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

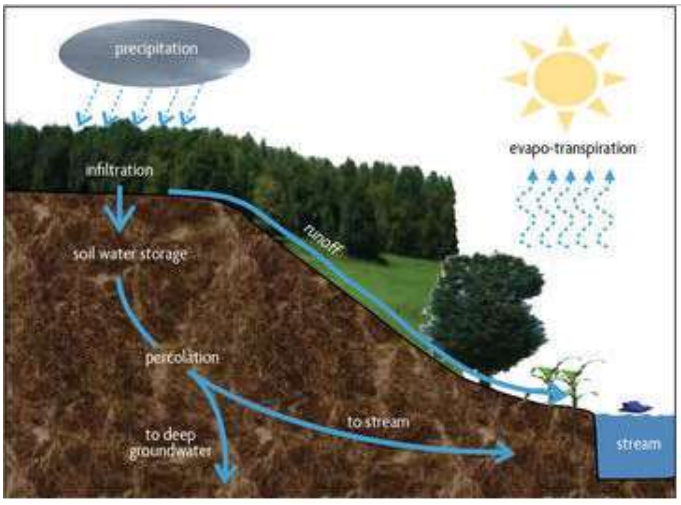
Materials: Computer and internet access - https://wikiwatershed.org/model/

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.

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

This tool predicts where precipitation will travel through the watershed. You can change the land cover type, soil group, and the amount of precipitation to show how these three factors affect the amount of *runoff* and *infiltration*.

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		
Developed-High		
Grassland		

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.

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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?***

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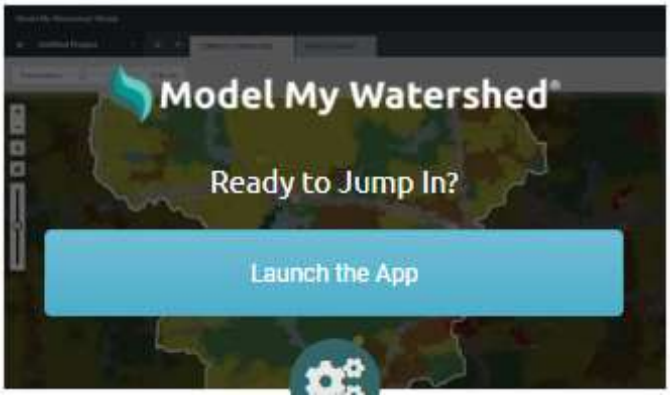
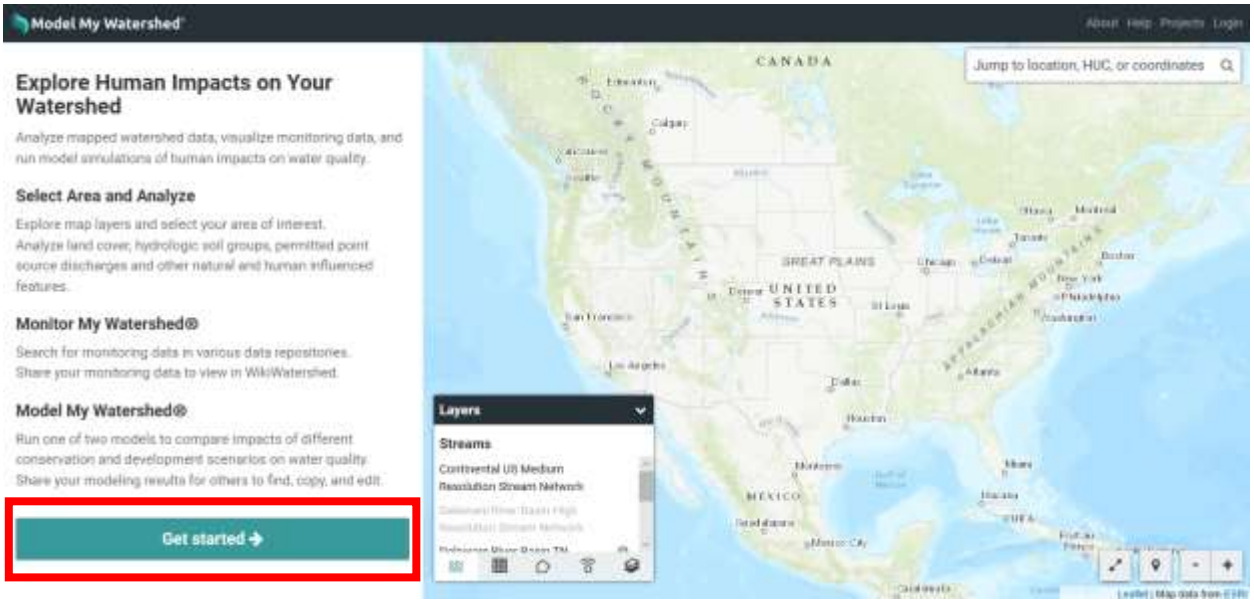
Visit https://wikiwatershed.org/model/ **and click "Launch the App" under *Model My Watershed***

