

THINKING AND ACTING LIKE A SCIENTIST

TEACHER'S GUIDE

Sudden or Slow?

How do wind and landslides affect a hillside?

GRADE 2

Earth and Space





Sudden or Slow?

Grade Level/Content	2/Earth and Space Science
Lesson Summary	In this lesson, students will replicate wind erosion and a landslide, and compare how much time it takes each event to affect Earth's surface.
Estimated Time	1, 45-minute class period
Materials (per team)	large tray, large plastic cup, moist sand, small pebbles, water, straws, safety goggles, rulers, Investigation Plan , Observation Form , Assessment , journal
Secondary Resources	Weathering and Erosion Video Bill Nye Talks about Erosion Weather WizKids: Landslide Forces in Nature: Landslides Earthquakes Landslides
NGSS Connection	2-ESS1-1 Use information from several sources to provide evidence that Earth events can occur quickly or slowly.
Learning Objectives	<ul style="list-style-type: none">• Students will create a model to determine the effect of wind erosion on a hillside.• Students will create a model to determine the effect of a water-triggered landslide on a hillside.• Students will compare the two models to conclude that some Earth events happen slowly and some Earth events happen quickly.
Cross-Curricular Project Connections	Look Out Below!, Rock On!

How do wind and landslides affect a hillside?

Water can change Earth's surface. In 2004, a large tsunami triggered by an underwater earthquake occurred in the Indian Ocean. A series of huge waves up to 100 feet tall, travelling at a high-speed, met land. Waves smashed ashore moving rocks, trees, and anything in their paths. As they receded, they carried much of this debris back to the ocean with them. Within an hour, the surface of Earth was dramatically changed.

Changes from water can also be slow. If you have ever seen the Grand Canyon, you have observed the power of water over millions of years. The flowing Colorado River gradually wore down Earth's surface making the canyon deeper and deeper.

Some changes to Earth's surface are quick and dramatic: tsunamis, a volcano erupting, a landslide sweeping away boulders and soil, an earthquake splitting land leaving wide gaps. Other changes are more subtle and happen over time: a stream wearing away rocks over years making them smooth and flat and wind gradually wearing away a rock creating a graceful rock arch.

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

Create moist sand and rock mixture that will hold a cup shape. Students will need the following:

- Foil pan or plastic tray
- Large plastic cup
- 1 cup of sand/rock mixture
- Straws
- Safety goggles
- [Investigation Plan](#)
- [Observation Form](#)
- [Assessment](#)
- Journal
- Rulers

Part 2

INVESTIGATION FACILITATION



Question

Introduce the investigation question.

How do wind and landslides affect a hillside?

CURIOSITY

Show students a picture of a hillside. Ask them to *Think, Pair, Share* to discuss ways that this hillside might change over time.

Student responses will depend on the image shown. They may include:

- *More trees will grow on the hill.*
- *Some trees will fall.*
- *Something will be built on the hill.*
- *Some rocks will roll down the hill.*



Personal Knowledge

Students capture what they already know about changes to Earth's surface.

- Find out what students already know about how Earth's surface can be changed.
- Create a class list. (*List may include types of changes, such as wind blowing sand, waves moving sand, or rivers carrying away rocks and soil.*)

COLLABORATION

Conduct a collaborative *Brian Sketch*. Place the students in small groups. Provide each student with a sheet of plain white paper and a pencil. Ask each team member to do a quick sketch to show how Earth's surface can be changed. After a designated time, have the students pass their sketches to the person on the right. This person may add to the sketch by drawing more, adding labels, or adding descriptions. After a designated time, rotate the drawings until each student has an opportunity to contribute to each drawing. Then, allow the groups time to share their finished drawings and share what they learned about ways that Earth can be changed. Share these ideas to a class list.

RISK TAKING

Add all ideas, even misconceptions, to the class list. If something is questionable, place a question mark next to it and explain that we should revisit this idea later. Telling students their personal knowledge is incorrect does not cause them to change it. Instead, confront misconceptions at the appropriate time in the investigation. Often, this will be during data analysis and explanation.



Prediction

Students communicate an expected outcome, based on prior knowledge.

Explain that students will conduct an investigation to learn about what changes happen to Earth's surface quickly and what changes happen slowly. Model packing the cup with sand and rocks to make a "hillside."

- Ask student what they think will happen if you blow through a straw at the hillside. Then, ask what they think will happen when water is poured onto the hillside.
- Have students discuss their predictions using the frame *I predict _____ because _____.*
(Possible student predictions may include: *I predict that the water will all run off the hill and make a flood because the hill is steep. I predict the water will all soak into the grass on the hill because the grass will trap it.*)



Investigation Plan

Students conduct an investigation to observe how wind and landslides affect a hillside.

