



Discovering the Science of the Environment

With Support from the National Resource Conservation Service



IUPUI SCHOOL OF SCIENCE

SOIL EROSION AND WEATHERING

Grade Level(s): High School (Earth Science, Environmental, APES, Agriculture Science)

Program Duration: 2-3 class periods

- Block Schedule (90 min)
 - Day 1:
 - “What is Weathering and Erosion” mini lesson
 - Soil Glue lab and discussion
 - Soil Erosion and Agriculture Case Study
 - Day 2:
 - “Human Effects on Soil Erosion” mini lesson
 - Soil Erosion lab
 - Discussion of lab questions
- 45-50 min class periods
 - Day 1:
 - opener (bellringer)
 - “What is Weathering and Erosion” mini lesson
 - Soil Glue lab and discussion
 - Day 2:
 - Opener
 - Soil Erosion and Agriculture Case Study
 - Review questions together
 - “Human Effects on Soil Erosion” mini lesson
 - Day 3:
 - Soil Erosion lab
 - discuss lab questions

Program Overview

Students will understand how soil is a valuable resource and understand what humans have done and are currently doing to change the soil quality. They will learn (by modeling) how weathering and erosion affects soil and its ability to produce crops within sustainable agriculture.

- **Essential Question:** How is soil a valuable resource and what are humans doing to change soil quality.
- **Outcomes: Students will be able to -**
 - Model how weathering and erosion affect soils and their ability to produce crop
 - Shelterbelts
 - Unsustainable ag practices - tilling
 - [Dust Bowl](#)
 - Clear cutting
 - Wind and water erosion

- Soil Aggregates
- Glomalin
- Porosity lab
- Erosion lab - find/create one

Materials

Lab 1: Soil Glue Lab	Lab 2: Soil Erosion Lab	Activity 1: Soil Erosion and Agriculture Case Study
<ul style="list-style-type: none"> ● 2 Wide-mouthed glass jars ● 2 Pieces of 1/4-inch wire mesh about 1 1/2 x 6 inches ● 2 Clods of soil, each about the size of an egg, from the top two inches of soil from two different areas. 	<ul style="list-style-type: none"> ● Soda bottles (2-liters) (1 per student) ● Clear plastic cups (1 per student) ● Scissors ● Soil ● Leaves ● Mulch ● Grass clippings, different types of plants/weeds, mulch, etc. ● Some kind of container that the bottles can sit in horizontally (can be a container for a group, partners or individually) ● Watch this video beforehand <ul style="list-style-type: none"> ● youtube.com/watch?v=im4HVXMG168 	<ul style="list-style-type: none"> ● Printed copies of the case study ● Highlighters/writing utensils <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> ● Digital annotation app such as Notability or Google Docs

Introduction - 10 minutes

○

What is Soil Erosion and Weathering? Mini Lesson- (90 min or 2-45 min classes)

Materials

- What is Soil Erosion and Weathering? PowerPoint and a way to project it
- Printed or digital copy of the student lab sheet
- 2 Wide-mouthed glass jars

- 2 Pieces of 1/4-inch wire mesh about 11/2 x 6 inches
- 2 Clods of soil, each about the size of an egg, from the top two inches of soil from two different areas.

Instructions and/or Summary of Activity

Purpose: To give students direct instruction on what soil erosion and weathering are, how these processes affect soil quality, and how it is connected to sustainable agriculture. To allow students to model how healthy and unhealthy soil react to rain events and its connection to agriculture.

Instruction:

1. After the bellringer, present the rest of the slides to the students. When you get to the Grand Canyon video (slide 4), have the students discuss their answers from the bell ringer to a partner or group. This video will give them more insight and information about how erosion and weathering have impacted rocks and soil.
2. Have a whole class discussion on bellringer and have each group share their answers about how the canyon/rocks formed and its connection and impact from erosion and weathering.
3. Finish presenting the mini lesson and transition over to the Soil Glue Lab.
4. Have students complete the lab
 - a. The student lab sheet walks students through a background section, pre-lab, lab, and post-lab section
5. Students can work on the post-lab section individually or within a group.
 - a. Question 5 of the post-lab could be used as a whole class discussion at the end of the class period.

Soil Erosion and Agriculture Case Study

Materials

- Digital copies of the case study students can download and annotate digitally through Notability or some other note taking app
 - OR
- Physical copies of the case study students can highlight and write on with partners

Instructions and/or Summary of Activity

Purpose: To have students read about current events and connect them with the concepts learned in the mini lesson and soil glue lab. This activity is especially important in the light of scientific information being presented to the public. Students (and some adults) struggle with unpacking scientific information when reading a news article. This aligns with SEPS.8: Obtaining, evaluating, and communicating scientific information.

