

## **MNLA Curriculum Unit C, Lesson 2**

**UNIT TITLE:** Water in the Landscape

**LESSON 2:** Soil and Plants Help to Keep Our Water Clean; 30-40 minutes

### **MINNESOTA ACADEMIC STANDARDS IN SCIENCE:**

3.1.1.2.4 Scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena.

3.1.3.2.2 Men and women throughout the history of all cultures, including Minnesota American Indian tribes and communities, have been involved in engineering design and scientific inquiry.

4.3.2.3.1 Water circulates through the Earth's crust, oceans and atmosphere in what is known as the water cycle.

4.3.4.1.1 In order to improve their existence, humans interact with and influence Earth systems.

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**GRADE LEVEL/SUBJECT:** 3-4 Science

**OVERVIEW:** This lesson will expand and/or reinforce third and fourth grade students' knowledge of the Water Cycle. Students will learn how soils are developed, how water moves through soils and how soil and plants can help remove pollutants from water.

**OBJECTIVE:** As a result of this activity, students will be able to:

- describe how soil is formed
- name and provide general descriptions of three types of soils
- observe and describe differences in water movement through soil types

### **MATERIALS:**

- 9 - 18 oz clear plastic cups with 3 holes snipped out along the bottom edge with a pruning shears so water can drain
- 2 cups each of 3 different sized dry beans: lentils, navy or pinto and lima beans work well
- 2 cups each of dry sandy soil, mineral loam soil and high organic soil or medium
- 6 aluminum pie pans
- 2 gallons of water
- red or blue food coloring
- 1 piece of notebook paper for each student
- optional: large flashcards with the words *sand*, *silt* and *clay* written on them

### **MATERIALS FOR OPTIONAL ACTIVITY:**

- pint-sized jar with lid for each student; fill each jar half full of a loam soil (if a loam is not available, mix extra sand into the mineral soil available)
- small bottle of liquid dish soap

### **ACTIVITIES AND PROCEDURES:**

1. Introduce yourself and briefly tell what you do. Use the titles of your position and those of your colleagues to provide students with a vision of career opportunities. Emphasize that understanding plants, soil and water is important to your career and that your work helps keep the environment healthy.
2. Review the Water Cycle by asking the students to describe the phases. Emphasize how water trickles through the soil and the plants growing in the soil will help clean up the water.
3. Describe how the bedrock of the Earth weathers over time through wind and water abrasion and freezing and thawing. As the rock weathers it breaks into very small pieces that become soil. Describe how old plant parts decay and mix in with the weathered rock. Thus soils are part mineral (weathered rock) and part organic material (decayed plant parts). Write on the board OR show big flash cards with the words SAND, SILT and CLAY. These are the 3 types of mineral or weathered rock particles that make-up soils. Ask students, "Which rock particle do you think is the largest?" Describe how sand particles are large and clay has the smallest particle size.
4. Use 3 - 18 oz clear plastic cups (holes punched in the bottom), each filled with a different size of bean (dry lentils, pinto or navy beans and lima beans work well), to represent the 3 sizes of soil particles. Ask students to look at the cups of beans and describe the spaces/pores between the beans in each cup. Just like sand, the pores between the large beans are large and pores between the smallest beans are small, like clay. Ask students which "holes" or pore spaces they think water would run through the fastest and which will hold water the longest. Relate large sized pores to sandy soils where water runs through quickly and the small sized pores are similar to clay soils in which water runs out slowly.  
Have one or more students come up and assist with the next part of the demonstration. Set the cups in pie pans to catch the water. Pour 1/2 cup of water into each of the 3 containers of beans at the same time. Ask students to observe and describe the speed of water movement. The demonstration can be repeated with additional rounds of water applications to the same cups.
5. Fill three 18 oz. clear plastic cups: (with 3 drainage holes snipped out along the bottom edge) one cup with a dry sandy soil, one cup with a dry mineral loam soil and one with a high organic soil or potting medium.  
Have one or more students assist in pouring 1/2 cup of water at the same time into each cup. Ask students to watch the wetting pattern and speed of water movement in each cup of soil. Ask students to describe what they observed and why they think the

water moves differently in each cup. Then, discuss how different soil particle sizes influence the speed of water movement. The demonstration can be repeated with additional rounds of water applications to the same cups. Tell students that this water movement happens in their yards and fields every time it rains.

6. Ask students to define water pollution (as unwanted substances getting into the water). Ask students to brainstorm several ways water can become polluted. Call on individual students for responses; write responses on the board. Explain that because only 3% of the water on the earth is fresh water that people can use, it is important to use it wisely and keep it clean. Ask students for ideas on how to help keep our water clean.

Tell students; nature has a natural way to help clean up water. Ask students for ideas and then tell them; that the natural way to clean water is to let it run through soil. Soil and the plants growing in it will pull pollutants out of the water. Therefore, soil and plants are important in maintaining a clean water supply and a healthy environment. Explain how your role as a Green Industry professional supports a healthy relationship between soil, plants and water.

7. You may want to label the 3 cups: Sand, Silt, Clay before beginning this experiment. Put 3 drops of red or blue food coloring into 1/2 cup of water to represent water being polluted. Fill an 18 oz. clear plastic cup (with holes punched in the bottom) with sand and place it in an aluminum pie pan. Pour the colored water over the sand. Ask students to observe the original color of the water and the color of the water that comes out the bottom of the cup. Ask students to describe their observations.

Fill another 18 oz. cup with loam or potting medium and repeat the colored water application. Again, ask students to describe their observations.

Fill another 18 oz cup with loam or potting medium and place a disc of coir hanging basket liner on top of the medium to represent plants. Repeat the colored water application. Ask students to describe their observations.

Ask students to compare the colored water that drained from each of the three soil types. Discuss with students how the soil and plants can hold onto some of the pollutants and help clean the water. Emphasize how the soils and plants in our yards and throughout the landscape help to clean up water. Explain that swamps and wetlands are also important areas where nature is filtering water through soil and plants.

### **Extension / Optional Activity:**

Pass out a jar filled half-full of loam soil to each student. Have each student pour 1/2-3/4 cup of water into their jar, add 3 drops of liquid dish soap and put the lid on tight. Ask students to predict what will happen to the soil if they shake the jars and leave them sit for 24 hours.

Have students shake their jars and then set them aside for 24 hours. The soil in the jar will settle out based on particle size into visible layers. The next day the students

should be able to see and identify the sand, silt and clay layers. Organic matter may sit on top or float.

NOTE: Recommended to test this experiment using the soil types selected before going into the classroom.

### **ASSESSMENT:**

Students will need a piece of notebook paper and a pencil. Students must answer the following questions:

1. How are soils formed?
2. List the 3 types of soil and describe how water runs through each type
3. How do soil and plants help clean our water?

### **HANDOUTS AND WORKSHEETS:**      NA