires for each applicable individualized education program to be followed. Depending on students in the classroom, this usually requires preferential seating, a copy of notes, text to speech capability of all reading online or a human reader for printed text. This lesson will also need to be modified regarding both the four paragraph essay in the explain portion of the lesson and the presentation in the evaluate portion of the lesson. The teacher may choose to allow students who need their work scaffolded to write a two paragraph essay or to display the information through images rather than written word. Likewise, for students who have generalized anxiety disorder the teacher may choose to have students record their presentations rather than presenting them in front of the live class audience. Required written answers may not be completed in complete sentences by some students with an IEP.

The main way that this lesson has a real life connection is in students' innate interest and curiosity regarding natural disasters such as volcanoes. While the students being taught this lesson in Tennessee have most likely never been personally affected by a volcano, the hope is that they will become personally invested in the science exploration of the effects of volcanic

eruptions since they are taking ownership of a specific volcano that they are researching. Students will become connected to the volcano and the surrounding ecosystem as they create artistic models depicting both the flora and fauna of the ecosystem surrounding their volcano. One hope is that this lesson might tap into students' interest in a geology career upon completion of high school. Building hooks and creating connections will help students to remember what they learned at the lower levels and have something to build on later in their schooling.

LESSON PROCEDURE

5E	Details of 5E Lesson Implementation
<p>Engage</p>	<p>Procedure: (Day #1- 60 minutes) Students will watch a National Geographic video of volcanoes erupting. The teacher will ask the students what they already know about volcanoes. This will be done by hanging chart paper with the following questions around the room. <i>"What is a volcano?" "Where do most of earth's volcanoes erupt?" "What are different types of volcanoes?" "What causes volcanoes to erupt?" "What do you wish you knew more about volcanoes?"</i> The teacher will be able to use these questions to gauge students' prior knowledge so that he/she can address any gaps in the learning up until this point.</p> <p>Once the teacher has assessed student background knowledge regarding volcanoes themselves, the teacher will lead a mini direct instruction lesson ensuring that students have an understanding of earth's major spheres. The teacher will show the youtube video titled, "Earth's Four Spheres," by Geography Realm. This video does not have speech but has videos, text, and labels. The teacher will lead the instruction by pausing and having students take visual notes to help them remember the four main spheres.</p> <p>To end the engaging portion of the lesson, the teacher will pose the learning objective: "How does the earth's geosphere interact and affect the earth's biosphere." The teacher will give each student an index card on which students can write their answer to this question, based on what they have seen so far. This card will be passed back out later for students to modify their answer after the other phases of the</p>

	<p>unit.</p> <p>Modifications: The teacher will follow all individual education plans throughout each part of the lesson. This portion of the lesson is easily accessed by most learners.</p> <p>Standards Addressed: background knowledge is explicitly taught to scaffold the following standard:</p> <p>5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</p> <p>Formative/Summative Assessment: gallery walk question responses and class discussion, index card exit ticket</p> <p>Resources https://youtu.be/xExdEXOaA9A?si=GmqV0IA2L6fquh7O (phenomenon video of erupting volcanoes) https://youtu.be/tDbBjEYsSg4?si=nVD7bl9m8Px8XnzB (video containing an explanation of the Earth’s main spheres)</p>
<p><u>Explore</u></p>	<p>Procedure: (Day #2- 60 minutes)</p> <p>The teacher will introduce the student to the NASA volcano website, https://appliedsciences.nasa.gov/what-we-do/disasters/volcanoes . The teacher will provide scaffolded instruction to introduce the site to the students. Students will then be given 15 minutes to explore the site. After students have explored the interactive website, students will discuss with their partner what they noticed about where the majority of earth’s volcanoes are located. The teacher will pull the students back to a whole class and review the ring of fire, which they learned about the prior school year.</p> <p>Students will choose a volcano from a list given to them by the teacher. Students will then choose one of these volcanoes to research. Students should complete the research and fill out the document during this class period.</p>

The students will also be made aware that at the end of this unit, they will be presenting their volcano to the class. The teacher will provide the presentation rubric to the students so that they are able to work with the end in mind. The teacher will also review the details of the rubric with the students. All three of these documents, created by Victoria Dillard, are linked in the resource section below.

(Day #3- 60 minutes)

Students will draw a model of the volcano they chose to research. Their model should be full color and should include representations of at least 5 types of vegetation and 5 types of organisms that live in the area. The model will be drawn on a white sheet of copy paper.

Once the students have completed the drawing, students will complete the mini lesson titled, *Analyzing a Volcanic Ash Model*, created by MyNasaData. Students will answer the questions from the mini lesson on the handout provided. (linked below)

(Day #4- 60 minutes)

Students will watch the video, *Volcanic Lava*, by National Geographic.

Students will read the readworks.org article titled, "No! Volcano!" The teacher will either assign the article for students to complete online or will print the article and questions. This article will add to the students' knowledge of how an erupting volcano will affect the ecosystem.

After learning about ash the day before, watching the volcanic lava video and completing the readworks.org reading passage, students will draw a second model showing what the ecosystem around their volcano might look like after a volcanic eruption.

