Green Girls Curriculum
Lesson 6: Street Trees and Sustainable Cities

Duration: 2 hrs

Standards:
Next Generation Science Standards: MS-LS: 1-6, 2-1, 2-2, 2-4; MS-ESS: 2-4, 3-3, 3-4, 3-5

New York State Science Learning Standards: MS-LS: 1-6, 2-1, 2-2, 2-4; MS-ESS: 2-4, 3-3, 3-4, 3-5

Keywords: Stormwater, Combined Sewage Overflow, Permeable and Impermeable surfaces

Purpose:
- In urban ecosystem knowledge, students will:
  - Understand the importance of the trees around their school
  - Learn how to tell if a tree is healthy, immature or sick and learn the different ways healthy trees benefit the urban environment in its ecosystem and infrastructure.

- In analytical skills, students will:
  - Collect and analyze data about street trees and use the data to gain a better understanding of what makes a city sustainable.

- In socio-emotional skills building, students will:
  - Increase in self awareness and social connectedness by discussing the concept of trust with a peer.
  - Build stronger relationships by engaging in a blindfolded trust activity in which they will have to communicate boundaries and their partner will have to listen and respond thoughtfully. Students will be encouraged to put their trust in their teammates' leadership and will be asked to reflect on their experiences afterward.
  - practice communication skills with a partner during their tree count activity.

Some things you should know before you start this lesson:
- [Tree map of NYC and environmental benefits of each street tree](#)
- [What is a combined sewer system and how does it work ?](#)
- [Green Infrastructure and Stormwater Management](#)

Background:

An [urban forest](#) includes parks, street trees, gardens and wetlands, located in a densely populated area. As urban population increases, the need for a healthy urban forest becomes more important. Street trees specifically have an important [role against climate change effects](#). Street trees provide resources like removing air pollutants that cause respiratory problems, reduce surface temperature during the summer, and reduce carbon dioxide emissions through photosynthesis.

In addition, with an urban city having [impervious grounds](#) it becomes a challenge to avoid floods and water excess to be absorbed by plants. [Combined sewer overflow](#) (or CSO's) is a problem as storms start to intensify due to climate change. CSO's collect rainfall/snowmelt water, domestic sewage (such as bathroom, shower, dish/laundry water) and industrial wastewater all into one pipe. Under normal conditions, these combined wastewater would travel to a wastewater facility to be treated and discharged to a body of water. When the volume of water being collected exceeds what the pipe can hold, untreated sewage/rainwater would overflow onto rivers and bodies of water, affecting water quality for local ecosystems as well as humans. The untreated wastewater would contain human waste, toxic chemicals, and debris. A solution to help prevent this toxic overflow, street trees can absorb some of the storm water and reduce runoff. As scientists and engineers understand the flow of water through permeable and impermeable surfaces, there have been some solutions to help reduce the stormwater runoff such as [rain gardens](#), infiltration basins and permeable paving. In this lesson, students will learn about how to identify and assess tree health, understand why they are important and how they help mitigate climate change effects such as stormwater runoff.

Assessment:
Formative:
Active participation in discussions (can be logged at each session)
[Tree Count Data Collection sheet](#) (attention and accuracy in process)
Exit Ticket

Summative:
[Tree Count Data Collection sheet](#) (accuracy and thoroughness in completion)
[Pre/Post Survey](#)

Essential Questions:
1. How do trees benefit the local ecosystem and community?
2. How do trees help mitigate excess stormwater in our city?
3. How will climate change impact stormwater issues in our city and how can greenspace help mitigate these issues?

4. Whose job is it to care for the trees and the urban forest?

Session Routine:

| Activity	Time	Description
Starting Circle	10 min.	Introduce the day. "Hook" activity!
SEL Activity	20 min.	Meet a Tree Activity
Activity 1	40 min.	Street Tree Count
Activity 2	40 min.	Building SIPs
Final Circle	10 min.	Debrief Questions and Discussion

Materials:
Two water bottles (1 with vinegar, 1 with cocoa powder/leaves), blindfolds, markers, NYC maps, Tree Uptake Worksheet, Plastic bottles, scissors, construction paper, seeds, soil, measuring cups, cotton strips, seed information sheets.

**Opening Circle (8 mins):**

Temperature Check: Ask students to go around in the circle and give a one word descriptor of how they are feeling.

