

# THINKING AND ACTING LIKE A SCIENTIST

## TEACHER'S GUIDE

# Save the Sand!

What is the effect of wind on sand?

GRADE 2

Earth & Space





# Save the Sand!

<b>Grade Level/ Content</b>	2/Earth and Space Science
<b>Lesson Summary</b>	In this lesson, students will explore how wind can change the shape of a sand tower to better understand how wind can shape the land. This lesson is designed to be delivered before <a href="#">Windbreak Challenge</a> .
<b>Estimated Time</b>	1, 45-minute class period
<b>Materials</b>	pictures showing the action of weathering and erosion, such as a canyon, glacial abrasion, desert arch, or sand dune, foil pan or plastic tray, sand, straws, ruler, safety goggles, <a href="#">Investigation Plan</a> , <a href="#">Observation Form</a> , journal
<b>Secondary Resources</b>	<a href="#">YouTube: Weathering and Erosion</a> <a href="#">YouTube: Bill Nye Erosion</a> <a href="#">YouTube: StudyJams Weathering and Erosion</a>
<b>NGSS Connection</b>	<b>2-ESS2-1</b> Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
<b>Learning Objectives</b>	<ul style="list-style-type: none"><li>• Students will provide evidence that wind can change the shape of the land.</li><li>• Students will design and test solutions to prevent wind erosion.</li></ul>
<b>Cross-Curricular Project Connections</b>	Castles in the Sand, Trees Needed!

## What is the effect of wind on sand?

Have you ever seen the Grand Canyon? If you go there, you can see high, rocky cliffs. The cliffs are over 18 miles wide, and a mile deep. Far down at the bottom of the cliffs, flows the Colorado River. The river made the tall cliffs. Over millions of years, the water washed away bits of the rock. Each year it carved the canyon deeper. The river is not finished, though. The water still erodes rocks as it flows.

Water isn't the only thing that erodes the surface of Earth. Other forces are at work as well. What about a sand storm or a sand dune in the desert? These weren't caused by water. They were moved by wind. Wind can move sand to make giant sand dunes. Wind also wears away rocks to make amazing landforms. Ice is also a strong force. As water freezes, it gets bigger. It creates cracks in rocks and breaks them apart. In this lesson, students will create a model to demonstrate wind erosion. Then, in the follow-up lesson, [Windbreak Challenge](#), students will design and test the effectiveness of a windbreak against the erosion of sand by wind.

## 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

Arrange a suitable area where students can work with the sand. Create moist sand that will hold a cup shape. Students will need the following:

- pictures showing the action of weathering and erosion, such as a canyon, glacial abrasion, desert arch, or sand dune
- foil pan or plastic tray
- sand
- straws
- ruler
- safety goggles
- [Investigation Plan](#)
- [Observation Form](#)
- journal

# Part 2

## INVESTIGATION FACILITATION



### Question

*Introduce the investigation question.*

#### **What is the effect of wind on sand?**

##### CURIOSITY

Show students pictures of sand dunes at a beach and desert. Ask them to describe how these sand dunes might change and what could cause these changes. Then, introduce the investigation question.



### Personal Knowledge

*Students capture what they already know about weathering and erosion.*

- Find out what students already know about weathering and erosion. Guide them in discussing examples they have seen in the community.
- Identify several examples of weathering and erosion outside the school. Then, take students on a walk around the school to see the examples. Alternatively, show students photographs of the changes. Ask them to identify the examples and explain why the changes occurred.

##### DISCOURSE

Conduct a *Gallery Walk*. Place pictures on chart paper that show evidence of weathering or erosion such as a desert arch, a sand dune, a canyon, or glacial abrasion. Under each picture, place a t-chart with the headings *What I See* and *What Action Caused This*. Post the charts around the room. Have students rotate in small groups to record their observations and thinking. As students finish, have them share their thoughts about what they observed and the forces responsible for these actions.

*Continued*

## RICH LANGUAGE

As students are discussing their observations, encourage them to use precise terms. For example, if a group recorded that sand is moved from one place to another, you might introduce the term *transport*. For example, say, *I notice that Kaya's group mentioned that the sand moved from the dune into the water. Another way to say this is that the sand was transported. Did anyone else notice materials being transported from one place to another?*



## Prediction

Students communicate an expected outcome, based on prior knowledge.