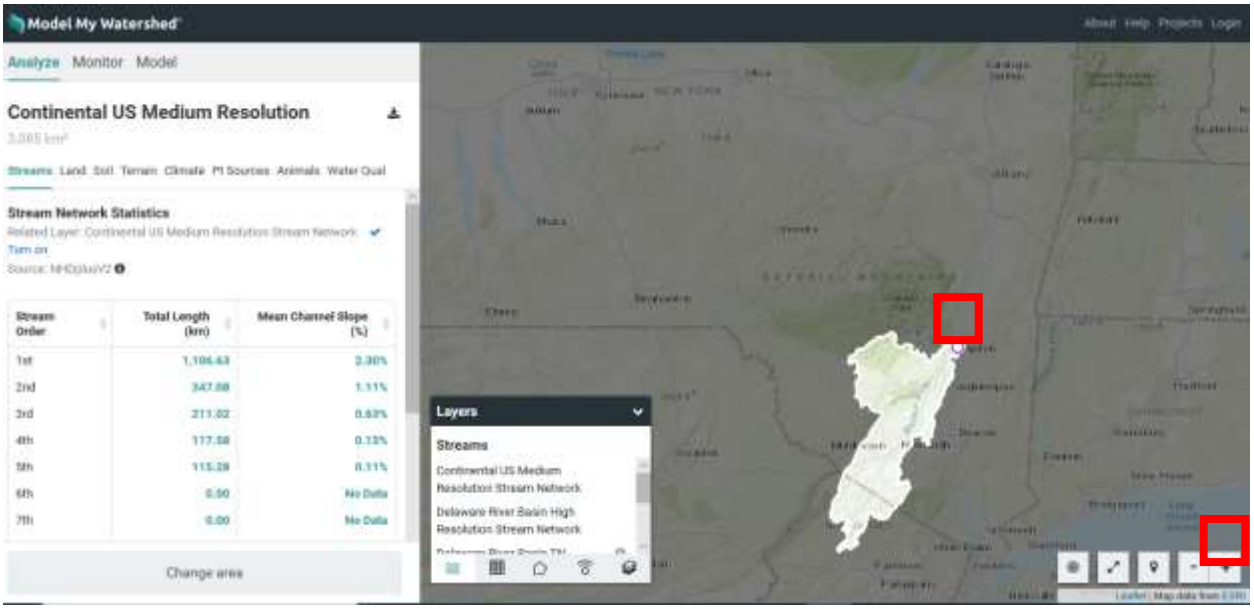


This tool allows you to outline a watershed and control the type of land cover, soil, and amount of precipitation within that area. You can compare different scenarios to predict how humans can negatively, and positively, impact the environment.

