Model YOUR Watershed

Grade Level: Middle and High School (6^{th}-12^{th})

Performance Objectives:

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Lesson Summary: Students will understand how water moves through a watershed and the environmental factors that influence water quality. Students will develop a model watershed using an online application to investigate how land cover types impact water quality. Students will construct a model to demonstrate techniques that reduce human impact.

Time: 1 hour

Materials: Computer and internet access - https://wikiwatershed.org/model/

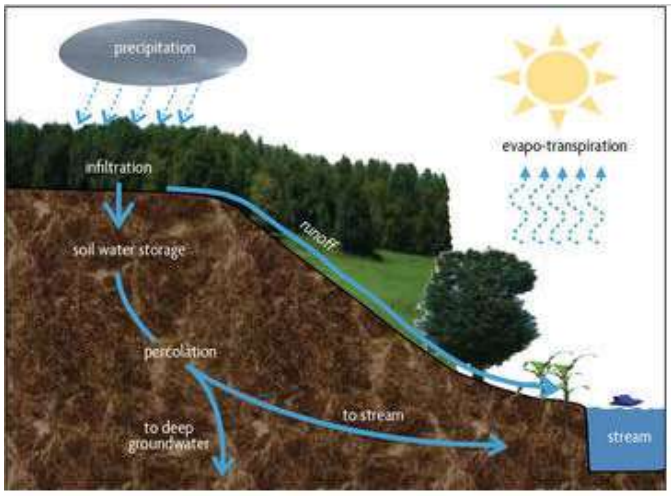
Let's Get Started!

The precipitation that falls in your neighborhood, at school, on the Adirondack Mountains and on the streets of New York City, all ends up in the Hudson River and ultimately, into the Atlantic Ocean. This means that we all live in the same *watershed*. We live in the **Hudson River Watershed**.

Vocabulary:

Runoff – Precipitation that falls on an *impermeable* surface (a surface that does not allow water to soak into) and travels quickly above ground. Examples: asphalt, cement, and tightly packed soils.

Infiltration – Precipitation that *percolates* (soaks into the ground) and travels slowly underground, above the water table.



Evapotranspiration – Precipitation that is evaporated from surfaces and soaked up by transpiring plants released back into the atmosphere.

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Visit https://wikiwatershed.org/model/ **and click "Launch the App" under *Runoff Simulation***

1a. Leave the **Precipitation** slider in the middle and the **Hydrologic Soil Group** as *A-High Infiltration.* In the table below, record the predicted amount of runoff for each **Land Cover Type**: *Developed-Low*, *Developed-High*, and *Grassland.*

	Amount of Runoff (cm)	
Land Cover Type	**Soil Group – A**	**Soil Group – B**
Developed-Low	1.2	2.1
Developed-High	3.5	3.8
Grassland	0.0	0.6

1b. Change the **Hydrologic Soil Group** to *B-Slow Infiltration.* Record the amount of runoff for the same three **Land Cover Types:** *Developed-Low*, *Developed-High*, and *Grassland.*

1c. Which conditions (land cover type and soil group) resulted in the largest amount of runoff? Predict how runoff can negatively impact our streams.

When the plot of land was highly developed with a soil group of B the runoff was the highest at 3.8cm. This is because there was more impervious surface or low infiltration compared to the low developed land and the grassland. Runoff picks up and carries pollutants and can cause flooding.

2. Think about a location (where you live, your school, a park that you like to visit, your favorite restaurant, etc.). In the *Runoff Simulation* application, choose the land cover type that best describes the location you chose. Is there more infiltration or runoff? What is one thing that you could change about the landscape to ***decrease*** the amount of ***runoff*?**

Every answer will be different. Could plant more trees, reduce pavement, rain barrels, etc.

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3. Which land cover type has the highest percentage of coverage in your watershed? What percentage of your watershed is covered in "Developed, Medium Intensity?"

Every answer will be different. My example is Deciduous Forest and about 2.5% Developed.

4. What city have you created a boundary around and what percentage of your selected area is Development, Medium Intensity? (Hint: Look at the bar graph on the left)

My example is close to 9% developed, medium intensity.

5. Slide "**Precipitation**" to the amounts listed in the first column of the table. Fill in the rest of the table.

Precipitation (cm)	Runoff (cm)	Infiltration (cm)	Infiltration-Runoff (cm)
2.5	0.5	1.6	1.1
5.0	1.4	3.2	1.8
10.0	3.9	5.7	1.8
15.0	7.6	7.0	-0.6
20.0	11.6	8.0	-3.6
25.0	15.8	8.8	-7.0

6. Predict why runoff becomes higher than infiltration after a certain amount of precipitation. Why is this important to know?

After a certain amount of precipitation, the ground is completely soaked and unable to let anymore water in. This is important because we can figure out what kind of storm (how much precipitation) would cause local flooding.

7. Define the following terms:

Porous Pavement: Pavers, bricks, or special asphalt that allows water to soak through and infiltrate to groundwater.

Green Roof: A roof that has vegetation planted to soak up rainwater.

Rain Garden: A shallow depression in the ground with native plants to encourage infiltration and transpiration rather than runoff.

8. Describe the changes you made and the difference in runoff and infiltration between the "Current condition" and the "New scenarios."

The students should describe the conservation practices they used, and the new scenario SHOULD have less runoff than the current condition.

9. During a heavy rainstorm, you decide to take a stroll through your neighborhood. You notice that there is a lot of runoff moving through the streets. It is carrying garbage and other invisible pollutants, and you know that the water is going straight to your local stream. Write a letter (limit to one page) to your town supervisor to inform them of the negative impacts runoff can have and encourage them to make better land use policies in your town.