Have students use what they already know to predict what will happen to sand when wind blows against it. Provide this sentence frame for students to complete when writing their prediction: *I predict \_\_\_\_\_ because \_\_\_\_\_.*

1  
2  
3

## Investigation Plan

Students conduct trials to determine the effects of wind on sand structures.

- Review the materials as a whole class.
- Discuss with students how they will explore how wind affects the land.
- Divide the class into teams of 2. Give each team their materials and review the [Investigation Plan](#).
- Show the teams how to use the straws to model wind blowing against the sand dune. Each group will need to determine the following:
  - who will be the wind maker
  - how long the wind maker is going to blow across the sand dune
  - where the wind maker will blow
- Instruct teams to follow the **Investigation Plan**.
- Students will record their quantitative and qualitative observations for two trials.

**Caution: Students should stand behind the maker when they are blowing across the sand.**

### INTEGRITY

Check the setups, and encourage students to record what they actually observe.

### 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.

**INVESTIGATION PLAN**  
**SAVE THE SAND!**

1. Put on safety goggles.
2. Scoop sand onto the tray and form it into a sand dune.
3. Observe the shape of the sand dune. Measure how tall it is. Record your observations on the **Observation Form**.
4. Decide the following with your team:
  - Who will be the wind maker
  - How long the wind maker is going to blow across the sand
  - Where the wind maker will blow
5. Use the straw to blow across the sand dune for the decided time.  
**Caution: Students should stand behind the wind maker.**
6. Observe the shape of the sand dune. Measure the height of the sand dune again. Record your observations on the **Observation Form**.
7. Repeat steps 2-6 for Trial 2.

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### Investigation Plan



## Observation

Students record the effects of wind on sand structures.

- Using the [Observation Form](#), have students observe and record their results. Have them record both quantitative observations (height measurements) and qualitative observations (breaks in structure). Have them record the results for both trials.

### DISCOURSE

Conduct a whole class discussion to share observations. Discuss why different groups may have achieved different results (*Examples: They placed the straw closer to the structure. The wind makers blew for different amounts of time. The fwind makers blew at different strengths.*) Together, discuss how their observations model real-life beach erosion.

OBSERVATION FORM SAVE THE SAND!		NAME: _____
		DATE: _____
<b>Trial 1</b>		
Before the wind blows on the sand dune:	After the wind blows on the sand dune:	
How tall is the sand dune? _____	How tall is the sand dune? _____	
Draw what the sand dune looks like:	Draw what the sand dune looks like:	
<b>Trial 2</b>		
Before the wind blows on the sand dune:	After the wind blows on the sand dune:	
How tall is the sand dune? _____	How tall is the sand dune? _____	
Draw what the sand dune looks like:	Draw what the sand dune looks like:	

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. They may also use math if appropriate (*difference in height of sand dunes, etc.*).
- Have students **interpret** what the identified patterns or trends mean. Students should find that their sand dunes will be smaller in height and change shape when the wind is applied.
- Ensure they have enough data that can be used as evidence to support a claim.

### CONSTRUCTION OF MEANING

Ask a couple of students to share the ongoing progress of their investigation. They may share an "Aha" moment while the class asks clarifying questions.



## Secondary Knowledge

Students use secondary sources to understand how wind changes Earth materials.

Share what you know (or find a video or article) about the effect of wind on Earth's land. Looking for media on sand dunes and how sand dunes move from wind would be a good place to start. Sand dunes have been known to bury homes and even entire towns! (Examples: [Michigan Ghost Town](#), [Moving Dunes](#)). Students use this information in the reasoning portion of their explanation.



## Explanation

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

- Have students use 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 Lab Journal.
- Have students develop a **Claim** to answer the question: What is the effect of wind on sand?
- 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 from class discussions.

### Claim

*We claim that wind can transport sand from one place to another.*

### Evidence

*The evidence that supports our claim is shown in the drawings of our observation. In both trials, after we turned on the fan, the sand moved and changed the shape of our structure. The height was 2 inches less in the 1st trial and 3 inches less in the 2nd trial.*

### Reasoning

*Investigation: We made a drawing of our setup and then created it using the materials. We completed two trials and compared our results. We used the same steps during each trial.*

*Science: We learned from our class discussion that wind can be a force for erosion. If not stopped, wind can carry sand away from beaches, making the beaches smaller. This supports our claim that wind can transport sand from one place to another.*

- 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.



