

SMCOE Green Career Awareness

AGRISCIENCE

Solutionary Phase	Problem Cycle 1
Lesson # and title	Lesson 7: Erosions Impact on Soil
Duration	45 minutes

Lesson Overview

After learning about the basics of soil and the ways that agriculture can impact soil health, students will be introduced to another problem impacting soil: soil fertility lost to runoff. Students will learn about how different factors contribute to soil erosion and how scientists and landscape coordinators measure the impact of erosion. They will then test the amount of soil in water samples by using a secchi disc and try to match them to data collected at TomKat Ranch. Finally, they will think of solutions to erosions.

Learning Objectives

- Students will be able to measure the amount of sediment in water using a secchi disk
- Students will be able to identify agricultural practices that may reduce the amount of sediment that ends up in streams, rivers and lakes

Content Standard(s)

CA NGSS

ESS2.C: The Roles of Water in Earth's Surface Processes


- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.

ESS3.C: Human Impacts on Earth Systems

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.
(MS-ESS3-3)

The landscape coordinator at TomKat Ranch is briefly described.

Equipment, Instructional Resources, and Materials

-  Lesson 7 - Erosion Impact on Soil Slides
- [Data sheet for students](#)

For erosion demonstration (optional):

- One container with just soil
- One container with a growing plant
- Containers to catch “run off”
- Graduated cylinders to measure water



For testing sediment in water at the different sites:

- 1 secchi disk per group:
 - tie a piece of string around a washer
 - use masking tape to wrap around washer to make a solid colored disk

- tape string so it is in the middle of the washer so it will hang flat



- 2 sets of 4 milk cartons (quart sized) labeled site 1, site 2, site 3 and site 4
 - Fill cup cartons $\frac{3}{4}$ full of water
 - Add a few drops of chocolate milk (or other dark substance) to site 2 ("some sediment)
 - Add many drops of chocolate milk (or other dark substance) to site 3 (a lot of sediment)
 - Add a lot of chocolate milk (or other dark substance) to site 4 (too much sediment)
- Test sediment in water by lowering secchi disk until it disappears; measure the distance from the secchi disk to the point you pinched after it disappeared



Suggested Student Grouping


Small groups

Vocabulary

- Agriculture - The practice of growing plants for food, clothing, animal feed, and other resources humans need or desire. It also includes raising domesticated animals (livestock).
- Biodiversity - Biological diversity is the variety of life in an area. Examples include the variety of individuals in a species, the variety of species in an ecosystem, and the variety of biomes or species on earth.
- Conventional/degenerative agriculture - Industrial practices of farming which include large single-crop farms, intensive tilling and irrigation, and the use of synthetic fertilizers, pesticides, and herbicides. This way of farming is very productive, but requires high amounts of energy, adds toxins to the soil, and increases carbon release from the soil rather than carbon sequestration (capture).
- Erosion - When rocks, soil, or other landforms are gradually worn down by ice, water, or wind.
- Monoculture - The practice of growing or producing only one crop, species, or animal in the same place at the same time.
- Polyculture - The practice of growing or producing multiple crops, species, or animals in the same place at the same time.
- Run off - Water that flows over the ground surface rather than soaking into the ground
- Soil - The material on the surface of the Earth in which plants grow. It is a mixture of eroded rocks, minerals, and organic matter. It holds water and air, provides nutrients and structural support to plants, and supports a diverse ecosystem of living micro- and macro-organisms.
- Sediment - Small, solid pieces of material from rocks or organism

The Lesson

Preparation

- Review  Lesson 7 - Erosion Impact on Soil
- Decide if you will do the erosion demo or just play the video (slide 5)
- Cue up <https://bigpictureranch.vids.io/videos/119ddcb71c12e9ce98/kiss-the-ground-for-schools> to 12:03 (password: school)
- Prepare secchi disks by tying string to a metal washer. Then, wrap masking tape around the metal washer and ensure that the “secchi disc”
- Create 2 sets of water samples (See material list above)

Lesson Procedure

Link to Lesson Slide Deck: [slidedeck](#)

