Virtual Field Trips

Evolving Erosion

Investigating Earth and Sky Virtual Field Trip

This is a supplementary educator guide to assist parents and teachers with the asynchronous portion of the virtual field trip. To reserve your virtual exhibit exploration experience, please fill out the Virtual Field Trip Request Form.

All associated activity guides can be found with the attached documents found on our website. Additional resources can be found at the end of this guide.

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How does erosion change the landscape?

Earth's landscapes are constantly changing over time due to volcanic activity, tectonic activity, erosion, and human activity. Once the landscape has been built up by volcanic activity, it can be changed through different Earth processes, specifically erosion. By learning how the landscape is formed over small-scale or shorter timeframes (earthquakes, tsunamis, lava flows), we can better understand how the landscape can be modified over large-scale or longer timeframes (different types of erosion and tectonic plate activity).

Connection to the Next Generation Science Standards

During this virtual field trip, your young scientists will use observations to analyze and interpret data from maps to describe patterns of Earth's features, provide evidence of the effects of weathering or the rate of erosion by water, ice, wind or vegetation, and generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

After this field trip, your 4th grader should be able to explain these endpoints in their own words: What erosion is, how erosion can change environments, how humans can increase/decrease erosion in their communities, how maps can be used to identify different landmasses based on tectonic activity, how maps can change based on Earth's natural processes, how humans can change the biogeography of a region, how changes to the environment can cause or prevent hazards from natural Earth processes, changing variables in an experiment can alter the results, and how the results from experiments can lead to discoveries to reduce the impacts of Earth's natural processes on human communities.

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.

4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Disciplinary Core Ideas:

ESS2.A

Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

ESS2.B

The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water feature areas of Earth.

ESS2.E

Living things affect the physical characteristics of their regions.

ESS3.B

A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

ETS1.B

Testing a solution involves investigating how well it performs under a range of likely conditions.

Science & Engineering Practices:

Analyzing and Interpreting Data

Students will watch several videos and observe the results of several activities to compare the information to better understand the natural Earth processes being demonstrated, and begin thinking critically on how humans can modify the real-world results to create a safer community.

Planning and Carrying Out Investigations

Students will conduct several experiments throughout the program which culminates in an investigation that examines possible solutions to mitigate the hazards of changing landscapes and their effects on humans.

Constructing Explanations and Designing Solutions

After analyzing the videos and results of the activities, students will be able to further investigate or, be given a quiz or poll to determine what could have been done differently in each activity to reduce the impact of the natural hazard on the human populations.

Crosscutting Concepts:

Patterns

Students will be able to identify the **patterns** of different land masses based on tectonic activity and the different types of erosion.

Cause and Effect

Students will be able to identify how volcanic activity builds the landscape up, while different types of erosion **cause** the landscape to be worn away over time, and how humans affect the environment and how natural Earth processes affect humans.

Nearpod Field Trip Outline

1. Welcome and Introduction to your Virtual Field Trip - Galactic Gizmos (Slides 1-3)

   *Press the play button in the bottom left corner to play an audio transcription of the text on the slide.

   a. What is a landscape?

      - A landscape is part of the Earth's surface that can be viewed at one time from one place. It consists of the geographic features that mark, or are characteristic of, a particular area.

   b. Build it up, knock it down

      - Land masses are shaped and formed by volcanic eruptions, carved by glaciers, torn apart by earthquakes, or forced high above sea level by tectonic activity.

      - Landscapes are constantly changing and evolving over time through natural processes such as erosion. Most often we cannot see these changes happen in real time, but if we travel to Hawai'i we can watch the landscape change in a matter of minutes!

2. Volcanoes (Slides 4-9)

   a. **Video: All About Volcanoes: How They Form, Eruptions & More!**

      - Students will watch the video from SciShow Kids describing how volcanoes form, the difference between magma and lava, and a brief explanation of how the Hawai'ian islands formed.

   b. **Video: Volcanic Slime**

      - Students will watch a video that models geothermal activity and the build-up of gases in the Earth's mantle.
        - **ESS2.B** – This activity highlights the effects of gas release from rift valleys caused by diverging tectonic plates..

      - The *Volcanic Slime* and *All the Slime* activity guides can be downloaded from the Additional Resources under this Virtual Field Trip.

   c. Hawai'i

      - Each of the Hawai'ian Islands was formed from cracks in the ocean floor releasing lava. Over time the lava flows created layers of rock that grew on top of each other like stacked LEGO bricks, and continued to grow until they broke the ocean's surface.

- **Video: River of Lava**
    - Students will watch a video from BBC Earth that provides stunning, up-close visuals of lava flows interacting with the landscape.

d. **Quiz**
- Q: From the video, did the changes to the landscape happen slowly or quickly?

