MAPPING OUR PARKS

Optional Activity: Measuring Infiltration Rates

Overview

As you learned in Lesson 2, most rainwater that lands on natural landscapes such as wetlands and forests infiltrates down into groundwater. The groundwater flows through the ground and down to a nearby stream. Streams downhill from natural areas receive a large amount of groundwater and very little stormwater runoff.

On the other hand, rainwater that lands on impervious surfaces such as rooftops, parking lots and even compacted soils forms large amounts of stormwater runoff. As it flows over the land, stormwater runoff picks up pollutants and carries them directly to streams. Runoff can erode stream banks, causing more soil to flow into streams. It can also wash away streambed habitat (rocks, pebbles and dead wood) and even the stream organisms. Thus, streams downhill from impervious surfaces receive a large amount of runoff and are often unhealthy.

For these reasons, it is very important to examine the amount impervious surfaces throughout a watershed. However, some surfaces are more impervious than others. You can determine imperviousness by measuring how quickly water filters into a surface. This is called the infiltration rate. In this activity, you will measure infiltration rates for various surfaces in your schoolyard.

Materials

- Coffee can, pipe other hollow cylinder with both ends removed
- Permanent marker that will be visible on the cylinder
- Metric ruler
- Putty
- Bucket of water (1-2 L per sample site)
- Stopwatch or timer
- Hammer
- Block of wood
- *Infiltration Rates Worksheet*
- Digital camera (optional)
- GPS unit (optional)

Directions

1. Create an infiltration measuring tool. Place your cylinder on its side. Be careful of any sharp edges on the cylinder. Place the ruler inside the cylinder. Be sure the "0" end of the ruler lines up with one edge of the cylinder and hold the ruler flat against the inside of the cylinder. Use the permanent marker to "graduate" your cylinder. That means make evenly spaced marks on the inside of your cylinder. Start at the "0" end and make a mark every 2 cm. Label your marks (2 cm, 4 cm, 6 cm, etc.).

2. Measure the distance across the center of your cylinder opening in centimeters. This is the diameter of the cylinder. Use this value to calculate the area of your cylinder opening, and record the area in cm^2 on your *Infiltration Rate Worksheet*:

   Area = π ($\frac{1}{2}$d)^2; where is π = 3.14, and d = diameter of the cylinder

3. Locate in your schoolyard three or four sites with different surfaces (for example, a lawn, an athletic field, a parking lot, a tree grove). On your *Infiltration Rate Worksheet*, record a description of each site. Your description should include the location (provide longitude and latitude from a GPS unit if possible). It should also include the surface type (for example, grassy, bare, asphalt).

4. Think about which of these four surfaces are more impervious than the others. Through which surface will water flow the fastest? Through which will it flow the slowest? Rank all four sites according to how fast you think water will flow through them (1 = fastest). Record your predicted infiltration rank on your *Infiltration Rate Worksheet*.

5. Now measure the infiltration rate at one of the four sites. With the "2 cm" mark at the top, firmly and evenly push your cylinder into the ground 2-4 cm. Having the "2 cm" mark at the top lets you measure a drop in the water level as the water filters through the soil. If necessary, place a block of wood on the top of the can and tap it with a hammer to get it to go into the ground. Note: If you are trying to measure infiltration at a site covered with asphalt or cement, you will not be able to push your cylinder into the ground. To ensure that water does not run out from under your cylinder, seal the space between the cylinder and the ground with putty.

6. With your timer ready, quickly fill the cylinder with water until it overflows. As soon as the cylinder is filled, start your timer.

7. While the experiment is running, you may wish to take a picture of it with a digital camera.

8. At the end of 5 minutes, note the location of the water level. Record the distance the water level dropped on your *Infiltration Rate Worksheet*. Be sure to include units. If you wish, take a picture of the test.

9. Calculate the volume of water that drained into the ground. To do this, multiply the distance the water level dropped by the area of the cylinder. Record this value on your *Infiltration Rate Worksheet*. Be sure to include units.

10. Calculate the rate at which water drained through the soil on a per minute basis. To do this, divide the value for the volume of water drained by 5. Record this infiltration rate on your *Infiltration Rate Worksheet*. Be sure to include units.

11. Repeat Steps 5 – 10 at the remaining sites.

12. Answer the reflection questions.

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Infiltration Rates Worksheet

Name: _____ Date: _____ Class: _____

Area of cylinder opening (include units): _____

Site description (location and surface type)	Predicted infiltration rank (1 = fastest)	Distance water level dropped after 5 minutes (include units)	Volume of water drained after 5 minutes (include units)	Infiltration rate (include units)

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Name: _____ Date: _____

Reflection Questions

1. How accurate were your predictions of the infiltration rank at your sites? Why do you think your predictions were correct or incorrect?

2. How do you know that some of your sites produced runoff?

3. You may have experienced a site in which all of the water drained through the cylinder in less than 5 minutes. How would you change your test to get an accurate drainage rate at such a site?