Where Does the Soil Go?
Erosion and Deposition on Our Site

Science Instructional Materials Lesson Upgrade

Introduction

This lesson upgrade was developed as part of an Office of Superintendent of Public Instruction (OSPI) and Washington State Leadership and Assistance for Science Education Reform (LASER) project funded through an EPA Region 10 grant. The purpose of the lesson upgrades is to incorporate environmental and sustainability concepts into high use science instructional materials and also address the cultural relevancy of the lessons by incorporating Native American stories.

This lesson is designed to be taught with Lesson 7 of the STC®/*Land and Water* unit.

This and other upgraded lessons can be downloaded at: http://www.wastatelaser.org/_support/ESEL/land_and_water/index.asp

Assessment and Standards

Science Instructional Materials Lesson Upgrade

Pre Assessment

Administer the Land and Water pre-assessment prior to Lesson 7A of the *Science Instructional Materials Upgrade* that has been added. Using the rubric, score the assessment and use results to help guide instruction.

Post Assessment

After Lesson 15/16 of the *Science Instructional Materials Upgrade,* you will administer a post assessment to determine student growth.

Standards

A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas

ESS2.C: *By the end of Grade 5*. Water is found...and running water on land...The downhill movement of water as it flows to the ocean shapes the appearance of the land….

Common Core State Standards in Mathematics

Measurement and Data (4th grade)

4.MD.1. Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

Common Core State Standards in English Language Arts

Writing (4th and 5th grade)

W.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

W.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

W.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

W.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

Speaking and Listening (4th and 5th grade)

SL.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade level topics and texts, building on others' ideas and expressing their own clearly.

SL.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

Language (4th and 5th grade)

L.4.6. Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being and that are basic to a particular topic.

LESSON 7A

Where Does Our Soil Go? Modeling Erosion and Deposition on Our Site

Overview and Objectives

In Lesson 7, students tracked the flow of water and movement of soil by placing "toothpick flags" in their stream table as they poured water over the soil and sprinkled marine sand into the flowing water. In this lesson, students conduct their observations of fast and slow moving water and erosion and deposition outside at a designated tributary or source of flowing water. This enhances the lesson and lends a foundation to understanding how our Earth has been shaped by water.

- Students record evidence of the flow, erosion, and deposition in their local tributary or source of flowing water.
- Students predict where the water might be fast and slow moving and where erosion and deposition might occur.
- Students create a birds-eye view of their site.

Background

Refer to the beginning of the STC®/*Land and Water* Teacher's Guide for background information on erosion and deposition as well as velocity of a streams.

Materials

For each student

1 science notebook

1 clipboard

1 **Field Sheet** (blackline master)

For each group of four

Laminated photos or maps of tributary site

1 set of four flags (*fast, slow, erosion, deposition*)

Tape measure or yard sticks

Preparation

1. Locate a local tributary, stream, irrigation ditch, or other source of running water that is easily accessible.
2. Take pictures of the site and/or find maps. Arial maps would be useful and can be found on the internet. Laminate these to protect them.
3. Identify any safety concerns with the site such as wild animals, loose or unstable soil/ground, or extremely fast flowing water.
4. Determine the approximate length and width of the site so that you have an idea of what students should get as their answer when they estimate the size of the site.
5. Print off enough flags for each group of four to have one of each kind (*fast, slow, erosion, deposition*). As an option, you may want to laminate and then secure these flags to the ends of yard sticks.
6. Make one copy of the **Field Sheet** for each student.
7. You may want to enlist some parent volunteers to help supervise on the day that you visit your site.
8. Decide how you plan on dividing your groups of four students.
9. (Optional) Decide which Native American story you want to share with the students.

Procedure

1. (Optional) Have students listen to the Native American story. Use the lesson plan as guide.
2. Students begin with writing the title, date, and focus question in their science notebook.
3. Ask students, "What do you think (name your local tributary or other moving body of water such as an irrigation canal) looks like? Where might it be fast? Where might it be slow? Would you be able to see evidence of erosion and deposition?"
4. Have students draw a birds-eye view of what they think their local tributary looks like, including "flags" of where they predict they will see evidence of slow and fast moving water and erosion and deposition.
5. Take your students to the "tributary" site. Make sure they have their clipboards, field sheet, and pencils.