  A: Quickly

- Q: Were you able to watch the changes in the landscape in real time? Or were the images sped up?

  A: Real time

- Q: Do you think that the Hawai'ian Islands were formed ONLY by volcanic processes?

  A: No

- Q: Besides lava flows, what other processes shaped the Hawai'ian landscape? Select all that apply.

  A: Tectonic activity, Rifts, Wave action, Erosion

e. What do you notice?
- Students will compare the real world image of lava meeting the sea versus the animated results.
    - The image on the left is the building up of a volcanic island from the lava meeting the ocean and cooling off.
    - The image on the right is the edge of a volcanic island which has been eroded by wave action, demonstrating how the landscape changes over time.

f. **Open Ended Question**:

How are the land masses on the previous slide similar? How are they different? Do you think they were formed the same way?
- Students will respond by comparing and contrasting the similar landscapes.
- Sample responses: Yes, the land masses were formed in the same way; Yes, both land masses were formed by volcanic activity/lava flows; Both have rocks that meet the water; Both look like they are flowing into the water;

Both are on islands; The rocks look the same except one is smoking due to dissipating heat.

2. Earth Processes (Slides 10-16)

    a. Tectonic Plates

        - Pieces of Earth's crust and the upper mantle (the top two layers of the Earth) are constantly moving.

            - As the plates **converge**, or come together, they slide over top each other creating earthquakes from the vibrations, and magma can flow between the cracks caused by the movement creating volcanoes.

            - As the plates **diverge**, or move apart, the space is replaced by magma creating new edges to the plates. This activity creates volcanic activity and can result in earthquakes.

        - Tectonic activity can cause **volcanoes**, **earthquakes** and **tsunamis**.

            - The Ring of Fire in the Pacific Ocean which gets its name from the volcanic activity that occurs all around the edges, or boundaries, of the Pacific Plate.

            - The movement of the tectonic plates can also cause earthquakes. As the plates interact with one another, the friction between the plates creates vibrations. When these vibrations occur underwater they can create huge waves called tsunamis, which are rare.

    b. **Quiz**

        - Q: Based on the images on the previous slide, where does most of the volcanic activity occur?

            A: On the edge of the tectonic plates

        - Q: Why is the area around the Pacific Plate called the Ring of Fire?

            A: It's surrounded by active volcanoes

        - Q: Could the earthquakes resulting from the tectonic plates moving create a hazard for humans?

            A: Yes

        - Q: What other hazards to humans can come from tectonic activity? Select all that apply.

            A: Tsunamis, Gases released into the atmosphere, Lava flows, Property Damage

c. Earthquakes

- An earthquake is the result of tectonic activity as the tectonic plates around the world slide past, over, or under each other.
- The different types of earthquakes can change the landscape in many ways and can even increase the evidence of erosion.
- **Video: What Is An Earthquake?**
  - Students will watch a video from Peekaboo Kidz that describes tectonic plates and explains how they can cause earthquakes and tsunamis.

d. **Video: Graham Cracker Plate Tectonics**

- Students will watch a video that models the three different plate boundary interactions.
  - **ESS2.B** and **ESS3.B** – This activity highlights the hazards that would affect city planning and building structures due to tectonic activity.
- The *Graham Cracker Plate Tectonics* activity guide can be downloaded from the Additional Resources under this Virtual Field Trip.

e. **Quiz**

- Q: What types of land features were simulated during the Graham Cracker Plate Tectonics activity? Select all that apply.

  A: Mountains, Canyons, Valley or Rift
- Q: Can tectonic activity change the landscape that humans see and live in?

  A: Yes
- Q: Can tectonic activity change how we view landmasses on a map?

  A: Yes

Need a break?
This is a great time during the virtual field trip to take a break if you or your students need to get away from the screen. Don't worry, when you return, we will pick up where we left off and jump back into the virtual field trip!

f. Poll

- What other Earth processes can cause the landscape to change?
    - **Glacier movement**
        a. Although there are several correct answers, the only other process we haven't talked about yet is glaciers.

3. Erosion (Slides 17-27)

a. What is erosion?

- Erosion is the process by which the surface of the Earth is worn away by the action of water, waves, glaciers, wind, etc.
- Erosion is also the gradual decline or disintegration of something, like in the video of the land dam failure.
- **Video: Dam Breach Experiment - Failure of a Model Dam**
    - Students will watch a video from HD1080ide that models how a dam could fail during a flood if not properly constructed or maintained.

b. **Collaborate**

How could the engineers have strengthened the land dam?

Post ideas on different ways the engineers could have added to the land dam to make it stronger and more stable in order to better protect the communities near the land dam in case of failure.