Instructions:

1. Pass out the Case study to students - either by digital means or actual paper copies
2. Using the methods in the teacher directions, or your own annotation methods, teach/remind the students how to annotate text and read critically.
 - a. It may be useful to practice with your students on a couple of paragraphs before setting them loose. Especially if they have done very little of this type of reading and annotating in your class or their English class.
3. Students can answer the discussion questions individually or as a group
4. Question 10 asks students to compose a letter using Claim, Evidence, Reasoning. If you have never taught this skill or had your students practice it, you may need to review the skill and help your students compose the letter.
 - a. You can have students brainstorm their letter with a group, and write it individually
5. **NOTE:** There are going to be many more opportunities in this and other modules to practice this skill. The purpose is to have students get better at it over time so they can do really well articulating thoughts and using evidence to back up their claim by the time they do the project and take the assessment.

“Human Effects on Soil Erosion” mini lesson with Soil Erosion lab - 90 min or 2-45 min classes**Materials**

- “Human effects on Soil Erosion” PowerPoint and a way to project them
- Printed or digital copy of the student lab sheet
- Soda bottles (2-liters) (1 per student)
- Clear plastic cups (1 per student)
- Scissors
- Soil
- Leaves
- Mulch
- Grass clippings, different types of plants/weeds, mulch, etc.
- Some kind of container that the bottles can sit in horizontally (can be a container for a group, partners or individually)

Instructions and/or Summary of Activity

Purpose: To give direct instruction about how human activities directly cause soil erosion and how we can reduce and conserve soil. The lab will reinforce for students that different types of soil and the materials within the soil play an important role in soil erosion, the quality of soil, and the importance of conserving and protecting soil within sustainable agriculture.

Instructions:

1. Prior to the mini lesson and lab, discuss with students about collecting their own soil samples and bringing them to school on the day this lab is executed.
 - a. Make sure to note with the students that their sample does not need to include ONLY soil... it can include mulch, grass clippings, weeds, corn husks, leaves, wood chips, twigs, roots, and more. Encourage the students to gather the soil and what is in and around the soil.
2. Present the “Human Effects on Soil Erosion” Powerpoint
3. Have students complete the lab
 - a. The student lab sheet walks students through a background section, pre-lab, lab, and post-lab section.
4. Students can work on the post-lab section individually or within a group.
 - a. Question 3 of the post-lab could be used as a whole class discussion at the end of the class period.

Wrap-up

Depending on how many days it takes your class to complete the module, you may need more than one wrap up activity. Below are 4 possible wrap up activities to get your class processing what they learned that day.

1. Have students summarize the lesson/labs main concepts in their own words. Prompt them with these questions:
 - a. You're talking over dinner with your parents and they ask you what you learned in school today. What are two concepts you'd mention?
 - b. Imagine a classmate is absent from class today. How would you explain the lesson to him/her?
2. Have students get creative and draw concepts of what they learned in the lessons/labs (could be on paper or digitally)
 - a. Design a t-shirt or poster that represents something you learned today.
 - b. Create an advertisement for a sustainable farm. The advertisement should include a slogan and images and one concept you learned today.
3. When doing the Case Study or the Lab Questions, always feel free to use those questions as classroom discussion. Especially the Claim, Evidence, Reasoning questions. Have students Think, Pair, Share their responses. Ask for alternate responses.
4. 3, 2, 1 Exit Ticket - Have students write three new words they learned and their definitions, Describe 2 main topics from the day, and ask 1 question they still have.

Possible Terminology/Vocabulary

- | | |
|------------------------------------|-------------------|
| ● Erosion | ● Soil aggregates |
| ● Weathering | ● Topsoil |
| ● Conventional Agriculture/Farming | ● Dust Bowl |
| ● Sustainable Agriculture/Farming | ● Terracing |
| ● Renewable resources | ● Contour farming |
| ● Nonrenewable resources | ● Windbreaks |
| ● Plowing | ● Shelterbelts |
| ● Tilling | ● Cover Crop |
| ● Pesticides | ● Terracing |
| ● Factory-made fertilizers | ● Contour Farming |
| ● Monoculture | ● Clearcutting |
| ● No-till farming | ● Deforestation |
| ● Natural pest control | ● Desertification |
| ● Natural fertilizers | ● Urbanization |

Suggested Reading

<https://cees.iupui.edu/education/discovering-science-environment>

<https://www.nrdc.org/stories/soil-erosion-101>

https://forces.si.edu/soils/02_07_04.html

<https://notillagriculture.com/no-till-farming/advantages-and-disadvantages-of-no-till-farming/>

<https://www.youtube.com/watch?v=kVLt2fZOqE>

<https://www.no-tillfarmer.com/articles/1384-removing-terraces-from-no-till-cropland-not-recommended>

<https://www.smithsonianmag.com/history/farming-like-the-incas-70263217/>

<https://www.gettingmoreontheground.com/2016/07/26/contour-farming-increases-soil-moisture/>

<https://www.fs.usda.gov/nac/practices/windbreaks.php>

Additional Comments

This module is intended to be used with the Matter Cycling and soil Formation module and the Human Impact & Soil Conservation Module found on [insert CEES website here]