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# Agent Erosion

**Topic**  
Erosion

**Key Question**

How do wind, water, and ice change Earth's surface?

**Learning Goal**

Students will use models to observe that rocks are weathered into sands and soils.

**Guiding Documents**

*NRC Standard*

- *The surface of the earth changes. Some changes are due to slow processes, such as erosion and weathering, and some changes are due to rapid process, such as landslides, volcanic eruptions, and earthquakes.*

*Project 2061 Benchmarks*

- *Change is something that happens to many things.*
- *Waves, wind, water, and ice shape and reshape Earth's land surface by eroding rock and soil in some areas and depositing them in other areas, sometimes in seasonal layers.*
- *In doing science, it is often helpful to work with a team and to share findings with others. All team members should reach their own individual conclusions, however, about what the findings mean.*

**Science**

Earth science  
erosion  
deposition

**Integrated Processes**

Observing  
Collecting and recording data  
Comparing and contrasting  
Predicting  
Applying

**Materials**

Fine sand or dirt  
Shoe box lids  
Rectangular pans (9" x 12")  
Paper cup  
Masking tape  
Water  
Drinking straws  
Safety goggles



Fine grained colored sand  
*Optional (see Management 5):*  
gravel  
clay  
ice chunks

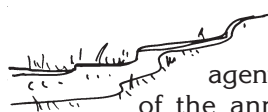
**Background Information**

Weathering, erosion, and deposition are three of the processes that change the Earth's landscape. Mountains and hills are gradually flattened and valleys widened into huge plains through these processes.



*Weathering* is a term that includes all the changes in rock materials that result from their exposure to the atmosphere. It transforms solid bedrock into small fragments that can be removed by agents of erosion.

*Erosion* is the wearing down of Earth's surface by natural forces. The tools (agents) for the changing of Earth's crust can be wind, water, and ice. Whatever the method, Earth is constantly being altered. The process of erosion is often very slow and difficult to observe, but over thousands of years, the mountains and hills have been worn down and rivers have widened their valleys into broad plains.



Water is by far the most powerful agent of erosion. More than one-quarter of the annual precipitation falling onto the continents runs off into the ocean via rivers, streams, etc. Rivers carry away rocks and soils, eroding the mountains and hills and carving out valleys and canyons. Streams of water roll materials downhill onto the lowlands or out to sea. Such erosion is often easily seen in coastal areas and along rivers and streams where noticeable amounts of land can be lost each year. Water continuously erodes and changes Earth's surface.

Wind erosion occurs mostly along the ground surface. Wind carries off soil and small rocks. The surfaces of boulders and rocks may eventually be pitted or worn smooth by the flying dust and sand grains. During the 1930s, large amounts of topsoil were lost when areas of the Middle West received little rain. Plants died and could no longer anchor the soil when winds blew. This area and period of time became known as the Dust Bowl.

Snow collects in hollows of mountains. As the weight of the snow builds up, it becomes compressed and forms ice. As more snow is added and turns to ice, gravity and the weight of the ice causes it to slowly move downhill; thus a glacier is formed. Glaciers carry embedded rocks and



soil a great distance before dropping them. The glaciers also act like bulldozers by pushing rocks in front of them. Rocks stuck in the bottom and sides of glaciers scrape, scratch, and dig into the rocks beneath the glacier. Glaciers can also cause erosion as the ice melts and slowly flows downhill.

*Deposition* is the laying down of eroded materials. It is evident in the bends of rivers and the deltas that form as major rivers drain into the oceans. Materials deposited by winds are found in the lee of objects and structures. Glacial deposits result as the glaciers melt leaving ridge-like hills.

Although erosion is a natural process, people can increase the effect by clearing land of vegetation or improper cultivation. They can also slow down the process by planting cover crops on bare land, terracing land, building wind breaks, etc.