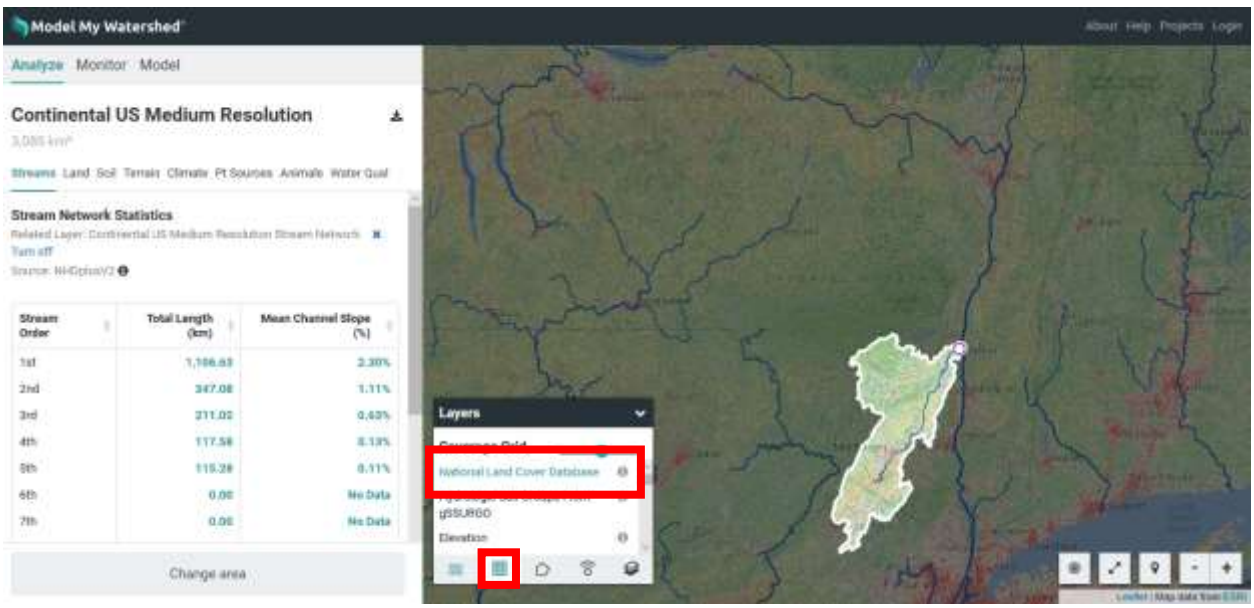
Click "**Get Started**."



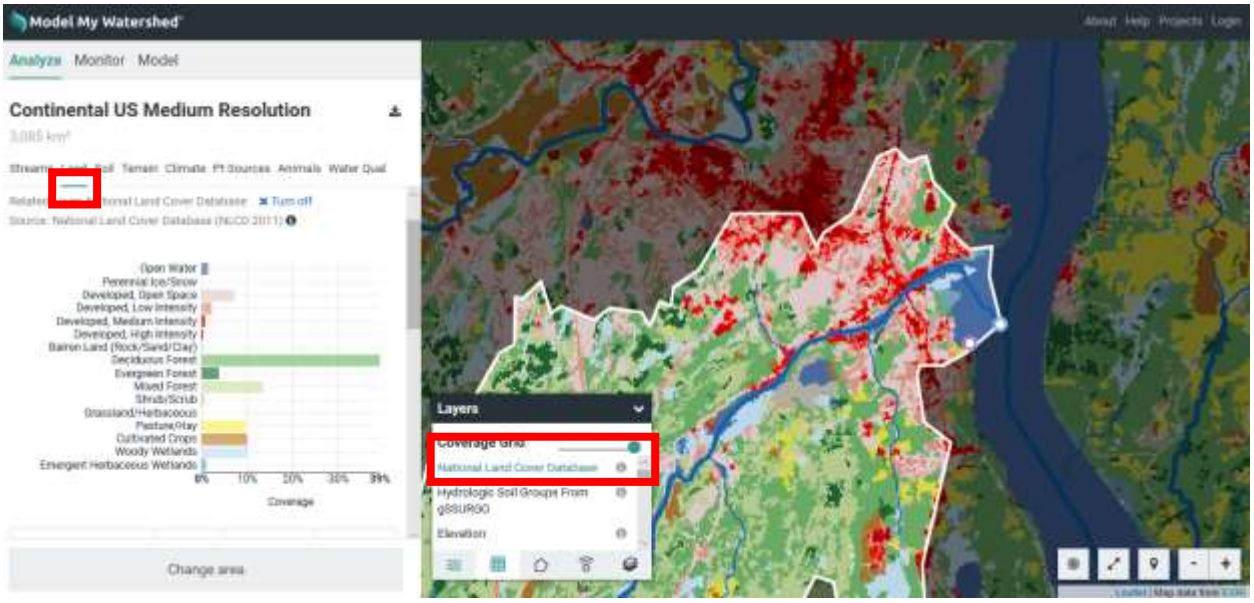
Use the plus button in the bottom right corner to zoom to the state of New York. Can you see the Hudson River? Click "**Delineate watershed**" on the left side of the screen, and "**Continental US Medium Resolution**." Then, choose a location near the Hudson River and click on the map (again, you can choose ANY location). You should see an area of land highlighted on the map and your location represented as a small circle. This is your *watershed.* All the rain that falls within this watershed drains into streams, the Hudson River, and eventually the Atlantic Ocean.



