ScienceNews
EDUCATOR GUIDE

March 25, 2023
Shores Still Reeling
from 2010 Oil Spill

SOCIETY
FOR SCIENCE

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About this Guide

Soil erosion happens naturally and through human actions. In this activity, students will explore how an oil spill changed Louisiana's coastline, and they will look for examples of landscape features that were created by erosion and examples of human-caused erosion in their area.

This Guide includes:

Article-based Comprehension Q&A — Students will answer questions about the online *Science News* article "The Deepwater Horizon oil spill ruined long-term shore stability," which explains how damage to plants and soils is causing coastal marshes to retreat in parts of Louisiana. A version of the article, "Shores still reeling from 2010 oil spill," appears in the March 25, 2023 issue of *Science News*. Related standards include NGSS-DCI: MS-ESS1; HS-ESS3; MS-ESS3.

> **Student Comprehension Worksheet** — These questions are formatted so it's easy to print them out as a worksheet.

Cross-curricular Discussion Q&A — Students will discuss a disastrous event that led to erosion and use the event to contextualize the impact of erosion on humans and the ways humans increase and decrease erosion. Learning Outcomes: Determining examples of erosion and its positive and negative impacts on humans and analyzing an example of a human-induced ecosystem disruption and understanding how it caused erosion in the ecosystem over time. Related standards include NGSS-DCI: MS-ESS2; MS-ESS3; HS-ESS3.

> **Student Discussion Worksheet** — These questions are formatted so it's easy to print them out as a worksheet.

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Article-based Comprehension, Q&A

Directions for teachers: Ask students to read the online *Science News* article "The Deepwater Horizon oil spill ruined long-term shore stability" and have them answer the following questions. A version of the article, "Shores still reeling from 2010 oil spill," appears in the March 25, 2023 issue of *Science News*.

1. Why does Scott Zengel, an environmental scientist, consider the study highlighted in this article unique?

The scientists showed that the Deepwater Horizon spill changed the soil stability in marshes that were inundated with oil.

2. Outline the cascade of events that led to the destabilization of the Louisiana marshes and shoreline studied by the ecologists. Include at least four events.

The Deepwater Horizon oil rig exploded. Nearly 800 million liters of oil spilled into the Gulf of Mexico. The oil that spilled into the marshes killed the plants along the coast. The soil under the dead plants washed away. The oil that remained in the water then killed the next level of marsh plants and loosened more soil, thus speeding coastal erosion.

3. What was the rate of marsh loss in the area studied before and after the Deepwater Horizon oil spill? (Include the appropriate units.) What does this finding suggest? Are there any other factors that could contribute to the difference in rates?

Before the spill, the marshes under study had been retreating on average 0.8 meters per year. After the spill, the rate increased to approximately 1.7 meters per year on average, which suggests the oil spill has played a meaningful role in shore loss. However, scientists also have to consider the role played by coastal storms.

4. The article mentions two very different tools used by the ecologists to study the spill's impact on the marsh. Name the tools and explain how they were used.

The scientists used a sheer vane and satellite images. The sheer vane was used to test soil strength, and the satellite images were used to see how the marshes had changed over time. The views from the air covered a 23-year period and included images from before, during and after the Deepwater oil spill.

5. Before the 2010 oil spill, the soil concentration of oil aromatics (volatile compounds in oil) in the area studied by the scientists averaged 23.9 nanograms per gram of sediment. How high were the average aromatic concentrations in 2011? How many times greater is the post-spill average concentration than the pre-spill average concentration? What is important about this finding?

The concentration of aromatics averaged 17,152 nanograms per gram of sediment in 2011. The 2011 average concentration is 717.7 times higher than the pre-spill average concentration. This measurement

indicates that there were large amounts of oil introduced to the soil from the oil spill.

6. What scientific unit is used to measure soil strength? Describe the changes the scientists found in soil strength before and after the spill. What does the most recent soil-strength figure indicate?

Soil strength is measured in kilopascals. Before the oil spill, the average soil strength was 26.9 kilopascals. Soil strength declined to 11.5 kilopascals in 2011. By 2018, the average had risen to 16.4 kilopascals. What the 2018 figure indicates is that soil strength is improving from the 2011 level, but soil strength in the marshes has not yet returned to pre-spill levels.

7. How can coastal erosion be mitigated? Why could this action work?

Because marsh plants hold soil in place, replanting is a strategy that can slow coastal erosion.

8. The University of Louisiana scientists who did this research have studied the effects of the Deepwater Horizon oil spill for more than a decade. What have the scientists learned doing a long-term study that they might not have learned if they had done a short-term study right after the spill?