### Management

1. This activity is divided into several parts which investigate different agents of erosion. It is suggested that these parts be done over an extended period of time.
2. Look around the school ground or neighborhood for places where wind, water, or people have eroded the area. For real-world examples of *Water Erosion*, if there are no gutters or drain spouts, simply pour a bucket of water over some loosely packed soil so that students can get an idea of what happens with that process.
3. For erosion simulations, use fine sand if possible; it moves more easily than coarser-grained sand.
4. During *Wind Erosion* simulations, a fan or a student blowing through a straw (use the small coffee stir sticks) can move the sand. Blow-dryers are very dramatic; however, caution must be used to protect students' eyes. Safety goggles are strongly encouraged!
5. The results of glacial erosion are not evident in many environments. Students will not be able to find evidence of such on most school grounds. As a result, the teaching and learning in *Part 4: Glacial Erosion* is left as an option for primary students. If you wish to teach it, make large chunks of ice the night before the lesson. Use half-pint milk cartons and add sand and bits of gravel before freezing.
6. Select some objects in the classroom that students can pick up, carry, and deposit elsewhere to show change. Some suggested items are chairs, books, plants, etc.
7. Throughout all parts of the activity, emphasize the processes of *pick up, carry, and deposit*.



### Procedure

#### Part One—Introduction

1. Introduce the term *erosion* by doing some class role playing. Tell the students that they are going to change the room a bit. Inform them that the student doing the change will be called *Agent Erosion*. Tell them that the job of Agent Erosion is to pick up, carry, and deposit (put things down) items from around the room. Inform them that for the first few times, you will be the director and will tell Agent Erosion what to pick up, where to carry it, and where to deposit it.
2. Choose a student to be Agent Erosion. Direct him/her to pick up, carry, and deposit some items from around the room. Have different students repeat this procedure. Emphasize the processes and what changes resulted in the room. Select a student to be director and continue the role play.
3. Take the students outside to look at a door mat. Ask them what they see on or under the mat. Ask them how the dirt (grass, sand, etc.) got there. Ask them if they think Agent Erosion has been there. [This is a case of pick up, carry, and deposit. The soil, etc. was picked up on their shoes, carried to the area, and deposited when they scraped their feet. They were the agents of erosion.]
4. Tell the students that in nature the processes of pick up, carry, and deposit change the way Earth looks. Ask them what they think does the picking up and carrying.
5. If it is possible, find areas on the school ground where erosion can be shown—gullies formed by running water, hard-packed paths formed by human feet, or piles of dust in the corners of buildings. Ask the students how many of them have experienced having dirt or sand blown in their faces. Ask them which agent of erosion is picking up and carrying that dirt and sand.
6. Back in the classroom, list the agents of erosion [wind, water, ice, people] on the board. Also list places where the students have seen erosion. [steep hillsides, seashore, river-bottom land, ice-covered land, bare ground where people have worn a path]
7. Ask where the soil and rock go when they are eroded.



### Part Two—Wind Erosion

1. Review what the students learned about erosion. Tell them that they are going to see how wind erodes sand and dirt.
2. Place a thin layer of sand or dirt in a shoe box lid (or a flat pan) and place the container where all the students can observe it.
3. Discuss what the students think will happen when the sand is blown by wind.
4. Have students wear safety goggles, if available; otherwise, caution them to be very careful not to get any sand and dirt particles in their eyes. Tell the students that you are Agent Wind and you will create a wind by blowing gently through a straw. Have them predict what will happen.
5. Ask them what actually happened when Agent Wind blew across the sand and dirt. Have them point out where the particles were deposited.
6. Suggest the students role play Agent Wind Erosion. Stress that they must blow gently or they might get sand in their eyes. Urge them not to inhale any sand or dirt through the straw. Give the students a tray with sand and dirt on it. Let them blow gently through straws to move the sand. Tell them to observe what happens.
7. After they have blown the sand and dirt, have them describe what happened and relate it to the wind blowing outside.
8. Ask the students what objects wind can move. [small rock particles, sand, light soil]
9. Place rocks on top of the sand. Ask the students what happens to the soil around and under the rocks when the wind blows.
10. If available and time permits, use other things such as a fan or blow-dryer to simulate the wind.
11. Invite students to go outdoors to look for evidence of wind erosion. (Be sure to include observations of litter.)