## Evaluation

Students reflect on the investigation.

- Ask students what they might do differently if they repeated the investigation.
- Ask students what other questions about weathering and erosion they would like to pursue.



## Secondary Knowledge

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

- Use these resources (or your own) to further develop students' understanding of weathering and erosion.  
[YouTube: Weathering and Erosion](#)  
[YouTube: Bill Nye Erosion](#)  
[You Tube: StudyJams Weathering and Erosion](#)
- After reviewing these resources, students should have a good understanding of how weathering and erosion can affect a sand dune. They should also be aware of the need for engineering solutions to prevent wind erosion.

### CRITICAL THINKING

In this investigation, students modeled a negative effect of wind erosion. They should realize, however, that these forces have positive impacts as well. As students explore weathering and erosion, encourage them to consider both the positive and negative impacts of the actions. You may wish to have them create a three-column chart labeled *Action*, *Positive Results*, and *Negative Results* to help them think critically about the impact of these forces on Earth.



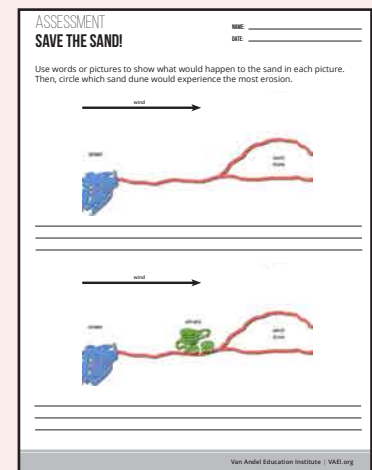
## Application

Students demonstrate understanding of erosion by suggesting ways to prevent erosion.

1. Have students apply their learning by answering the question: What are some examples of places you might wish to construct a windbreak? (on a beach, on the perimeter of a farm)
2. Have students complete the follow-up investigation, [Windbreak Challenge](#), to design and test solutions to prevent or slow wind erosion. They will use the same procedure they used in this investigation to test their windbreaks and compare design solutions.
3. Students can use their knowledge of wind erosion and windbreaks to design and test solutions to prevent other erosional forces such as water and waves.

### Assessment

1. Student provide an explanation (**claim, evidence, and reasoning**) that clarifies the effect of wind on sand.
2. To assess understanding upon completion of the windbreak design application, give students the [Beach Diagram](#) and have them identify and explain which sand dune would experience the most wind erosion. (*The first sand dune*)



Beach Diagram Assessment

## Take This Lesson Across the Curriculum

### Castles in the Sand

Building a sand castle can be fun. You just need a bucket and some sand. Some sand sculptures can be quite large and intricate. Imagine that there is going to be a sand sculpture contest, and your class is judging it! Students will design a sand sculpture contest.

Reading/Language Arts	Math	Science	Social Studies
<p><b>Do We Have a Winner?</b></p> <p>Read <i>The Sand Castle Project</i> by Robert Munsch. Explain how the main character responds to the challenge in the story. What rules might you make for your sand sculpture contest?</p> <p>CCSS.ELA-LITERACY.RL.2.3</p>	<p><b>Space for Sculptures</b></p> <p>Sand sculptors need space for making their sculptures. Create a rectangle. Divide it into rows and columns that are the same size. Count to find the total number of squares.</p> <p>CCSS.MATH.CONTENT.2.GA.2</p>	<p><b>Save the Sand!</b></p> <p>Understand the problems of sand erosion to design a way to protect the sculptures during the competition.</p> <p>NGSS: 2-ESS2-1</p>	<p><b>Why Have Rules?</b></p> <p>Imagine what it would be like if the sand sculpture contest had no rules. Write a paragraph explaining why rules are needed.</p> <p>NCSS: D2.Civ.3.K-2</p>

### Trees Needed!

Trees and shrubs are one solution to wind erosion. Farmers sometimes plant trees along the edges of their fields to prevent rich topsoil from being blown away. Some beach communities ask people to donate trees they no longer want to be used to build windbreaks. Students will propose a way to use trees to solve the problem of wind erosion at a beach.