Next **ASK** students:

- Where does water go when it falls on NYC?
    - *Hook Option*: go outside and with a bucket of water and ask for two volunteers. 1 volunteer will dump on the sidewalk, 1 on a patch of grass. Have students observe where it goes and what paths it takes.
    - Introduce the concepts of *permeable surfaces vs. impermeable surfaces.*
- What are some ways the water that falls is used in the city? What happens if it doesn't get used?
    - Students may answer (trees drink the water, goes into lakes, river, ocean, toilets, showers, treatment plants floods the streets, goes into the drain)
    - Explain the concept of CSO and other issues with stormwater overflow in your city.
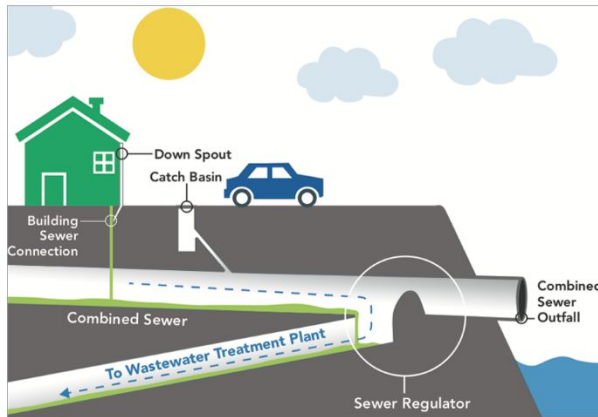
Dry Weather Conditions in the Combined Sewer System*
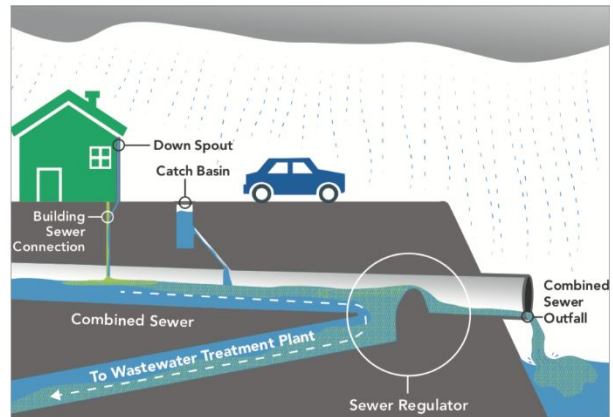
Wet Weather Conditions in the Combined Sewer System

Image source: NYC DEP

Consider printing and laminating this image or another similar image of a combined sewer system to give students a visual of this process as you discuss.

- In this image, where does the water go when we flush our toilets on a dry weather day?
    - On a typical day, water goes into the sewer system and travels to a wastewater treatment plant where it is cleaned and returned to the ocean.
- In this image, what happens when we flush our toilets on a wet weather day?
    - Our sewers become overwhelmed and cannot handle the volume of water. We then use a combined sewage overflow system which flushes untreated wastewater directly into water bodies around NYC.
- What impacts do CSO have on the environment?
    - CSO contribute harmful chemicals, fertilizers and more directly into our water. This degrades the environment for marine species and makes the water unsafe to swim in or fish in.
- How much water do you think a single tree can uptake in one day?
    - A healthy tree can uptake on average 1,525 gallons per tree.

- How could trees help with stormwater overflow in our city?
    - There are ways that an urban tree (pg 8) can help with stormwater overflow:
        - Interception = leaves, branches and trunk surface absorb rainfall, which also reduces the volume of water hitting the surface

- - ■ Transpiration = where trees intake a large amount of water from the soil for photosynthesis

  - Review: How is Climate Change impacting NYC? Think water!
    - Increased storm surges
    - Sea level will rise 1-3 feet over the next 50 years.
    - Overall, average annual precipitation has increased across New York State since 1900.
    - New York is getting more rain and snow in the winter and less in the summer.
    - Increased precipitation is expected to continue, with more frequent storm events and heavier downpours

EXPLAIN that today we will be exploring the role of the trees in our neighborhood and learning how they benefit our city and make it sustainable.

SHOW students the agenda for the day and allow them to read it aloud and provide time for questions.

Activity 1 - Meet a Tree (20 mins):

Materials: Blindfolds.

Time: 20 – 30 minutes

Ideal location: Forested area or park with many trees.

Put students into pairs or allow them to pair off

ASK STUDENTS and let them discuss in pairs: What does it take for you to trust someone? How long does it take?

INTRODUCE the game:

Once you are surrounded by trees in a forested area or a park, stop on the path to introduce the activity. Explain that the purpose of this game is twofold; it is a game to increase communication and trust between students and a game to help us tune into the nature and trees around us and begin the process of tree identification.