- Students are asked to share their thoughts and think aloud. Other students who participate in the lesson can also leave their thoughts and compare their answers to the ones that are posted.

c. **Video: Jell-O Shoreline**

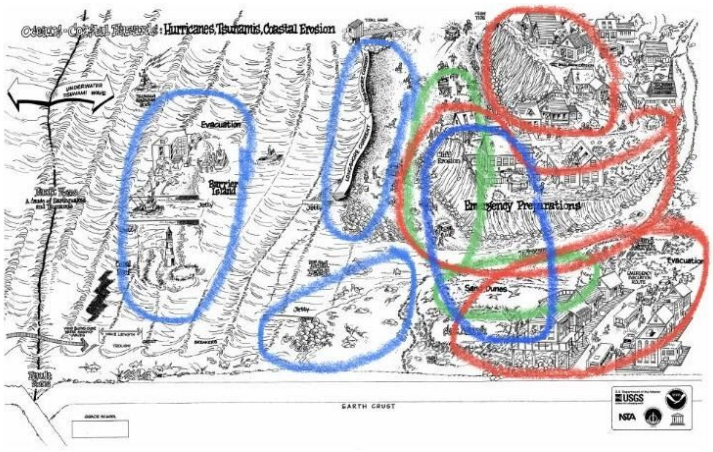
- Students will watch a video that models how an unprotected shoreline one that lacks a natural barrier reef) can be eroded by tidal forces, but installing break walls can prevent coastal erosion.
    - **ESS2.E, ESS3.B** and **ETS1.B** – This activity highlights how engineers designed a solution to the problem of coastal erosion
- The *Jell-O Shoreline* activity guide can be downloaded from the Additional Resources under this Virtual Field Trip.

d. **Draw It**

Below is an image of a coastal town. Circle the areas on the map that can be eroded by different types of natural processes.

- Circle areas in blue that can be eroded by waves.
- Circle areas in green that can be eroded by wind.
- Circle areas in red that can be eroded by runoff from the community.

  - Students will use the image provided to circle the areas where they believe different types of erosion can occur.
  - Note the overlap between the different types of erosion and how that may affect city planners who are attempting to build in the area.
  - Sample response:



e. **Video: Water Erosion**

  - Students will watch a video that models erosion by runoff.
    - **ESS2.A** – This activity highlights how water (in the form of rainfall) can shape the land.
  - The *Water Erosion* activity guide can be downloaded from the Additional Resources under this Virtual Field Trip.

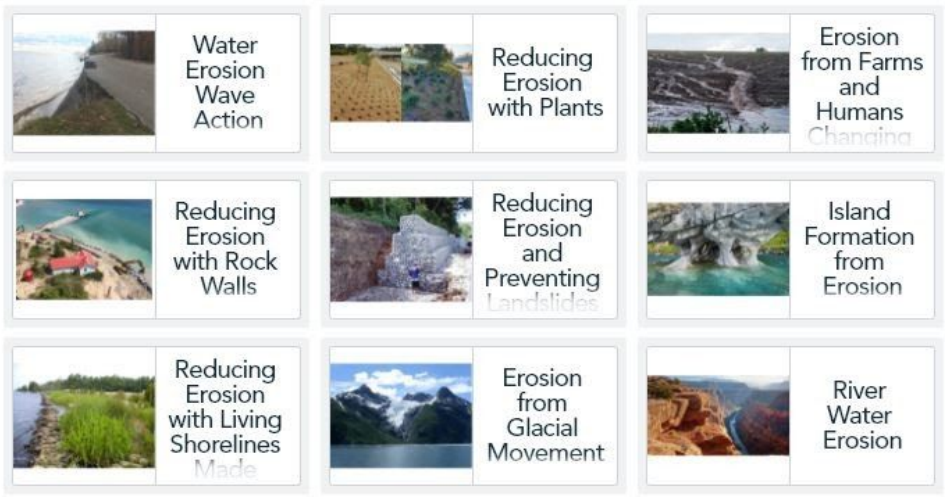
f. Erosion Hazards

  - As humans change the landscape in their communities, how water flows through the community also changes. This means more water may flow through or collect in different areas, meaning the environment has changed how it interacts with water.

- If there is a lot of concrete it cannot absorb water which can cause flooding. Even man-made lakes can cause trouble when not properly maintained.
- **Video: How Do Sinkholes Form?**
    - Students will watch a video from Practical Engineering that explains how sinkholes form by water erosion, and the dangers they cause when they collapse.

g. **Matching Pairs**

- Students will match the different images to the phrase that best describes the types of erosion or to the structure humans can build to reduce erosion.



h. Changing Maps

- Each time the landscape changes drastically due to Earth's natural processes, maps of the affected area may need to be updated to show the physical changes to the landscape.
- This includes changes in coastlines due to erosion, new land masses formed by volcanic activity, or even road maps due to sinkholes.
- Images of Mt. St. Helens over the years provide evidence of changes in the landscape after it erupted in 1980.

i. Rivers of Ice

- Giant blocks of ice can be formed when layers upon layers of snow become so heavy that the weight of the snow presses each layer together creating a glacier.