In the "Layers" box click "**Continental US Medium Resolution Stream Network**" to see the streams within your watershed. At the bottom of the same box click the grid icon and then "**National Land Cover Database**." You should see your watershed highlighted, streams present, and the land cover type represented by different colors. This land cover data is collected by the United States Geological Survey.



Move the "**Coverage Grid**" slider all the way to the right so the land cover is less transparent on the map. On the left side of the screen, click the "**Land**" tab located between "Streams" and "Soil."



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?"

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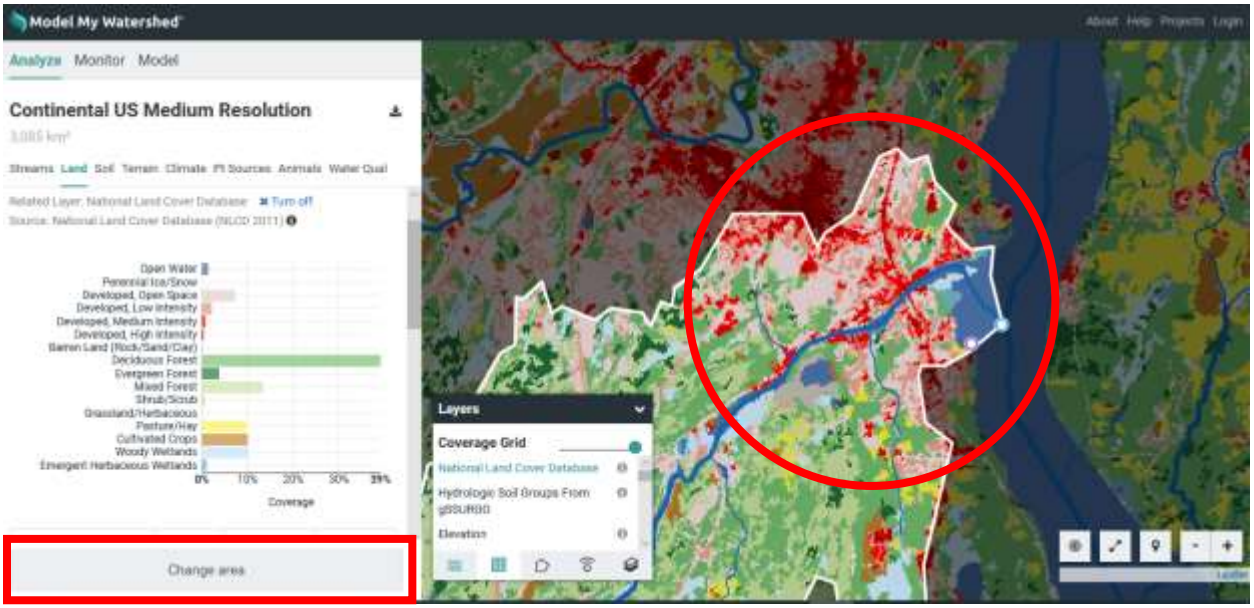
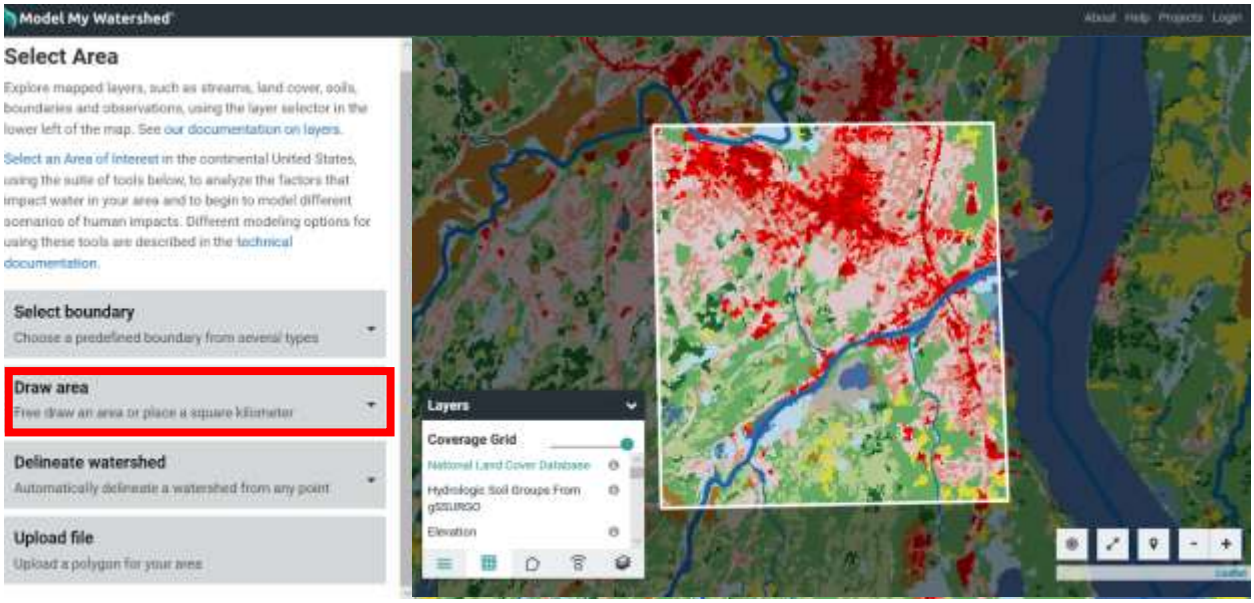
Find an area close to your location that has a lot of Development (red). Remember the city you are focused on and click "**Change area**" at the bottom left of the screen.