Reading/Language Arts	Math	Science	Social Studies
<p><b>Give Your Tree a Trip to the Beach!</b></p> <p>Students will write a letter to the editor to encourage community members to donate dead trees to be used as windbreaks at a local beach. The letter should provide reasons why this will benefit their community.</p> <p>CCSS.ELA-LITERACY.W.2.1</p>	<p><b>How Many?</b></p> <p>Estimate the length in feet of a shrub or a bush. Use a yardstick to check your measurements. Imagine that you want to protect a sand dune that is 10 feet wide. Estimate how many of these shrubs you would need.</p> <p>CCSS.MATH.CONTENT.2.MDA.3</p>	<p><b>Save the Sand!</b></p> <p>The trees are to help prevent sand erosion. Let's learn more about how a windbreak can help prevent this problem.</p> <p>NGSS: 2-ESS2-1</p>	<p><b>Who's in Charge?</b></p> <p>Beach erosion is a serious concern in beach communities. Investigate which person or organization in a beach community is in charge of making sure beach erosion is avoided.</p> <p>NCSS: D2.Civ.6.K-2</p>

For additional lessons or to customize this lesson, go to [www.nexgeninquiry.org](http://www.nexgeninquiry.org).



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# INVESTIGATION PLAN

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7. Repeat steps 2–6 for Trial 2.

# OBSERVATION FORM

## SAVE THE SAND!

NAME: \_\_\_\_\_

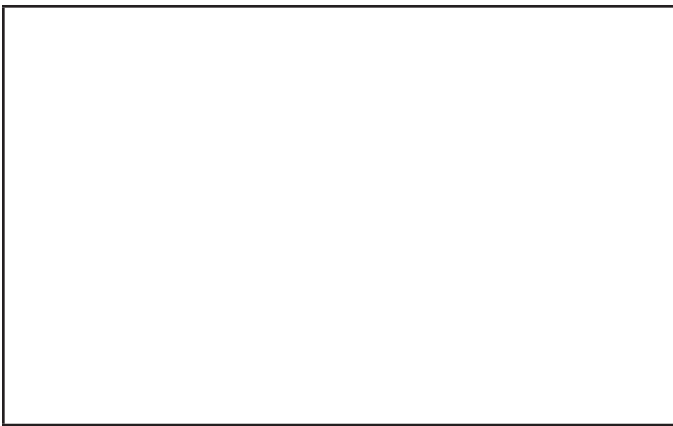
DATE: \_\_\_\_\_

### Trial 1

**Before the wind blows on the sand dune:**

How tall is the sand dune? \_\_\_\_\_

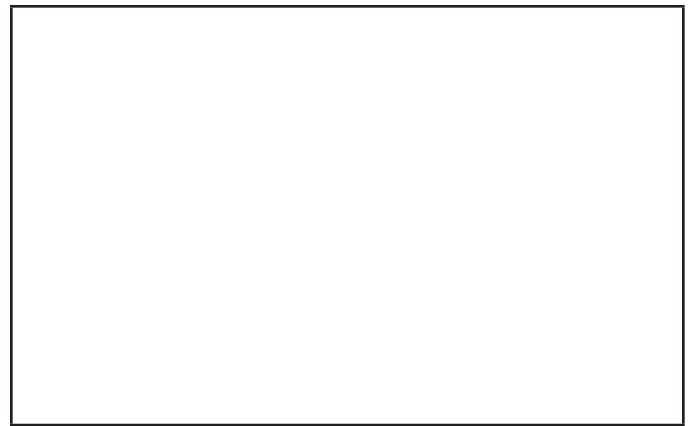
Draw what the sand dune looks like:



**After the wind blows on the sand dune:**

How tall is the sand dune? \_\_\_\_\_

Draw what the sand dune looks like:



### Trial 2

**Before the wind blows on the sand dune:**

How tall is the sand dune? \_\_\_\_\_

Draw what the sand dune looks like:



**After the wind blows on the sand dune:**

How tall is the sand dune? \_\_\_\_\_

Draw what the sand dune looks like:



# ASSESSMENT

## SAVE THE SAND!

NAME: \_\_\_\_\_

DATE: \_\_\_\_\_

Use words or pictures to show what would happen to the sand in each picture. Then, circle which sand dune would experience the most erosion.