- These glaciers can change the landscape by either moving over it and directly changing the landscape with the help of gravity, or it can reshape the landscape through erosion as it melts.

- **Video: What Is A Glacier?**

    - Students will watch another video from Peekaboo Kidz that explain what glaciers are, the different types of glaciers (alpine or ice sheets), how they form, their powerful erosive force, and how they play a role in climate change.

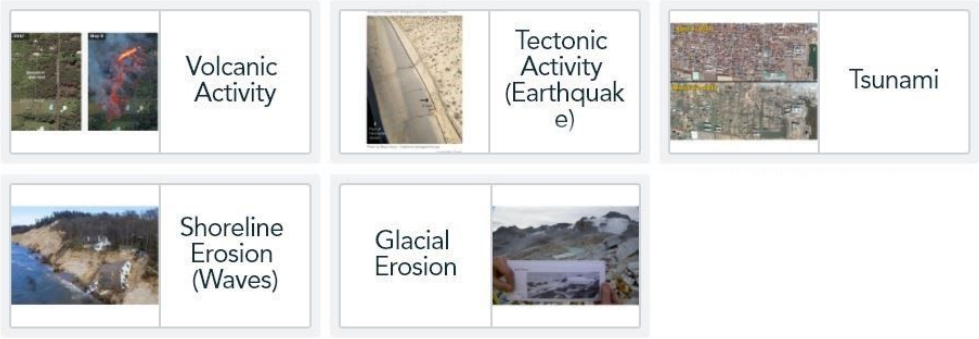
j. **Video: Ice Erosion**

- Students will watch a video that models how differently shaped surfaces of ice can create unique landscape features.
    - **ESS2.A** – This activity highlights how ice can shape the land.

- The *Ice Erosion* activity guide can be downloaded from the Additional Resources under this Virtual Field Trip.

k. **Matching Pairs**

- Students will match the images of the changing landscapes to the name of the hazard associated with each image.



Additional Resources

National Geographic – Resource Library - Landscapes.

More information about Glaciers and Glacial Landforms has been provided by the National Park Service.

Find local vendors to purchase native plants: Keep Growing Detroit, Stage Nature Center, or Plants for Ecology

Learn more about how to help protect the local watershed and reduce the human impact on the environment by visiting Clinton River Watershed Council, Friends of the Rouge, or Huron Valley Watershed

For information on how weathering and erosion work together to shape the Earth, check out Weathering and Erosion: Crash Course Kids #102 - Crash Course Kids.

Activity Guides

The following Activity Guides have been included with the Virtual Field Trip. We recommend that you look through them and decide how and when to incorporate them within your schedule.

Volcanic Slime 10 Minutes

Materials:

- Slime
- Straw
- Baking sheet
- Plastic wrap

Graham Cracker Plate Tectonics 20 Minutes

Materials:

- Graham crackers
- Frosting
- Sprinkles
- Plate
- Small bowls
- Knife
- Food coloring
- Water

Jell-O Shoreline 30 Minutes

Materials:

- Jell-O mix
- Hot water
- Cold water
- Canned fruit cocktail
- Spoon
- Heat resistant container
- Aluminum foil

Water Erosion 10 Minutes

Materials:

- Container
- Aluminum foil
- Water
- Food coloring
- Flour
- Cocoa powder

Ice Erosion 20 Minutes

Materials:

- 2 small identical containers
- Water
- Ice
- Flour
- Baking sheet

Curriculum Connections

This virtual field trip can be paired with the Mystery Science: The Birth of Rocks curriculum.

Video References

SciShow Kids. 2015. All About Volcanoes: How They Form, Eruptions & More! https://youtu.be/K7Oq9_DU1Mc

BBC Earth. 2012. River of Lava | Benedict Cumberbatch Narrates South Pacific | BBC Earth. https://youtu.be/21bZx0vBI9s

Peekaboo Kidz. 2015. What Is An Earthquake? | The Dr. Binocs Show | Educational Videos For Kids. https://youtu.be/dJpIU1rSOFY

HD1080ide. 2019. Dam Breach Experiment: Failure of a Model Dam. https://youtu.be/RcNqv0dm2lA

Practical Engineering. 2017. How Do Sinkholes Form? https://youtu.be/e-DVIQPqS8E

Peekaboo Kidz. 2020. GLACIER | What Is A Glacier? | Why Do We Have Seasons? | The Dr Binocs Show | Peekaboo Kidz. https://youtu.be/JJi5ICgmTsE