4. Prop up one end of the pan about 10 cm. Poke a hole in the bottom of a paper cup. Cover the hole with masking tape. Fill the cup with water.
5. Ask the students what will happen when you hold the cup over the dirt pan and pull off the tape. [The water will pour out onto the dirt.] Ask what they think will happen to the dirt.
6. Invite a student to be Agent Water Erosion and pull off the tape. Ask students what this is like in nature. [rain]
7. Have them describe their observations and relate them to the water erosion they saw on the playground.
8. Allow time for many students to role play Agent Water Erosion.

### Part Four—Ice and Glacier Erosion (optional)

1. Relate to the students that a glacier is a huge amount of ice and snow that has collected over many, many years. Tell them that when the ice gets thick enough, it starts moving down the side of the mountain where it was formed. The tremendous weight of the glacial ice erodes the land by gouging and plowing up the ground and moving the rocks around. Glaciers can move large amounts of soil and large rocks many miles.
2. If possible, show pictures of a glacier, or a picture of the mountains in Yosemite National Park to explain the erosion of glaciers.
3. Flatten a piece of clay.
4. Remove the carton or paper cup from the “glacier” that was frozen prior to this part of the activity.
5. Ask a student to be Agent Ice Erosion. Direct the student to move the chunk of ice over the clay.
6. Have the students describe what has happened to the clay. Discuss the large indentations and scratch marks left on the clay. This is similar to what happens in nature when a glacier moves over the ground.
7. Allow other students to role play Agent Ice Erosion and move the ice over the clay.



### Part Three—Water Erosion

1. To introduce this part of the lesson, take the students outside to look for evidences of water erosion on the school grounds. Look for three types of terrain around the school ground: bare soil, an area covered with vegetation, and concrete or asphalt. Pour the same amount of water on each of the terrain types and see what happens. Have the students compare and contrast what happens in the three situations.
2. Tell the students that they are going back into the classroom to see how water erodes sand and dirt.
3. Place the soil and dirt mixture in the rectangular pan about 5 cm deep. If colored fine sand is available, spread a thin layer over the mixture. This will help the students see that the sand moves due to erosion.



### Connecting Learning

1. In the first part of the activity on erosion, how did you change the room? (Stress the use of the words *pick up*, *carry*, and *deposit*.)
2. Describe how nature does the same thing to our Earth.
3. What erosion do you see as you walk around the school ground?
4. How does water change the Earth?
5. How does wind change the Earth?
6. If we think of our pan of dirt and sand as a mountain and we keep pouring water on it, what will happen to the mountain?
7. Can you see signs of erosion everywhere? Explain.

## Extensions

1. Have the students create a miniature mountain with damp soil in a flat rectangular box (9" x 12"). It will represent a model of a mountain without any trees or vegetation on it. Ask what they think will happen when rain falls on the mountain. Invite the students to use the paper cup with a hole to pour "rain" on the mountain. Urge them to describe what happens to the mountain. Where does most of the erosion take place? Where does the eroded soil go? Discuss any changes that may have occurred on the mountain. Ask if they can identify miniature streams and canyons.
2. Repeat this erosion demonstration and add leaves, grass, twigs, and rocks to various parts of the mountain. Do these objects increase or decrease the erosion on the mountain?



3. After the soil is wet from the erosion by water, blow a strong wind over the wet landscape. How does the moist soil affect the wind erosion?
4. Ask students to brainstorm ways they could prevent wind and water erosion. Relate this to the real world.

## Curriculum Correlation

### *Language Arts*

Have the students write a story about a rock that starts in the high mountains and is gradually eroded by ice, water, and wind as it moves from the mountain top to the shores of the ocean.

### Home Link

Have the students look outside their homes for evidences of erosion and explain to their parents what caused the erosion.





# Agent Erosion

Geologist

How does erosion change land?

Pick one agent of erosion to test. Wind Water Ice



Before Erosion

After Erosion