- Review the materials as a whole class. Then, review the [Investigation Plan](#).
- Form teams of 4. Give each team their materials.
- Guide students in testing part 1 (modeling wind erosion by blowing the straw on the hill) and part 2 (modeling a landslide by pouring water on the hill).

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 test that is repeatable, generates quality data, and minimizes error. The more critically students think about their investigation plan, the more confident they can be in their results.

CRITICAL THINKING

As students work, probe them with questions that encourage critical thinking such as *Why is this happening? How does this affect Earth? What are the strengths and weaknesses of this model?*

INVESTIGATION PLAN
SUDDEN OR SLOW?

Part 1: Wind

1. Put safety goggles on.
2. Scoop the moist sand and rocks into the cup.
3. Pat the sand down to pack the cup.
4. Turn the filled cup over into the tray. This makes a hill.
5. Measure the height of the hill with a ruler. Write down the height on the **Observation Form**.
6. Use a straw to blow on the hill.

Caution: Always stand behind the person who is blowing through the straw. Only one person should use the straw, and the straw should be disposed of properly after being used.

7. Measure the height again. Write down the height on the **Observation Form**.
8. Write and/or draw other observations about what happened on the **Observation Form**.

Part 2: Landslide

1. Scoop the moist sand and rocks back into the cup.
2. Pat the sand down to pack the cup.
3. Turn the filled cup over into the tray to make a new hill.
4. Measure the height of the hill with a ruler. Write down the height on the **Observation Form**.
5. Pour ½ cup of water on the hill.
6. Measure the height again. Write down the height on the **Observation Form**.
7. Write and/or draw other observations about what happened on the **Observation Form**.

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Investigation Plan



Observation

Students record observations about how modeling wind and a landslide affect the hillside.

- Using the [Observation Form](#), have students observe and record the results, encouraging them to record quantitative (height measurements) and qualitative (breaks in structure).
- Conduct a whole-class discussion to share their observations. Discuss why different groups may have achieved different results (*e.g., They placed the straw different distances from the hillside. They used more or less force. They blew through the straw for differing amounts of time.*)

Caution: Students should stand behind the person who is blowing through the straw. Only one person should use the straw, and the straw should be disposed of properly after being used.

RICH LANGUAGE

As the students are sharing their qualitative observations, encourage them to use precise and descriptive terms. For example, if a student explains that the hillside "split open" you might introduce the term *crack* or *crevice* to describe what they observed.

OBSERVATION FORM
SUDDEN OR SLOW?

NAME: _____
DATE: _____

What effect did the **wind** have on the hill?

Height before wind: _____
Height after wind: _____
Qualitative observations:

What effect did the **landslide** have on the hill?

Height before water: _____
Height after water: _____
Qualitative observations:

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Observation Form

Part 3

INVESTIGATION ANALYSIS AND DEVELOPMENT OF CLAIM



Data Analysis

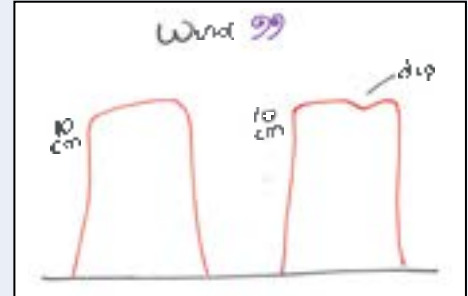
Students make sense of their data by organizing it and representing it visually.

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

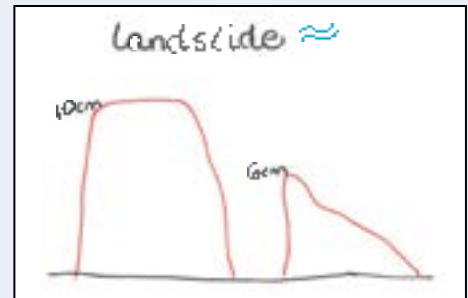
- Have students **evaluate** their data for trustworthiness.
- Then, have them analyze their data to find patterns and trends. They may **organize** the data and/or **represent** it visually to construct meaning. (Ask students if the wind and landslide changed the hillside in same way.)
- Have students **interpret** what the identified patterns or trends mean.
- Ensure they have enough data that it can be used as evidence to support a claim.
- Allow time for the teams to share their solutions and data and compare with other teams.

DISCOURSE

If your students are new to the process, it may be helpful to have students share examples with a *Research in Progress*. After each of the steps of data analysis (evaluation, organization, representation, and interpretation), have groups share their progress.



Part 1: Wind



Part 2: Landslide



Secondary Knowledge

Students use secondary sources to understand how forces such as wind and water change Earth materials.