As an exit ticket, the teacher will pass back out the index

card students used on the first day of the unit. Students will add new information answering the question, “How does the geosphere interact with the biosphere?”

Modifications Some students will require the read aloud accommodation on the readworks.org passage.

Standards Addressed

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

5.RI.IKI.7 Locate an answer to a question or solve a problem, drawing on information from multiple print or digital sources.

Formative/Summative Assessments- The completion of the volcanic research document and the completion of the four questions with the mini lesson: Analyzing a Volcanic Ash Model. Revised answers on index card.

Resources:

https://docs.google.com/document/d/1IJrUIPDawxFYIhu_gln-efR5lcSmFPvLWzrK2PpHjEk/edit (Research questions created by Victoria Dillard)

https://docs.google.com/document/d/1mYxBG8MMkG2DxwDPOlpE5ssZ_uOcv8403ILp8fFhP8s/edit (Research explanation and volcano list created by Victoria Dillard)

<https://myasadata.larc.nasa.gov/mini-lessonactivity/analyzing-volcanic-ash-model> (Interactive *Analyzing a Volcanic Ash Model* mini lesson)

https://docs.google.com/document/d/1Jt3g6456xGxF1f-dF0g-Yce9V1oe8RJwg_SuffTLkUc/edit (*Analyzing a Volcanic Ash Model* lesson questions handout)

<https://youtu.be/xExdEXOaA9A?si=IV7F8iac6L7J-Vjs> (Video of volcanic lava flowing)

<https://www.readworks.org/article/Oh-No!-Volcano/a516ad41-080c-4c2b-a2ef-ca09b61f2321#!articleTab:content/> (Readworks.org)

	<p>article link)</p> <p>https://docs.google.com/document/d/17FUGLtlFjVPx6pj4S5C5xvTb60R20_VlbwdxYFssw3Y/edit (Teacher made presentation rubric)</p>
<p><u>Explain</u></p>	<p>Procedure: (Day #5- 60 minutes)</p> <p>Students will reflect on their first and second drawing models of their volcano. During this phase of the lesson, students will explain how the geosphere interacted with the biosphere in the eruption of their volcano. Students should write a four paragraph essay in which they address both the changes to their ecosystem caused by the volcanic lava as well as the volcanic ash. Students should include an opening paragraph, two body paragraphs, and a closing paragraph.</p> <p>Modifications: The student expectations will be modified based on individual educational plans for each student. While most students will complete the essay in its entirety, some students will be given modified assignments such as only two paragraphs or only drawings. Likewise, some students require more scaffolding during writing lessons. The teacher will work with a predetermined small group of students at the teacher table to offer guidance.</p> <p>Standards Addressed:</p> <p><i>5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</i></p> <p><i>5.W.TTP.2 Write informative/explanatory texts to examine a topic and convey ideas and information.</i></p> <p>Formative/Summative Assessments Students will be assessed based on the explanation of how their ecosystem was affected by the volcanic eruption. Students will be graded using the informative essay rubric created by the state of Tennessee.</p> <p>Resources</p> <p>https://www.tn.gov/content/dam/tn/education/documents/rubric_writing_g4-5_explanatory.pdf (State of Tennessee writing rubric)</p>

Elaborate

Procedure: (Day #6- 60 minutes)

Students will view the youtube video titled, *Ecological Succession: Mt. St. Helens Rebuilds*. The teacher will use this video as an interactive session, pausing and discussing what is going on in the biosphere near the volcanic eruption, many years after the eruption. This gives students access to what happens next in the constant interaction of the geosphere and the biosphere. The students should realize that the story is not over for the biosphere that was so deeply affected by the volcanic eruption.

Students will now draw a third model of their volcano, predicting what the ecosystem might look like a decade after the volcanic eruption. Students will be given a large piece of paper on which they will glue all three of their drawings in order- pre volcanic eruption, at the time of the volcanic eruption, and post volcanic eruption.

As time allows, students will review what they will be presenting in the evaluate session of the unit.

Modifications: The teacher will follow all applicable individual education plans. This phase of the lesson is largely accessible to all learners.

Standards Addressed

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Formative/Summative Assessments Students will be assessed based on the three drawings showing the before, during and after interaction of the geosphere and the biosphere.

Resources

<https://youtu.be/mpXkBWNa6XA?si=m0UzvEs-S0yNa8Mo>

<p><u>Evaluate</u></p>	<p>Procedure: (Day #7- 60 minutes) Although students have been evaluated at every portion throughout the lesson, the final evaluation stage will include short student presentations of their volcano drawings. Students were given a teacher made rubric earlier in the unit so they are able to be prepared for their presentations. The rubric is also linked below.</p> <p>Modifications Students who are unable to present in front of a class of peers will be given the option to record their presentation to share with the teacher rather than standing in front of the class.</p> <p>Standards Addressed</p> <p>5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</p> <p>5.SL.PKI.4 Report on a topic or text, or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas.</p> <p>Formative/Summative Assessments <i>Student presentations</i></p> <p>Resources</p> <p>https://docs.google.com/document/d/17FUGLtlFjVPx6pj4S5C5xvTb60R20_VlbwdxYFssw3Y/edit (teacher made presentation rubric)</p>
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