K-12 IYS Activity

Soil Science Society of America

How Much Water Comes from the Sky?

Summary

Soils soak up water from the rain, letting it gradually flow through the soil and under the ground into rivers and streams. In urban areas, buildings and streets can cover up a portion of the soil, making it impossible for rain to soak in. Instead, rain often flows over the concrete and into rivers, streams or sewers. More and more cities want to enhance the soils ability to absorb rain, redirecting it from streets to bioretention systems and rain gardens. Here is an exercise to show how much rain actually falls on a sidewalk.

Learning Objective

- To visualize how much water lands on a particular area during a rainstorm or a specific length of time
- To see value of soil for soaking up water

Materials Needed

— a sidewalk
— a ruler or tape measure

Ages

K-12

Where could you offer this?

Local school, library, or other public location

What type of room do you need?

Classroom seating, lab/work benches, or need an area with regular sidewalks

Time Needed

Would be ideal as a trip outside to measure the sidewalk and then inside to do the calculation. Can also be done to show how much water would accumulate—in this case, would need vessels to hold the water.

Method

1. Measure the size of one square of sidewalk. For example, one sidewalk block could be 24 inches by 24 inches. This would be 24 x 24 = 576 square inches.
2. Figure out how much rainfall will fall on that area with a 0.5” and a 1” rain event. For example, if 576 sq. in. received 1 inch of rain, that would be 1 inch x 576 sq. in. = 576 cubic inches of water. Converting cubic inches of water to gallons uses a conversion factor of 1 cu. in = 0.004329 gal. Thus, 576 cu. in. of water = 2.5 gallons. For younger children unable to do the math, you can use a “rain and rainfall calculator” found in this website activity: https://water.usgs.gov/edu/earthrain.html.
3. Measure that amount of water into some type of container. In the above example, you would measure 2.5 gal of water, and state that is the volume of water that would fall on just that small area of sidewalk during a 1 inch rain event--not outside the possibility of weather events.
4. Calculate how much water falls on your block (add up the number of sidewalk squares or measure the length of your street, or playground, or school sidewalk area and see how many sidewalk squares fit into that section) for the 0.5” and the 1” storm events.
5. Take the annual precipitation for your area and figure out how much water that sidewalk square would get in a year and how much your block would get in a year.

There are different units of measure for water to describe how much a plant will need to grow. You may hear that your lawn needs an inch or two a week. That is enough water to cover your lawn an inch (or two) deep. Crop water needs are sometimes measured in cubic meters or acre feet. An acre foot is the amount of water required to fill an acre (43,560 square feet) with water 12 inches deep. Each acre foot is equivalent to 325,851 gallons of water. For some perspective, each time you flush the toilet, you use somewhere between 1.5 and 7 gallons of water (depending on whether you have a low-flush or conventional toilet). Conventional showers use 7-10 gallons of water per minute, while water-efficient showers use 2-4 gallons of water per minute.

Celebrating the 2015 International Year of Soils

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Discussion Questions

- How many showers could you take from the water that falls on that square of the sidewalk each year?
- How many showers could you take from the water that falls on your block?

Bioretention systems are designed to let that stormwater flow into soils instead of into streams or sewers. These systems are designed to let water flow into soils instead of over sidewalks. Typically, sand and compost are used to make a "super soil" or one that is able to drain large amounts of water and still let plants grow. More and more cities are using these types of natural, soil-based systems alone or in combination with engineered systems to let water soak into the soil.

More information on bioretention systems and rain gardens:

- Soils in the City | Soil Science Society of America soils.org/discover-soils/soils-in-the-city
- http://www.seattle.gov/util/MyServices/DrainageSewer/Projects/GreenStormwaterInfrastructure/CompletedGSIProjects/StreetEdgeAlternatives/index.htm
- http://www.lowimpactdevelopment.org/raingarden_design/whatisaraingarden.htm
- http://www.12000raingardens.org/

Additional Resources

www.soils4teachers.org