START the game:

Children will divide into pairs, one of them being blindfolded. The blindfolded person is to be the tree-hugger. The tree-hugger is led to one tree in the surrounding forested area. Encourage the students to have fun while leading the blindfolded friend. They can take them in loops or ruffle leaves to have the treehugger get a little confused. Remember to be safe and respectful.

Once the leader brings the tree-hugger to the tree hugger is encouraged to use all of their senses to get to know the tree. Memorize its size, shape, location, texture or bark, its smell, etc. The tree-hugger is then led back to the starting point, takes his/her blindfold off and then tries to locate their tree. The pair will then swap with the tree-hugger now being the guide. It helps to do the blindfolded walk in silence.

REFLECT

After everyone has had a chance to be a tree-hugger, you can close with a discussion with the following questions:

ASK students...

- How did it feel to be blindfolded? How was your partner as a guide?
- What other sense could you use?
- Raise your hand if you were not able to find your tree?
    - What was the most challenging part of finding your tree?
- Raise your hand if you were able to find your tree?
    - How did you know it was your tree?
- How was it to try and find your tree once the blindfold had been removed?

Activity 2 - Street Tree Count (40 minutes)

Materials: Tree count sheets, clipboards, writing utensils, tree ring or bark, leaves; tree identification guides

Ideal location: City block with trees and tree pits

Implementation

Put students into pairs or allow them to pair off. Students will **ASK** each other: What do trees need to survive?

SHOW *students a tree ring, leaves, piece of bark or other identifying features of a tree and* **ASK** *students to make observations. Pass around various tree ID guides.*

ASK students to identify which trees in the guides look familiar and which trees don't.

EXPLAIN the life of a street tree and **ASK** students why they think street trees are important.

- Remember to mention that trees uptake excess stormwater, excess carbon dioxide, remove air pollutants among many other benefits such as oxygen production, animal habitat, and fruit production.

TELL students: Today we are going to count the number of trees on the block. We will record the live mature trees, immature trees and stumps/dead trees on our worksheet. We'll work in pairs to count the trees on our block and figure out how much they benefit the local environment. Record anything significant you see concerning the health of the trees. A dead tree will not use any water so we will not be able to include that in our final count.

Before going out, go over the directions at the top of the sheet:

1. Sketch this block and label the streets *(do this as a group before leaving school)*
2. Include an ▲ for every live, mature tree you see.
3. Include an X for every dead tree or stump you see.
4. Include an O for every immature tree you see.

Students will circle up and we will share what number we came up with.

ASK students:
- How do these trees play a role in the water cycle of NYC?
- How many gallons of water a street tree can uptake in a year? (on average 1,525)
- How many gallons of water the trees on this block can help stop from running into the sewer system each year (they will need calculators or phones for this one!)

Students should be able to understand that without our street trees we would have too much water flowing into our sewers. If trees get too little water they die so it is important for us to provide for them in the dryer months so that they can provide for us during heavy precipitation.

Activity 2- Building Sub-Irrigated Planters

Materials: Recycled soda bottles (2L work best), hammer and nails or pushpins, nylon string, scissors, easy to grow seeds (sunflower, radish, peas, etc), potting soil, SIP directions sheet.

Time: 30-40 minutes

Ideal location: Indoors or outdoors with appropriate materials.

ASK students:

- Remind us, how much water was sucked up through the trees on the block?
- Which part of the tree was doing the job of sucking up the water?

TELL students: We are going to make our own mini experiment to see how much water different plants are capable of consuming over a period of time. We will have the chance to make Sub-Irrigated Planters.

EXPLAIN to students the layout of the SIP and detail that the cotton wick acts as a tree root in absorbing water. Use the SIP direction sheet to go over the process.

Students will build their SIP planters and mark the water line on their bottle. They will be asked to check on it before we meet next week and report if the water line has fallen and why.

Final Question: What role can trees play in a city that has even more rainfall and storm water, due to climate change?

Make sure to go over proper care for the particular plants you plant. Students will decorate a planter sleeve to block light to allow the roots to grow. Students may take their planters home with them or leave them on a windowsill at school where they are able to replenish the water when it runs low.

Closing Circle (5 mins) - led be peer mentor(s) or intern(s)

ASK students:

- What did we learn today?
- Do you think there are enough street trees and green space in NYC to mitigate the precipitation. Why or why not?
- What are some ways we can help?

Time for Praise! What positive feedback can you offer a teammate or fellow Green Girl?

Go around the circle and ask each girl to say ONE positive word about someone else in the circle. You may want to write a list of words on the board to help them (Shanna was friendly, helpful, funny, organized, fast, etc)

Exit Card Question:
What is the role of street trees in the water cycle in NYC? Do we have enough street trees? Why or why not?