Extension Activity:

Investigating Runoff on Pervious and Impervious Driveways

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Final Paper
NRS 591 - Watershed Science for Educators

Extension Activity: Investigating Runoff on Pervious and Impervious Driveways

Objective: Students will understand that different surfaces have different runoff potential.

Method: Students will create mini driveways representing grass, gravel, stone, and asphalt surfaces and investigate the runoff potential of each surface.

Materials: four ½ gallon waxed cardboard milk containers, a 4.4 lb. box of dry mix Plaster of Paris, a container for mixing plaster, a putty knife for spreading plaster, sand paper for smoothing out the dry plaster, 1 lb. of wheatberry grass (can be found at nature food stores), 1 bag of mason (course) sand, 1 small bag of top soil, bag of pea gravel (from hardware store), bag of ¾ inch processed gravel, retractable blade utility knife, scissors, black oil based paint, a paint brush, old newspapers, several plastic containers for scooping and pouring the driveway materials (old peanut butter jars will do), spray bottle and small watering can, bucket for collecting water, plastic bin for demonstrating the pervious or impervious surface of their driveway, science journals, brown sugar

Background Information:

1. Students would have completed or be working with the GEMS-NET Kit Matrix **Land and Water** under Earth & Space for Grade 4.

2. The teacher will have an understanding of how water shapes the land with runoff, stream formations, and deposited soil.

3. The teacher will have an understanding of how human made developments (from the individual home owner to the super shopping complex) influence the shape of the land and the flow of water.

4. The teacher will have researched traditional and nontraditional driveways. For this extension activity a grass, gravel, stone, and asphalt driveway will be investigated. Ask the students what type of driveways they have and have the students help create a bar graph of the data.

Procedure:

Part 1 - About six weeks prior to conducting activity

1. A day before starting Part 1 of the activity, use the utility knife to cut off one side of the milk carton and on the opposite side put six slices spaced out evenly into the bottom.

Place the wheat berry seeds in water to soak overnight.

2. Six weeks before the extension activity is to occur the four driveways will need to be prepared. Starting this early is essential so that the grass has plenty of time to grow and establish strong roots. In addition, the Plaster of Paris needs time to dry when it is first made and then to dry after it is painted.

3. Divide the classroom up into four groups. A member of each group will draw from a hat to see which driveway their group will make.

4. Set up four work stations around the classroom lined with newspaper and put the supplies in the center of the classroom.

5. Students collect their milk cartons and place them in their table open side up.

6. Each group will start by filling their milk carton ½ full with mason sand.

7. Next, each group will finish filling their carton according to their driveway surface.

a. Grass - Finish filling with top soil and add a thick layer of wheat berry grass seeds to the top. Water seeds with spray bottle. Place by a sunny window.
b. Gravel - Finish filling with ¾ inch dirt gravel and pack firmly.
c. Stone - Finish filling with stones (pea gravel).
d. Asphalt - Prepare Plaster of Paris in a plastic container following the directions on the box. Carefully fill the milk carton to the top with plaster. Use the putty knife to make a smooth surface.

Part 2

8. Spray water the seeds everyday. When Plaster of Paris is dry, have students sand paper the surface smooth and paint black.

Part 3

9. Assuming the students have science journals, have them turn to the next blank page or hand out a blank piece of paper. Have them divide the page into four squares, and label each square a different driveway surface.

10. Have the students write their predictions in each driveway square on what they think will happen when water is showered over the driveway surface with a watering can.

11. One by one have each group demonstrate what happens when water is showered over their driveway surface.

12. Have the children discuss their predictions and their observed findings.

Questions to pose:

1. Based on what you discovered during the study of the stream bed, what do you think might happen to the runoff water from the imperious driveway surface?
2. Where do you think the runoff water will go?
3. What driveway surface do think might be best to prevent runoff?
4. What do you think happens during a rainstorm when a new shopping plaza is built with its large asphalt parking lot?

13. Place some brown sugar on each driveway surface and watch what happens when it rains. Ask the students to brainstorm what the brown sugar might represent (oil from car, animal waste, fertilizer, rock salt, etc.)

Variations:

1. In their science journals, create two columns on the next available page. Title one column "Pervious Surfaces" and the other one "Impervious Surfaces". Take the students for a walk outside around the school grounds and have them fill in their two columns. Discuss their findings. Brainstorms ideas to help with runoff (rain barrels for roofs, grass instead of black top for the playground, gravel instead of asphalt, etc.)

Group Size and Age:

This activity is geared toward 4th graders since it ties in with the GEMS-NET Kit Matrix Water and Land. It can be used in a science class of approximately 20 students with the students working in small groups. If the classroom is larger double the number of groups and make two of each type of driveway.

Skills Used:

Communication and cooperation skills will be practiced in their small groups and during classroom discussion. This is a hands-on activity. Additionally, the students can get outside and see the principles being learned inside actually happening on the school grounds.

Assessment:

Hand out a paper with pictures of four houses with different driveways (grass, gravel, stone and asphalt) and ask students to write 1 to 2 sentences about what would happen to the water on the driveway during a rain storm.

Resources

http://www.ebecri.org/custom/landandwater.html

http://espo.gso.uri.edu/~robp/GEMSNET/kits/43_land.html

http://www.earthproducts.net/products/gravel.html

http://landscaping.about.com/od/drivewaysandwalkways1/a/driveway_types.htm

Active Watershed Education, "It's AWEsome!" Curriculum Guide for the Narrow River (Pettaquamscutt) Watershed, developed by: The Southern Rhode Island Conservation District and The University of Rhode Island Department of Natural Resource Sciences, updated in 2005 by Denise J. Poyer, Veronica Berounsky, Robert Kenney

Benchmarks for Science Literacy:

3B Design and Systems

Grades 3-5 BM 3 *The solution to one problem may create another one.*

3C Issues in Technology

Grades 3-5 BM 4 *Scientific laws, engineering principles, properties of material, and construction techniques must be taken into account in designing engineering solutions to problems. Other factors, such as cost, and environmental impact, also must be considered.*

Benchmarks on the Way to Environmental Literacy:

M20 explain the ways in which humans impact the environment

M22 project likely consequences of alternative actions regarding the use of everyday technologies.

M23 identify a community environmental problem and propose a solution for that problem using information collected to support the proposal.