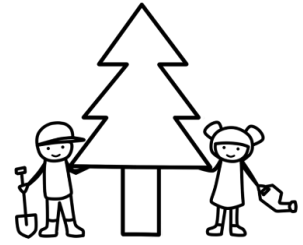


Lesson: Take Action

*Arlington Echo works to continuously improve our lessons. This lesson may be modified over the course of the school year.

Environmental literacy question: How have humans affected The Chesapeake Bay and its watershed?



Topic/Essential Questions: How do weathering and erosion change the Earth?

Unit/Lesson Sequence: This is one of two lessons in the “Erosion” 4th grade module based at Arlington Echo Outdoor Education Center.

Content Standards:

- **Environmental Literacy**
MSDE 1.0 ENVIRONMENTAL ISSUES The student will investigate and analyze environmental issues and develop and implement a local action project that protects, sustains, or enhances the natural environment.
- **Science**
MSDE 2.0 EARTH/SPACE SCIENCES The students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.
2.A.2. Recognize and explain how physical weathering and erosion cause changes to the earth's surface.
a. Investigate and describe how weathering wears down Earth's surface.
b. Cite evidence to show that erosion shapes and reshapes the earth's surface as it moves Earth's materials from one location to another.
- **Social Studies**
3.D.1. Describe how people adapt to, modify and impact the natural environment.
b. Describe ways people in Maryland modify the natural environment and the consequences of modifications.
- **Common Core**
CCSS.ELA-Literacy.RI.4.7 *Interpret* information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Length of Lesson: 45 minutes (day program)/60 minutes (overnight program)

Student Outcome: The students will demonstrate an understanding of the impact of erosion on the natural environment and ways to prevent erosion.

Knowledge of the Learner:

- Prerequisite knowledge, skills, and processes: Students must have a basic understanding of the roles of erosion and its effects on the natural environment.
- Student needs, interests, and previous learning: These will be determined during the pre-assessment.

- Conceptual difficulties: Relating sedimentation to ecological problems; building self-efficacy to help solve the problems. Learning to use project materials (i.e. shovel, gravel, native plants, etc.) properly.
- Differentiated: The instructor may pace the lesson according to the responses and participation of the students.
- Differentiated: This lesson will appeal to different types of learners. Kinesthetic learners should do well with the physical act of completing an action project. Interpersonal learners will benefit from the team dynamic required to work together. Visual learners will be able to understand the effects of erosion by seeing water move through different surfaces.

Knowledge of Content:

Content knowledge for the instructor: Provided in the lesson plan and supplements

• **Vocabulary**

- | | | |
|------------|---------------------|-----------------|
| -Watershed | -Berm | -Native |
| -Pollution | -Bio-retention area | -Eutrophication |
| -Erosion | -Infiltration | -Algae bloom |
| -Invasive | -SAV | |

• **Erosion Model Supplies**

- Erosion models of forest floor, mulched area, and bare dirt/sand path
- Trays to catch the water poured on each model
- Watering can
- Potted Atlantic White Cedar

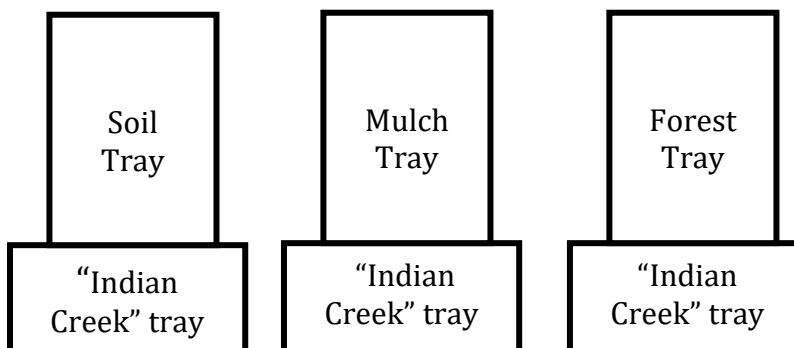
Action Project Supplies (depending on project)

- | | | |
|---------------|---------------|---------------------|
| -Buckets | -Shovels | -Gravel |
| -Wheel barrow | -Hand shovels | -Rain barrel halves |
| -Plants | -Gloves | |

• **Supplements**

- A: How to Plant
- B: Who Can? Cheer
- C: Vocabulary

Lesson Setup: Erosion models can be set up by placing the shallow trays (“Indian Creek”) at the base of each erosion tray (there are three: forest, mulch, and bare sand/soil). This way when water is dumped on it for “rain” there is a tray to catch the water, just as the creek catches water rolling down the hills (pictured below). Action project will vary; an Arlington Echo staff member will provide instructions for setup.



Instructional Delivery

Engage

Pre-Assessment:

- Welcome students to the activity and introduce yourself.
- Ask students: “What is erosion? Is it a problem? What causes erosion? How can we help control erosion?” *Erosion is the transport of weathered rock. Natural causes of erosion includes flowing water, waves and wind, gravity and glacier sliding. Human activities like mining, forest and native plant removal, construction and adding impervious surfaces can also cause erosion. Too much erosion can cause habitat destruction on land and pollute surrounding waters.*

Motivation/Warm-Up:

- Have students stand in a semi-circle around the models.
- Set the scene: “The forest around us is how most of the Chesapeake Bay watershed looked before many people came to live here. When Europeans first came to this land they saw natural areas like this. Since then, much has happened. People needed roads, places to live, and farms to grow crops. Many trees were cut down to make room for these developments. One of the problems that have occurred because of this is the washing of topsoil into rivers and tributaries (and Indian Creek!). When there is nothing covering the soil, it washes away with the rain. What is it called when soil washes away with rain?” (*Erosion*)