Select "**Draw area**" and "**free draw**" a square around the city that you chose. It does not have to be perfect, but make sure it is located within your watershed. At the left side of the screen, click the "**Land**" tab again.



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)

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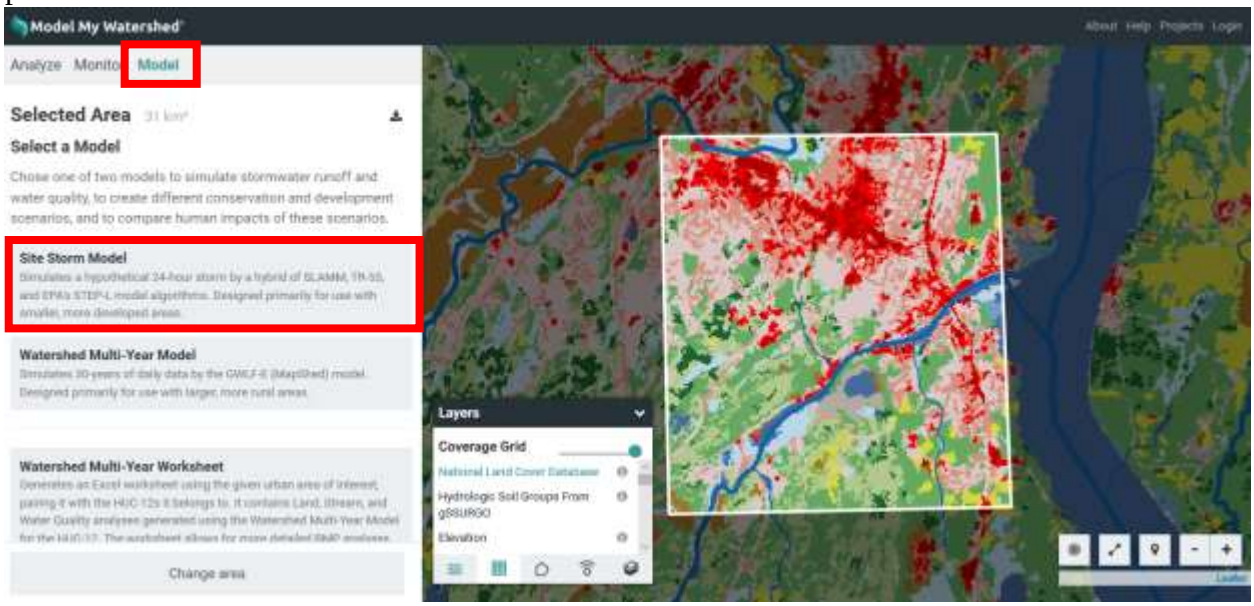
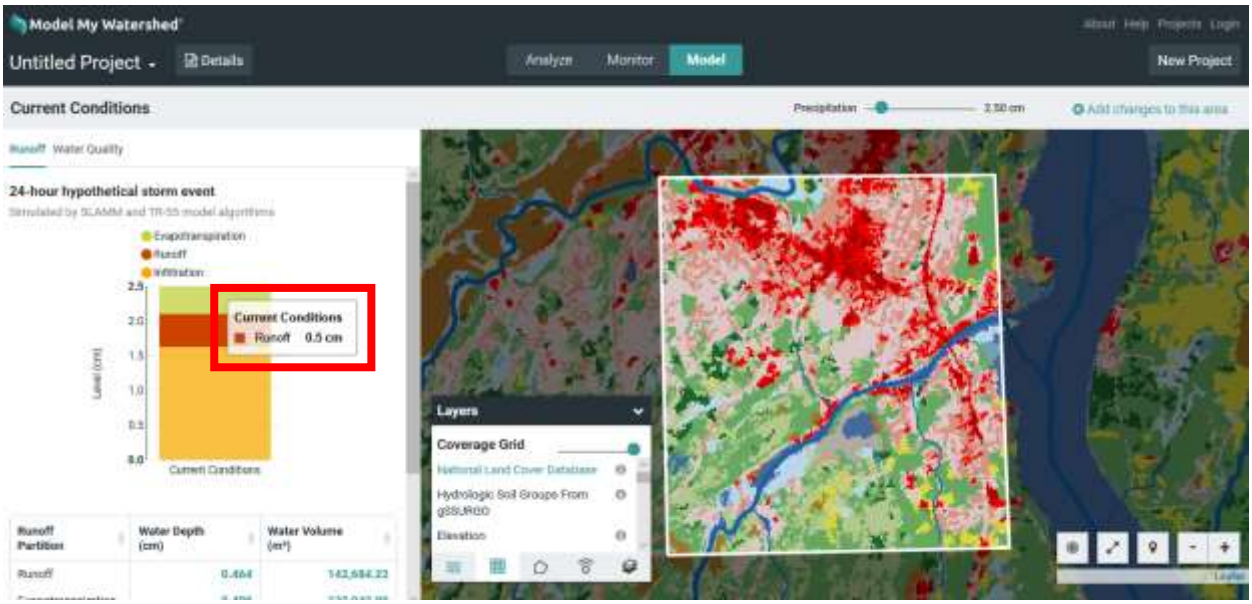
Click the "**Model**" tab. Then select "**Site Storm Model**." You should see how much runoff, infiltration, and evapotranspiration occurs in your selected area during a hypothetical 24-hr storm. Data is collected by the Environmental Protection Agency over several years to create predictive models.



Run your mouse over the bar graph on the left side of the screen. The amount of runoff, infiltration, and evapotranspiration should pop up as you move your mouse over each color.



5. Above the map, slide "**Precipitation**" to the following 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			
5.0			
10.0			
15.0			
20.0			
25.0			

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

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Change the precipitation back to 2.0 cm. At the top right of your screen click "**Add changes to this area**." Click "**Conservation Practices**" and then move your mouse over the various practices.

7. Define the following terms:

Porous Pavement:

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Green Roof:

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Rain Garden:

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Click on one of the "**Conservation Practices**" and replace some of the red on your map with the new practice. Do this with a few more conservation practices. Once you have altered your land cover type, click "**Compare**" at the top left of your screen.

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

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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.


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