Activity/Task	Description	Time (min)
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Kiss the Ground	<ul style="list-style-type: none"> • Play https://bigpictureranch.vids.io/videos/119ddcb71c12e9ce98/kiss-the-ground-for-schools from 12:03-16:20. • Have students discuss what they saw in the video. • Review the Essential Questions with the students on slide 3. 	5
Erosion Demonstration	<ul style="list-style-type: none"> • Explain the demonstration: There are two (or three if students are watching the video) containers of equal size and soil. In one container, there is a plant growing. In the other, there is only soil. If water is poured into each container, and then collected after it passes through the soil, what will happen? • In small groups, students share their predictions using the sentence frame: I predict that...because... • Perform the demonstration. Pour 200 ml of water into each container. Collect the water into containers that are placed under the plan/soil container and soil container. <ul style="list-style-type: none"> ◦ Or play the video on slide 5. • After the demonstration, students share their observations in their small groups. • Finally, students try to come up with an explanation of the observations that the container with no plant had darker water collected at the bottom. 	10
Introduce TopKat Ranch/Careers in Agriculture	<ul style="list-style-type: none"> • Tell students that they will be taking on the role of a Landscape Coordinator at a Bay Area Farm called TomKat Ranch. • Review the brief description of TomKat Ranch and the landscape coordinator position at TomKat Ranch 	5
Analyzing Ranch Data	<ul style="list-style-type: none"> • Teacher displays the slide of data from TomKat Ranch. In small groups, students discuss the guiding questions. • After students have had time to answer the questions in small groups, the teacher can ask for student responses or just simply go over the answers. • What type of data is being displayed? Water infiltration at different sites • What do you think it means? Water infiltration refers to how much water is going down into the soil and getting absorbed. • What are the two keys? Water infiltration (min/in) + Tests done on soil (overall score, bulk density, water infiltration and % Carbon) • What information do they provide? • From the TomKat Ranch site, the glossary describes the different characteristics. For this lesson, focus on water infiltration. From the glossary, “ Also an indicator 	5

	<p>of soil compaction, water infiltration rate is measured as the time required for soil to absorb water (minutes per inch of water). Compacted soils take longer to absorb water, increasing runoff and decreasing water available for local plant growth”</p> <ul style="list-style-type: none"> • What might be causing the areas to have different results? Answers may vary. Some students may mention livestock, shape of the land, the amount of plant cover. 	
Testing	<p>Define water infiltration using slide 9. Show the video explaining how secci disks are used. Tell students that they will be using models of secci disks to measure runoff in different simulated “samples.” Teacher explains that water has been collected from 4 sites at TomKat ranch. Students will use secchi disks to test the amount of sediment in each sample.</p> <p>To use the Secchi disk:</p> <ol style="list-style-type: none"> 1) Hold the string and lower the secchi disk into the water. Continue to lower the disk until it disappears. 2) Pinch the string at the top of the water. 3) Measure the length between the disk and where you pinched the string. 4) Record the depth on your data sheet. 	15
Match the site with location/What would you do?	<p>The slide shows TomKat data. There are 4 locations labeled A, B, C and D.</p> <p>Teacher summarizes the following information:</p> <p>The locations have the following infiltration scores: Location A 0-1 Location B (1-5) Location C (5-10) Location D (10-20)</p> <p>From the testing, the sites should have the following results Site 1: Very Clear Water Site 2: Some sediment Site 3: A lot of sediment Site 4: Too much sediment</p>	5

	<p>Students discuss the question: “What impact will the rate of water infiltration have on the amount of soil that may end up in rivers, streams and ponds?” Guide students to the conclusion that if water takes a long time to get absorbed, then it may end up moving away from the location and carry away topsoil. This topsoil may then end up in other water sources (similar to the demonstration that began the class)</p> <p>Ask students to match up the sites with the real locations?</p> <p>Site 1 should equal Location A (water was able to go into soil and not carry the soil away) Site 2 = B Site 3 = C Site 4 = D</p> <p>Discuss slides 13 and 14 with the students. For slide 14, students should note that they planted a monoculture so there isn’t much biodiversity.</p>	
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Assessment

Teachers may want to turn slide 13 or 14 into an exit ticket and collect student responses