The scientists learned that soil strength was not permanently diminished, which might have been their conclusion if they had not looked at soil strength over time. Although soil strength is not at pre-spill levels, it is better than it was in the year after the spill. Taking a long view also made it possible to see how oil residues remaining in the water in the marshes continued to destabilize soil long after the oil spill.

Student Comprehension Worksheet

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2. Outline the cascade of events that led to the destabilization of the Louisiana marshes and shoreline studied by the ecologists. Include at least four events.

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Cross-curricular Discussion, Q&A

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Want to make it a virtual lesson? Post the online *Science News* article to your virtual classroom. Discuss the article and questions with your class on your virtual platform.

Oily erosion
1. What disaster is referenced in the article? In one sentence, describe what happened.

The Deepwater Horizon oil spill of 2010 pumped nearly 800 million liters of oil into the Gulf of Mexico.

2. Discuss the impact of the Deepwater Horizon disaster on the local ecosystem and the surrounding region. Name both short-term and long-term effects on the ecosystem as a result of the disaster.

A short-term effect was the immediate deaths of humans and the deaths of animals and plants due to the oil spilled into the water. A long-term effect was the increase in shoreline erosion due to the oil seeping into the soil and killing the marsh plants, which weakened the soil.

3. How did the disaster drive erosion in the area? How long did it take scientists to understand the impact? Explain what the researchers measured and the timeline.

The oil seeped into the soil on the coast and killed the marsh plants, which weakened the soil's strength, making it more susceptible to strong winds and rains caused by storms. The series of events increased erosion. Scientists used a sheer vane to test soil strength and examined satellite images of the coastline to measure erosion. The researchers began their field tests immediately after the oil spill and continued testing the soil for the next eight years. They also analyzed satellite images taken over 23 years.

Impacts of erosion on humans
4. Erosion is a natural phenomenon that occurs over time. Give an example of natural erosion that you have seen or read about. What do you think caused the erosion in your example?

Student answers will vary but could include the formation of riverbeds, canyons, mountains or cliffs along a shore. In the cliff example, students might say ocean forces altered the rocks, soil and sand.

5. Search the *Science News* or *Science News Explores* archives to find a specific example of a time when erosion impacted humans. Explain the impact. What were the short-term and long-term effects of your example? Provide a link to the story.

Student answers will vary. One example of erosion's impact involves the development of civilizations. In places like ancient Mesopotamia, now modern-day Iraq, wind eroded sediment along the Tigris and Euphrates rivers. Fertile deltas formed where sediments accumulated. The fertile river deltas allowed agriculture to flourish, which contributed to thriving civilizations. The article "[Drone photos reveal an early Mesopotamian city made of marsh islands](#)" describes one ancient settlement.

How humans increase and decrease erosion
6. Name some ways humans increase or decrease erosion compared with what would happen naturally. Are those influences positive, negative or both?

Humans can have both positive and negative influences on erosion. Humans have increased erosion through deforestation, poor agricultural practices and construction. Human-driven climate change has influenced rainfall, which can drive erosion. Too much rain can lead to landslides and erosion; too little rain means the soil dries up and can be blown by the wind. Humans can help control erosion by planting or building roads and structures in ways that limit erosion.

7. Discuss an example of human-caused erosion that has happened near you. How did humans contribute to erosion in your example?

Student answers will vary. One example could be the problem of soil erosion in the Midwest. Agricultural practices such as particular ways of tilling have increased soil erosion. (Tilling refers to the turning over and breaking up of soil for planting.)

8. What were some short-term and long-term effects of your example?

In the short-term, increased soil erosion in the Midwest leads to soil runoff into the region's rivers. The accumulation of sediments lowers water quality. Long-term, the loss of topsoil reduces soil nutrients, which, in turn, can lower crop yields over time.

9. Discuss possible solutions to this human-caused erosion that has created a problem in your local area. How could you go about engineering a potential solution to control the erosion?

Student answers will vary. Midwestern farmers could practice conservation tillage to preserve soil and keep it from eroding. Conservation tillage combines a variety of tilling techniques along with the practice of leaving crop residue on a large portion of the soil surface to keep water from washing soil away.

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Student Discussion Worksheet

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Oily erosion

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2. Discuss the impact of the Deepwater Horizon disaster on the local ecosystem and the surrounding region. Name both short-term and long-term effects on the ecosystem as a result of the disaster.

3. How did the disaster drive erosion in the area? How long did it take scientists to understand the impact? Explain what the researchers measured and the timeline.

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5. Search the *Science News* or *Science News Explores* archives to find a specific example of a time when erosion impacted humans. Explain the impact. What were the short-term and long-term effects of your example? Provide a link to the story.

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