Management Tip: When visiting a stream, leave no trace. Make sure the site you are visiting can support the impact of a class visit.

6. Once at the site explain the safety concerns that you have identified and set the boundaries of the investigation.
7. Divide the students into groups of four. Let them know that they will each have a different job in the group (fast, slow, erosion, and deposition).
8. Have students spread out as much as possible along the tributary in their group. Two tape measure holders, one recorder, and one person who reads the tape measure. Students will use this measurement to get an estimate of the overall tributary size.
9. Students then draw a birds-eye view of the tributary. They will use the checklist provided on the field sheet:
    - Shape and size of the creek
    - Location of soils (sand, gravel) in stream
    - Streamside plants
    - Landmarks (for example, big trees)
    - A scale (to show how big of an area your map represents)
10. Students then share with each other their maps and compare them to the checklist.
11. Gather the students together and spend some time reviewing what the definition of erosion and deposition are and what might be evidence of them. Discuss what might be some evidence of slow and fast water.
12. Explain that each group member will receive a flag that has one of four labels, erosion, deposition, fast, and slow. These flags will be placed alongside the stream where you find evidence of condition on your flag.
13. Have students share with their group the evidence for which they will be looking.
14. Tell them that they will have five minutes to locate their evidence along their section of the tributary. They will then place their flag on the ground to mark their spot and return to the starting point.
15. Now guide students on a tour of the flags and have students who placed the flag tell why they placed their flag there. You do not have to have every student share, but make note of significant areas of slow or fast water and erosion and deposition.
16. Next explain that they will add the labels to their birds-eye view map. Provide ample time for them to do this. Have group members check each others' work.

17. Gather students together. Pose the following questions:
    - What are some plants and animals that live near the tributary?
    - What would happen if the flow of water increased? How might this increase affect the plants, animals, and people that live near the tributary?
    - How is this tributary like the streams we have investigated in our class? How is it different?
18. Have them check around the site to make sure they leave no trace of their presence. If possible, leave the site in better condition than you found it by collecting litter. Ask students why we would want to clean up around the tributary and why you would not want to litter or disturb the land around the tributary.
19. Have students paste their field sheet into their science notebooks.
    - Write or project the following questions on the board for students to respond to in their notebooks.
    - How does (name your tributary), a real stream, compare to the models of the streams you have made in your classroom? (You may want them to create a graphic organizer to help them with this question, such as a Box and T chart) See Figure 7A-1
    - How might the flow of water affect plants, animals, and humans?
    - How might erosion and deposition affect plants, animals, and humans?
    - How was learning about erosion and deposition in the stream table different from learning about them outside? How did going to the tributary help you understand erosion and deposition better?

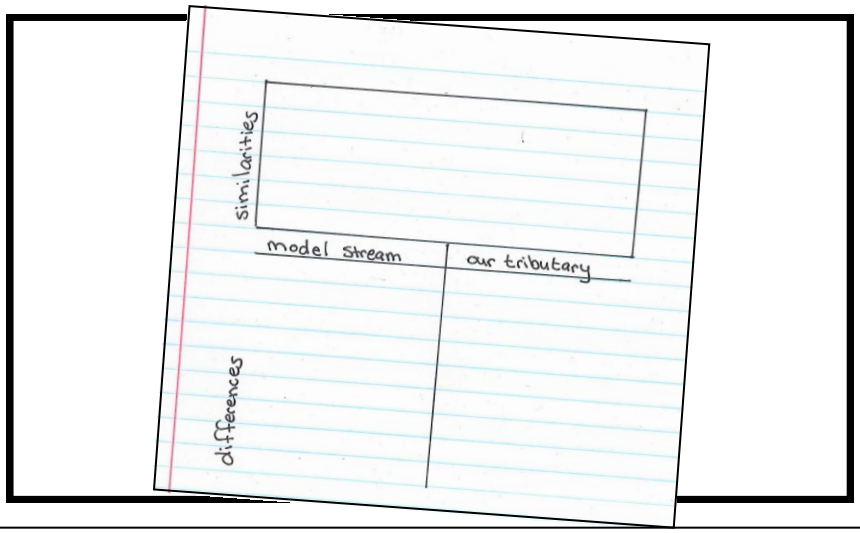


Figure 7A - 1

Sample notebook page with Box and T chart.

