Modeling Stormwater Runoff

Description:

Students will build a model of a city and learn how green infrastructure can reduce stormwater runoff.

Objectives:

- Understand the role of green infrastructure in wet weather events
- Distinguish between different types of green infrastructure

Vocabulary:

Green infrastructure, combined sewer overflow, impermeable surface, stormwater runoff

Recommended for:

4th – 12th grade students

Materials:

- Paint tray
- 2-3 Lego toy buildings
- Sponges of assorted sizes and colors
- 4 plastic containers (to hold sponges) labeled with green infrastructure cards
- Toy watering can
- Measuring cup
- Container of water
- Worksheet: *Modeling Stormwater Runoff*

Function of Activity Materials:

- Paint tray: impermeable surface of city streets
- Sponges (from small to large): rain barrels, green roofs, bioswales/rain gardens, and green spaces/parks
- Watering can: rain clouds

Background Information:

Large wet weather events and an overall increase in rainfall can overwhelm our sewer system, causing floods, backups, and combined sewer overflows (CSOs). Designing and constructing green infrastructure is a cost-effective way to manage stormwater runoff. Green infrastructure is modeled after the natural flow of water and these projects can help soak up and retain water.

Method:

- Pre-Lesson
  - Paint tray to create city blocks and adjacent waterway. Allow time to dry before use.
  - Cut out and attach green infrastructure description cards to plastic containers.
- Distribute a *Modeling Stormwater Runoff* worksheet to each student or student group for following along during the activity.
- Place Lego buildings on slope (city streets) of paint tray.
- Sprinkle small particles to represent litter on city streets (tiny plastic pieces, beads, glitter, etc.). Ask students what pollutants they might find on the streets (litter, oils, sediments, etc.). What happens to these pollutants during a storm if left on the streets?
- Measure a cup of water. Pour water into watering can. Pour the water over the city (make it rain).
- Take buildings off of tray and measure the amount of water that ran off using a measuring cup.
  - Subtract the amount of remaining water from the initial total (1 cup) to measure how much stormwater was "absorbed." Measure this as a percent (x 100) and include on the worksheet.

- Add green infrastructure to the city by placing various sponges around the paint tray. Run the experiment again. Compare the new measurement with the previous and observe how green infrastructure changes the amount of water that runs off into the waterway.
  - Subtract the amount of remaining water from the initial total (1 cup) to measure how much stormwater was "absorbed." Measure this as a percent (x 100) and include on the worksheet.
- Optional: Explore what will happen if there is another storm (pour another cup of water).

Discussion:

- Discuss other types of green infrastructure.
- How can we implement green infrastructure for our homes and schools?
- How can stormwater runoff affect the local environment and our waterways?
- Why is green infrastructure important? How does it reduce stormwater runoff?
- Consider and discuss large wet weather events that have greatly impacted NYC in the past. How might these relate to climate change? Consider climate change trends that may have even more impact on NYC in the future.

*Adapted from "Extreme Events: A Story of Urban Runoff." Climate & Urban Systems Partnership (CUSP), cuspproject.org

For more information contact:
New York City Department of Environmental Protection
educationoffice@dep.nyc.gov
Also visit DEP's website at:
www.nyc.gov/dep

Rooftop Garden

Flat roof buildings can be engineered to hold rooftop gardens.

In addition to holding water, these gardens help insulate buildings, keeping them cool in the summer and warm in the winter, thereby lowering energy costs.

Green Spaces

Green spaces offer places to recreate and relax.

Their permeable soils help to absorb and hold water after heavy rain and after snowmelt. They also stay cooler than paved surfaces during warm seasons.

Rain Garden

These below-grade landscape features can be installed to catch surface runoff from driveways, sidewalks, and rooftops to prevent excess water from entering the stormwater/sewer system.

Rain Barrel

Rain barrel water can be used for garden plants or simply allowed to flow slowly onto a yard.

These containers are attached to downspouts and used to catch rain from the roof of buildings.

Worksheet: Modeling Stormwater Runoff

Directions: Precipitation events, such as rain and snow, often result in surface runoff on city streets, sidewalks and rooftops. Answer the questions and fill in the blanks below while conducting your experiment.

1. Place your Lego buildings on top of the land. Describe your observations on the landscape you create.

   _____

   _____

   _____

2. I predict that [%] of the stormwater from the rain (1 cup) will be absorbed.

   How much of the stormwater was actually absorbed? [%]

3. Was your prediction correct? Why or why not?

   _____

   _____

4. How might green infrastructure help decrease the amount of stormwater runoff?

   _____

   _____

   _____

5. After adding green infrastructure to my city, I predict that [%] of the stormwater will be absorbed.

   How much of the stormwater was actually absorbed now? [%]

6. Besides rainwater, what else might drain into our combined and separate sewer systems during precipitation events? How do these potential pollutants impact our sewer system and the environment?

   _____

   _____

   _____

7. How did adding green infrastructure impact your landscape? Why is green infrastructure important?

   _____

   _____

   _____