- Use these resources (or your own) to develop students' understanding of weathering and erosion.
[Weathering and Erosion Video](#)
[Bill Nye Talks about Erosion](#)
[Weather WizKids: Landslide](#)
[Forces in Nature: Landslides](#)
[Earthquakes Landslides](#)
- After reviewing these resources, students should glean the concept of quick and slow changes that can happen to Earth's surface.

RICH LANGUAGE

When encountering scientific vocabulary, be judicious in the words you teach. Select the words that are most helpful in understanding the concept. As you discuss the word, give the students examples. For example, you might say, "Weathering is the process when a material is broken down over time. For example, over time, the force of blowing sand in the desert breaks down, or weathers, the rock." After giving an example, encourage students to discuss other examples.



Explanation

Students write a claim and provide evidence and reasoning to support it.

- Have students use what they've discovered from their analyzed data to write an explanation that answers their investigation question. Students may wish to use the [Explanation](#) prompt as a guide. Have them write their explanation in their journal.
- Have students develop a **Claim** to answer the question: How do wind and landslides affect a hillside?
- 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.

Claim

We claim that wind and landslides both change the Earth's surface. Some of these changes happen slowly (such as wind erosion), and some of the changes happen quickly (such as landslides).

Evidence

The evidence that supports our claim is shown in the drawing of our observations. The shape of the hill changed with the wind and the water (landslide). However, the water (landslide) made a much more drastic and quick change.

Reasoning

We claim that some changes to Earth's surface happen quickly and some happen more slowly depending on the type of force and how strong it is.

Investigation: We made a hillside out of sand. We modeled wind erosion using air blown through a straw, and a landslide using water poured through a cup. The landslide changed Earth's surface more quickly and drastically than the wind erosion.

Science: We learned from our readings that some changes to Earth's surface are quick and others are slow. We also learned that events that happen quickly can be observed, but events that happen over a long period of time are harder to observe.

- Once the explanation is written, have students discuss their results using a [Present and Defend](#).

DISCOURSE

Have students conduct a [Present and Defend](#) to develop presentation skills as well as audience participation. Research teams present a summary of their investigation to the class. The class analyzes the information presented and asks clarifying questions, challenges and/or supports the arguments made, and even presents alternative explanations as appropriate. Research teams defend their explanation with evidence and reasoning. If students are doing the same investigation plan, choose 1 or 2 groups to share.

OPENNESS TO NEW IDEAS

As students discuss the science behind the investigation, connect their learning to the predictions made earlier. As needed, instruct students to be open to new ideas. Explain that scientists have to be open to new ideas if they expect to make new discoveries.



Evaluation

Students reflect on the investigation.

Have students discuss:

- How confident are you in your results?
- What would your prediction be if you conducted this investigation again?

Part 4

INVESTIGATION ASSESSMENT AND EXTENSION



Application

Students demonstrate understanding of sudden and slow changes.

- Have students apply their learning by answering the question: What are some examples of sudden changes you have seen? (*video of a volcano or earthquake after effects*) What are some examples of slow changes you have seen? (*sand on a beach, rocks in a stream*)
- Have them research different Earth events and compare the relative amount of time each event takes (*hours, days, years*).
- Now that students understand landslides, they may wish to repeat the investigation to learn about how to prevent landslides.

CURIOSITY

You may wish to leave the materials available for students to explore in a center where they can test different designs to slow the progress of a landslide.

Assessment

To assess understanding, give students the set of pictures in the [Assessment](#). Have them circle quick or slow to indicate the type of change to Earth's surface.

ASSESSMENT
SUDDEN OR SLOW? NAME: _____
DATE: _____

Look at how Earth's surface changes. Circle **quick** or **slow** to describe the change.

1. quick slow	2. quick slow
3. quick slow	4. quick slow
5. quick slow	6. quick slow

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Assessment with Answers

Take This Lesson Across the Curriculum

Look Out Below!

Landslides can make sudden changes to Earth's surface. They also can pose dangers for people. Students will study what causes landslides and suggest ways to prevent them.

Reading/Language Arts	Math	Science	Social Studies
<p>Warning!</p> <p>Imagine a community wants to build some homes in an area that is prone to landslides. Write a pamphlet explaining what should be done to prevent future landslides.</p> <p>CCSS.ELA-LITERACY.W.2.2</p>	<p>Does Slope Matter?</p> <p>Draw three different triangles to show three different hillsides. Discuss with your class how the triangles are different. Predict which would be more likely to have a landslide.</p> <p>CCSS.MATH.CONTENT.2.GA.1</p>	<p>Sudden or Slow?</p> <p>Think about a hillside. What are the slow and sudden changes to Earth's surface that might occur on the hillside?</p> <p>NGSS: 2-ESS1-1</p>	<p>City Council</p> <p>Hold a mock City Council Meeting with each student having a role in the proposal to build the community.</p> <p>NCSS: D2.Civ.6.K-2</p>

Rock On!