By Betsy Rupp Fulwiler from "Writing in Science." (2007)

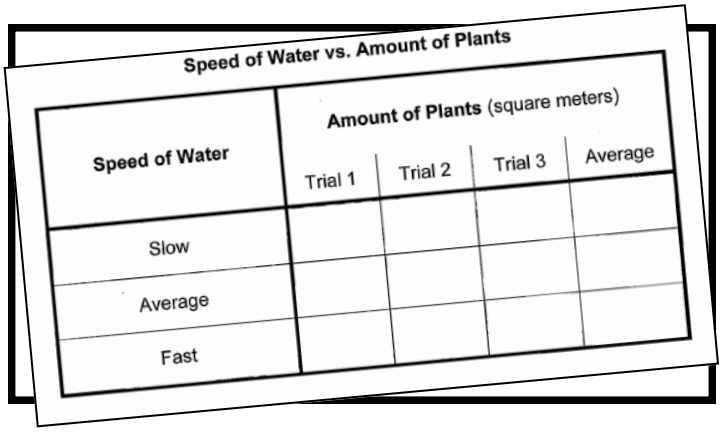
Management Tip: Because this lesson can incorporate a field study practice opportunity, this would be a good stopping point.

20. Review the answers to the following two questions from step 19.
    - How might the flow of water affect plants, animals, and humans?
    - How might erosion and deposition affect plants, animals, and humans?
21. Explain to students that they are going to develop a possible field study to help answer one of those questions. Review the attributes of a field study listed below. Have students record them in their notebook as a reference.
    - Logical steps to do the field study
    - Conditions to be compared
    - Data to be collected
    - How often data should be collected
22. Explain that the focus will be on the effects of the flow of water on the plants. Have students write the field study question in their notebook.
    - How does the speed of water affect the amount of plants or plant matter in the water?
23. Ask students to identify the variable that is being compared (slow and fast moving water) and the variable that is being measured (the amount of plants). You may want to ask what variables we can control. Because this is field study, this can be a challenge since there are things we cannot control in nature.
24. Develop logical step to do the field study based on your site. Here are some possible procedures.
    - Identify where there is fast, average and slow moving water along your stream site. You will need three "fast moving, average," and three "slow moving" spots to compare.
    - Record the date, time, and weather conditions at your site.
    - Decide how you will measure the amount of plants or plant matter (for example, you may want to decide on the square footage covered or percentage versus counting individual plants). Also note, that this is referring to the plants in the water, but you could choose to record the plants near the water.
    - Measure and record the amount of plants at each location.

25. Have students copy the data table in Figure 7A-2. Point out that by creating an accurate data table, they can receive credit for many of the attributes of a field study.

Figure 7A - 2

Data table for field study.



Speed of Water vs. Amount of Plants

Speed of Water	Amount of Plants (square meters)			
	Trial 1	Trial 2	Trial 3	Average
Slow				
Average				
Fast				

26. Students may conduct their study. Consider having the same location counted by multiple students. The varying results are a great way to introduce the concept of error and validity.

Final Activities

1. Have students write a conclusion. In their conclusion be sure that they:
   - Answer the field study question (Does the speed of the water, fast or slow, affect the amount of plants in the water?).
   - Include supporting data from the Speed vs. Amount of Plants data table (Sites the fastest moving water amount and the slowest).
   - Explain how the data supports their conclusion (explain the difference between the fastest and slowest or explain that there is no difference).

