Lesson 8

Impervious Surface

Cognitive Demand:

Interpreting Concepts (C)

Science Literacy (D)

Technological Design (T)

Recalling Science (R)

Overview:

Students will calculate the percentage of impervious surfaces in their schoolyard and investigate what effect it has on local water quality, and the Muskingum Watershed.

Materials- per group:

- Map of schoolyard*
- Measurements of various impervious surfaces in your schoolyard
- Measuring Wheel
- Calculator if desired

*If you do not have a map of your schoolyard, type in the address of your school at www.maps.google.com

Teacher Background:

Impervious surfaces are paved or hardened surfaces that prevent water from penetrating into the ground. Examples of impervious surfaces include: roads, rooftops, sidewalks, pools, patios and parking lots.

Environmental issues related to impervious surfaces:

- Impervious surfaces can alter natural stream flow, and pollute aquatic habitats, by increasing the amount and speed of stormwater runoff.
- Impervious surfaces can compromise groundwater supplies, by limiting the amount of water that is drained into the ground. Groundwater is an important source of drinking water for many.
- Soil and plants can naturally assimilate and break down airborne pollutants. Thus, when impervious surfaces replace the natural habitat, they remove the environment's natural ability to work against pollutants.

Per the U.S. Environmental Protection Agency (EPA), a representative city block produces more than five times the runoff produced by a forested area of the same size.

We can use impervious surface data to calculate the rate of urban growth across in the watershed, and to categorize high-development areas, and patterns of extensive growth.

Setting the Stage:

Schoolyard trails compacted by many kids walking over them are also highly impervious. When it rains, the stormwater washes over these surfaces, carrying sediment, liquids leaked from cars and trash into nearby storm sewers or streams. These pollutants are carried downstream affecting water quality in the Muskingum watershed. On warm days, when it rains, stormwater heats up as it flows over the warm parking lots and roads. This warm runoff travels into streams increasing the water temperature, which decreases the dissolved oxygen, making it difficult for aquatic life to survive.

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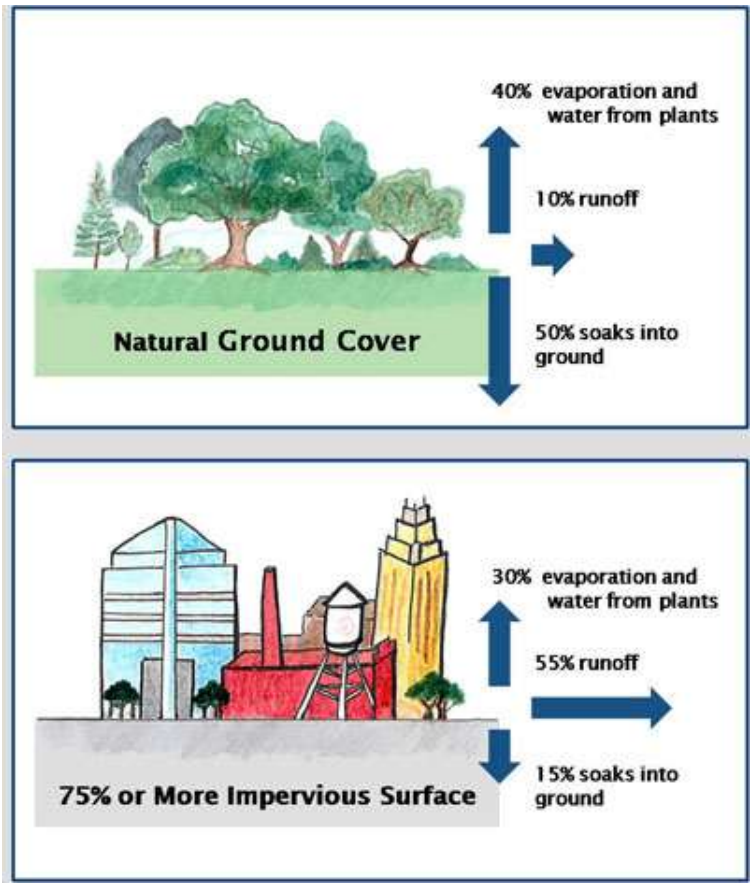
Acquisition of Learning

1. Handout the student page, the school map and the measurements of impervious surfaces.
2. If your schoolyard has impervious surfaces not listed with measurements, you can send student groups outside with a measuring wheel to obtain length and width measurements.

Closure

As a class, discuss the calculations of impervious surfaces. Ask which surfaces were largest, smallest, most eroded etc.

Ask students how the impervious surfaces in our schoolyard affect water quality in local streams.



Student Page

Name(s):_____

1. To determine what percent of your schoolyard is impervious to rain water or snow melt, use the map and data provided to calculate the following: What is the total acreage of your school lot? _____(acres)
2. How many square feet in an acre?

   $\frac{5280^2 \text{ (number of square feet in one mile)}}{640 \text{ (number of acres in a mile)}}$ = _____ ft^2 in one acre
3. How many square feet in your school lot? _____

   (We must know the square footage of the lot to work out what percentage of the lot is impervious.)
4. To determine the percentage of impervious surface in your schoolyard, use the measuring wheel to find on your map and data sheet all the impervious areas of it. If you don't have a surface listed below, leave that space blank, and if you have identified other impervious surfaces not listed below, add them.

Impervious Surface	Area (ft^2)
Roof of main building (ft^2)	
Trailer roof (ft^2)	
Trailer roof ft^2)	
Trailer roof (ft^2)	
Bus loop (ft^2)	
Parking lot 1 (ft^2)	
Parking lot 2 (ft^2)	
Tennis courts (ft^2)	
Sidewalk (ft^2)	
Front entrance walkway (ft^2)	
Cafeteria delivery parking area (ft^2)	
Basketball courts (ft^2)	
Track (ft^2)	
Shed roof (ft^2)	
Shed roof (ft^2)	
Eroded area 1 where water doesn't sink in (ft^2)	
Eroded area 2 where water doesn't sink in (ft^2)	
TOTAL Amount of Impervious Surface	
Square footage of your school's lot	
Divide: TOTAL Impervious Surface by Lot Size	
Percent Impervious Surface	
Percent Vegetated Areas	

Percent Impervious Surface in a Watershed	Its impacts on Water Quality and Aquatic Species
Unstressed	<1% impervious (>99% vegetated)
Lightly Stressed	1-5%
Stressed	5-10%
Impacted	10-25%
Damaged	>25%

1. Using the table above, how would you classify the impacts our schoolyard will have on water quality and aquatic species in local streams?

   _____

   _____

2. List 5 different impervious surfaces you identified at your school.

   _____

   _____

3. Would you find more impervious surfaces in an urban or a rural area?

   _____

   _____

4. If you tested the runoff water in local streams for pollutants (e.g. oil, antifreeze, fertilizer, trash, sediment etc.) during and just after a heavy rain storm, in what type of area or environment surrounding a stream, would you expect the water to be 'cleaner'? Explain your response.

   _____

   _____

5. During a rain storm, what happens to the oil, transmission fluid and antifreeze that leaks out of vehicles in your school parking lot?

   _____

   _____

6. What could you do in your schoolyard (anywhere on the lot) or neighborhood to decrease the amount of pollutants running off impervious surfaces into local streams?

   _____

   _____