There are many different kinds of rocks: large, small, rough, smooth, colorful, and dull. Students will examine rocks to show signs of weathering.

Reading/Language Arts	Math	Science	Social Studies
<p>Pet Rock</p> <p>Read, <i>Everybody Needs a Rock</i>, by Bryd Baylor. Discuss how rocks are different? How are they the same? What criteria would you use for choosing a rock?</p> <p>CCSS.ELA-LITERACY.RL.2.3</p>	<p>Which Is Bigger?</p> <p>Measure the length of two rocks of the same type. Compare them to see which is bigger. Why might one be bigger than the other? How might the measurements change over time if the rocks were left in nature?</p> <p>CCSS.MATH.CONTENT.2.MD.A.4</p>	<p>Sudden or Slow?</p> <p>Think about a hillside. What are the slow and sudden changes to Earth's surface that might occur on the hillside? What might happen if there were rocks on the surface of the hillside?</p> <p>NGSS: 2-ESS1-1</p>	<p>Rocks in Our Community</p> <p>How do rocks help your community meet their needs? Examine different ways rocks are used from sidewalks to fences.</p> <p>NCSS: D2.Civ.14.K-2</p>

For additional lessons or to customize this lesson, go to www.nexgeninquiry.org.

INVESTIGATION PLAN

SUDDEN OR SLOW?

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3. Pat the sand down to pack the cup.
4. Turn the filled cup over into the tray. This makes a hill.
5. Measure the height of the hill with a ruler. Write down the height on the **Observation Form**.
6. Use a straw to blow on the hill.

Caution: Always stand behind the person who is blowing through the straw. Only one person should use the straw, and the straw should be disposed of properly after being used.

7. Measure the height again. Write down the height on the **Observation Form**.
8. Write and/or draw other observations about what happened on the **Observation Form**.

Part 2: Landslide

1. Scoop the moist sand and rocks back into the cup.
2. Pat the sand down to pack the cup.
3. Turn the filled cup over into the tray to make a new hill.
4. Measure the height of the hill with a ruler. Write down the height on the **Observation Form**.
5. Pour $\frac{1}{2}$ cup of water on the hill.
6. Measure the height again. Write down the height on the **Observation Form**.
7. Write and/or draw other observations about what happened on the **Observation Form**.

OBSERVATION FORM
SUDDEN OR SLOW?

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DATE: _____

What effect did the **wind** have on the hill?

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Height after wind: _____

Qualitative observations:

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Height before water: _____

Height after water: _____

Qualitative observations:

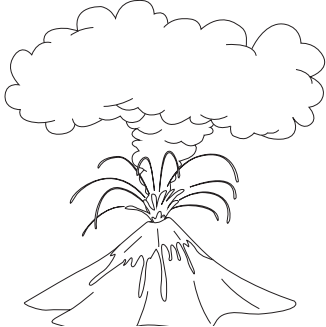
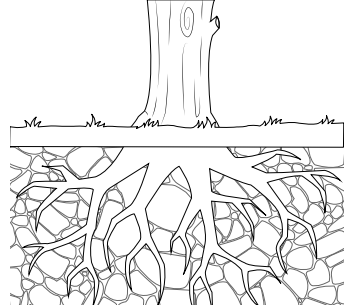
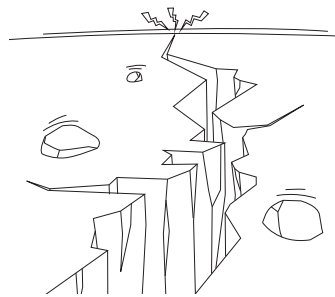
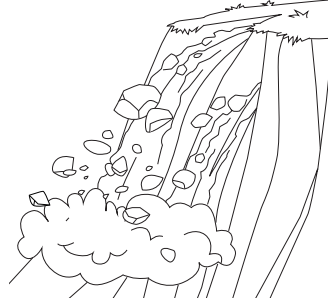
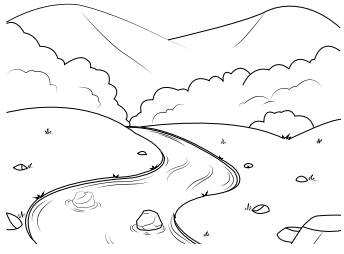
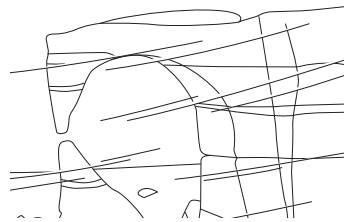
ASSESSMENT

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<p>3.</p>  <p>quick slow</p>	<p>4.</p>  <p>quick slow</p>
<p>5.</p>  <p>quick slow</p>	<p>6.</p>  <p>quick slow</p>