Assessment

Use students' responses to the question from step 19 to assess how well they apply the information learned in this lesson. Consider the following questions:

- Can students explain how the model is similar to and different from the real thing being modeled? (WA State 4-5 INQF)
- Can the students explain the flow of water and erosion affect the biotic factors in the natural environment? (WA State ESE2)

Additionally there is a field study question that students can attempt. Usually this item is embedded with a scenario, but the learning experiences from this lesson will serve as an authentic scenario.

Washington State 2009 Science Standards are referenced.

Record Sheet 7A-A

Name:_____

Group:_____ Date:_____

Field Sheet

Drawing a Birds Eye View of Your Site

Draw a birds eye view of your site. In your drawing, be sure to include:

- Shape and size of the creek
- Location of soils (sand, gravel) in stream
- Streamside plants
- Landmarks (like big trees, buildings)
- A scale (to show how big of an area your map represents)

Name:_____

Date:_____

Plan a field study to answer the question in the box.

In your procedure, be sure to include:

- Logical steps to do the field study
- Conditions to be compared
- Data to be collected
- How often data should be collected and recorded

Field Study Question: How does the speed of the water affect the amount of deposition at a river's delta?
Procedure:

Scoring Rubric for: New Field Study (page 1 of 2)	
Performance Description	**Attributes**
A **2-point response** demonstrates the student understands the Content Standard INQB: Scientists plan and conduct different kinds of investigations, depending on the questions they are trying to answer. Types of investigations include systematic observations, descriptions, field studies, models, and open-ended explorations as well as experiments. Item Specification 2: Describe a plan to answer a given question for a field study.	4–5
A **1-point response** demonstrates the student has partial understanding of the Content Standard.	2–3
A **0-point response** demonstrates the student has little to no understanding of the Content Standard.	0–1

Attributes of a Procedure for a Field Study

Attribute Name	Description	Attribute
Conditions to be Compared (Manipulated Variable)	Only one manipulated variable (*speed of the water*) is identified or implied in the procedure or data table (if given).	1
Data to be Collected (Responding Variable)	The data collected to answer the field study question (*amount of deposition*) is identified or implied in the procedure or data table (if given).	1
Record Measurements	The procedure states or implies measurements are recorded. Attribute Notes: If artificial data for the responding variable is given, this attribute cannot be credited. The phrases *take measurement* or *to count* cannot be used to mean record.	1
Observations are Repeated	More than one observation for all conditions is planned, or implied in a data table.	1
Logical Steps	The steps of the procedure are detailed enough to repeat the procedure effectively (examples of illogical steps: no ending time indicated, observing in different locations at very different times, recording vague data or results).	1
	Total Possible Attributes	**5**

Scoring Rubric for: New Field Study (page 2 of 2)

General Notes:

Inappropriate Procedures: If the response does not plan an appropriate procedure for the given question, the response may not earn any of the possible attributes.

Examples:

a) Repeats the procedure from the scenario

b) Measures only one condition (therefore cannot establish the controlled or manipulated variables)

c) N/A

d) Writes a procedure that is too vague to possibly be appropriate

e) Writes a prediction instead of a procedure

Naming Attributes: If the response names a bulleted attribute listed after "be sure to include:" without including that attribute in the procedure, the attribute point cannot be credited. When a bulleted attribute is named and implied in the response, both must be correct to be credited.

Clarifying Vagueness in Procedures:

a) Measuring a vague parameter may be credited as a manipulated or responding variable. However, a vague parameter is difficult to repeatedly measure, so the logical steps attributes cannot be credited.

b) The term "repeat" at the end of a step refers to that step only.

c) The term "repeat" as a separate step (or in a new paragraph) refers to the whole procedure.

d) The term "repeat," when qualified, cannot be credited for multiple trials (e.g., *repeat if necessary, repeat as desired)*.

e) A vague action that calls for the manipulated variable to be changed (e.g., *speed of the water*) without indicating how many times, gives no end to the investigation so the logical steps attribute cannot be credited.