Explore

Erosion Model:

- Show students the three erosion model trays. Explain that they are going to perform an experiment. Each tray represents a steep slope at Arlington Echo that leads down to Indian Creek - one with mulch, one with a “forest” floor, and one with just soil/sand. The shallow trays at the base of each erosion tray represent Indian Creek at the bottom of hills around site.
- Ask students how many of them have done a science experiment before. Ask them “What is the first thing we do in a science experiment?” *Come up with a problem in the form of a question.* Have them come up with a question that we could answer after pouring water on the trays. For example - *What will happen to Indian Creek when it rains on different kinds of surfaces?*
- What is the next thing we do in an experiment? *Make a hypothesis.* Have students predict what will happen when it rains on each hill.
- Next we will test our hypothesis. Pick a volunteer to be a rain cloud; they will pour water onto the forested hill. Pick another student to be the timer. They will count out loud telling the cloud to stop when water reaches “Indian Creek”. The other students should make rain sounds. Have students describe what happens. Was their hypothesis correct?
- Repeat this process with the mulch tray and the dirt tray.
- Which water is cleaner? Which slope had more erosion? Was your prediction correct?
- Show students a potted tree. Ask them what they think will happen when you lift the tree out of the pot (will the roots hold the soil or not?). Gently lift the tree out of the pot to show the roots to the students. Ask students, “Why didn’t the soil fall? What held the soil?” *The roots.* Point out how the roots hold the soil. Return tree to the pot.
- Explain that trees growing near the water keep it clean. The roots hold the soil in place. This helps to stop sediment from reaching the water.
- Between groups, pour muddy water into the woods where it will not drain into the cove.

Explain

Site Assessment

- Ask students why erosion might be a problem for fish and other animals that live in the water. *When erosion occurs, sediment ends up in the water, making it cloudy. This makes it difficult for submerged aquatic vegetation (SAVs: plants that provide oxygen in the water) to get enough sunlight for photosynthesis, without which plants will die. Sediment also carries high amounts of nutrients. Excess nutrients in the water can cause algae blooms and eutrophication, leading to a significant reduction of oxygen in the water.*
- Tell the students that if we can slow down the water like we did in the experiment, we can help stop erosion. *There are many ways to prevent erosion, planting native plants, installing rain barrels, planting rain gardens, creating bio-retention areas, etc....*
- Students will examine various areas around Arlington Echo's campus, looking for damage caused by erosion.
- Students will then brainstorm ideas of things they can do, as fourth graders, to help prevent erosion. They will vote for which project they would like to take on today.

Elaborate

Action Project:

- Inform the students that today they will be 'Taking Action' to help prevent erosion by doing an action project.
- There will be several possible action projects to prevent erosion set up around Arlington Echo's campus. Projects may include mulching, planting, berm placement, letter writing, poster making, and more. Based on what the students voted for, they will work on one of these projects.

Evaluate

Assessment: Ask students, "How did you help stop erosion today?"

Student Reflection and Closure: Do the "Who Can?" cheer with the students (**Supplement B**) and ask if what they learned today is a way they can change the world. How can projects like these help at their schools or in their communities?

After the lesson is finished, students will be escorted by Arlington Echo staff to their next activity.

Notes for Clean up:

Please clean, organize and return the lesson materials to their proper locations at the end of each day of instruction. Remember to inform the Arlington Echo staff if you need assistance or if any materials are damaged or missing.

Notes for Inclement Weather:

Arlington Echo encourages keeping our outdoor activities outdoors—even in the rain—but in the case of severe weather (thunder/lightning extreme cold, etc.), the rain location for this activity will be under the Main Pavilion or inside Field Hall. An alternate activity will be given to the instructor in case of inclement weather.

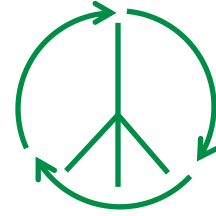
Supplement A: Take Action– How to Plant



Don't forget to water!

Supplement B: Who Can? Cheer

Instruct students that when you ask “Who can?” they shout “We can!”



Say: “Who can?”

Students: “We can!”

Say: “Who can?”

Students: “We can!”

Say: “Who can change the world?”

Students: “We can change the world!”

“We are ALL connected!”

Supplement C: Vocabulary

Watershed: An area of land where all the storm water enters rivers and streams and flows into a main body of water.

Pollution: The introduction of a substance that is harmful or poisonous into an area.

Erosion: The process by which soil is washed away by rain water usually to a body of water.

Infiltration: The process by which rainwater soaks back into the ground.

Bioretention: the process in which contaminants and sedimentation are removed from storm water runoff.

Bioretention Area: An area specifically built to help slow down, infiltrate, and filter storm water.

Berm: A raised bank, of land used to slowdown water, used in many Bio-retention areas.

SAV: Submerged Aquatic Vegetation, such as bay grasses.

Eutrophication: a form of water pollution that occurs when excessive fertilizers run into lakes and rivers. This encourages the growth of algae (algal bloom) and other aquatic plants.

Algae Bloom: The result of excess nutrients in waterways causing massive amounts of algae to grow usually in a thick layer on top of the water.

Native: Plants or animals that are naturally occurring in the area.

Non-Native: Plants or animals that have been introduced into an area they do not naturally occur.

Invasive: Non-native plants or animals that out compete native plants or animals for food, water, shelter, space, etc...