Lower Columbia Estuary Partnership

Calculating the Amount of Impervious Surfaces on the School Grounds

Grade Level: 5-7

Time: 15 minutes outdoors; 15minutes to 1 hour inside

In this activity, students will calculate the area of shapes on a map to determine what percent of the school campus is impervious to surface water. Students will discuss the schools contribution to watershed health based on the impervious surface cover.

Required Materials:

- Journal and writing utensil for each student to use outside.
- Variety of art supplies for creating posters/fliers

Objectives and Outcomes:

1. Learn about the use of Public Service Announcements (PSAs).
2. Identify nearby sources of pollution or watershed degradation.
3. Practice developing persuasive messages

Background:

Before completing this activity, students will have spent time learning about watersheds and how they relate to water quality.

- The Lower Columbia Estuary Partnership has a watershed model and teaching guide available for loan: http://www.estuarypartnership.org/teacherresources#Check%20Out%20Kits

- Cacapon Institute's Potomac Highlands Watershed School has K-12 educational materials about watershed issues, with Flash activities and a variety of other educational resources: http://www.cacaponinstitute.org/e_classroom.htm
- Oregon Museum of Science and Industry has a lesson and activity that allows students to create their own watershed: http://www.omsi.edu/sites/all/FTP/files/expeditionnw/4.E.1.Crumple.pdf

Impervious surfaces like roads, sidewalks, driveways, parking lots and rooftops prevent rain water from penetrating into the ground. In some instances, trails and lawns can also be impervious when they become compacted by many people walking over them. When it rains, the stormwater washes over these surfaces, carrying sediment, liquids leaked from cars and trash into nearby storm sewers or streams where they are harmful to water health.

Stormwater can heat up on hot days as it flows over warm pavement and cement and can become a form of temperature pollution as it enters local streams. Warm runoff water is harmful for many of our cold-water species such as salmon and makes it difficult for aquatic life to survive by decreasing the amount of dissolved oxygen. As more land is covered by impervious surfaces (e.g. stores, parking lots, roads, neighborhoods etc.), more polluted runoff enters our rivers and streams. As illustrated in the below figure.

Percent Impervious Surface in a Watershed impacts Water Quality and Aquatic Species

The percent impervious increases from forests to cities.

Water heath decreases from forests to cities

<1% impervious	Unstressed
1-5%	Lightly Stressed
5-10%	Stressed
>10%	Suffering

Activity:

1. Working in pairs, students will begin with a campus map and tour of the school grounds.
    a. Type in your school's address at www.maps.google.com and switch to earth view for campus details. Print a campus map for each pair of students. It may be helpful to edit the map image colors or print it lighter to allow students to easily write on it.
    b. Have students examine their map and outline areas they believe are impervious.
    c. Have students head outside with their maps and a clipboard to investigate and confirm that the Google map is accurate and that they have correctly identified the impervious surfaces.
    d. Students can make notes on their maps as they are touring the campus of any additional impervious areas they discover or areas that turn out to not be impervious.
    e. **Not sure if a surface is impervious?** Pour a water bottle out on the surface and see if water soaks into the ground or stays on the surface.
2. In the classroom, have students make final determinations on their maps to designate the areas they want to include in the calculation for percent impervious.
3. Students will use the attached worksheet for the following calculations.
4. Calculate the total area of the school campus in square feet (for a primer on calculating the area of basic shapes: http://www.mathsisfun.com/area.html):
    a. Divide the campus into basic shapes for simple calculations.
    b. Use the map's scale to calculate the square feet of the basic shapes.
    c. Combine the area of each shape to calculate total campus area.

5. Using the same technique, calculate the area of the impervious surfaces. Use the attached worksheet for recording surface areas.
6. Divide the total impervious surfaces by campus size and convert to a percent to calculate total percent impervious.

Optional: Instead of calculating area by hand, you can use Google Earth. In Google Earth create a polygon and then copy and paste the polygon folder into www.earthpoint.us/Shapes.aspx. Google Earth also features a ruler that can be used to quickly calculate lengths.

Calculating the Amount of Impervious Surfaces on School Grounds

School_____ Name(s)_____

1. What are the total square feet (ft^2) of your school's campus?
2. List the impervious surfaces found on your school's campus. Use the table below. If you don't have one of the surfaces listed, leave it blank. Add any other impervious surfaces you found in the blank spaces.

Impervious Surface	Area	Impervious Surface	Area
Roof of main building (ft^2)			
Roof of Portable (ft^2)			
Roof of Portable (ft^2)			
Roof of Portable (ft^2)			
Bus loop (ft^2)			
Parking lot 1 (ft^2)			
Parking lot 2 (ft^2)			
Basketball Court (ft^2)			
Sidewalk (ft^2)			
Front entrance walkway (ft^2)			
Cafeteria delivery parking area (ft^2)			
Track (ft^2)			
Shed roof (ft^2)			
Shed roof (ft^2)			
Compacted area 1 where water doesn't soak in			
Compacted area 2 where water doesn't soak in			

TOTAL Amount of Impervious Surface	
Total Square feet of school campus From question 1 above	
Divide: TOTAL Impervious Surface by School Campus Size	
Percent Impervious Surface	
Percent Pervious Areas	

To **convert** a **decimal** to a **percent**, multiply the **decimal** by 100, then add % symbol. An easy way to multiply a **decimal** by 100 is to move the **decimal** point two places to the right.

For example, 0.05 becomes 5.0%

3. Using the table to the right, how would you describe the impacts your school campus has on watershed health?

% Impervious	Health
<1%	Unstressed
1-5%	Lightly Stressed
5-10%	Stressed
>10%	Suffering

4. What could you do on your campus to reduce the amount of water running off of impervious surfaces?