



## NATURE WORKS EVERYWHERE

As part of Recycle for Nature, PepsiCo Recycling has partnered with The Nature Conservancy and its Nature Works Everywhere program to provide some fun activities to encourage families and children to get outdoors. Nature Works Everywhere gives teachers, students and families everything they need to start exploring and understanding nature around the globe alongside The Nature Conservancy scientists—interactive games, and interactive lesson plans that align to standards and can be customized for each classroom.

\*All website links work in Internet Explorer 9 or later, Google Chrome or Firefox browsers

## URBAN TREES LESSON PLAN

For more information about PepsiCo Recycling, visit: [www.PepsiCoRecycling.com](http://www.PepsiCoRecycling.com).  
For more resources that support this lesson, [download the full lesson plan here](#).

**Grades:** 5<sup>th</sup> – 9<sup>th</sup>

### Essential Questions:

How do trees benefit humans and the environment?

### Lesson Overview:

Students will learn about how trees are an essential part of our lives with a focus on the role they play in urban areas, including energy considerations.

### Middle School Next Generation Science Standards

LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

**Vocabulary:**

- *Transpiration:* The evaporation of water from plants.
- *Invasive Species:* Any kind of living organism that is not native to an ecosystem and which causes harm.
- *Energy:* Anything that can carry out an action or maintain a process.
- *Microclimate:* A small local area where the climate conditions differ from the larger surrounding area.

**Background for the Teacher:**

In this lesson, students learn the value of trees and how nature works to provide clean water and air. Forests renew our air supply by absorbing carbon dioxide and producing oxygen. Trees also clean our air by filtering out dust and greenhouse gases. One tree can absorb ten pounds of air pollutants a year. Through shade and the evaporation of water from their leaves, trees can reduce energy use.

Federal research has shown that well thought out tree planting can [lower summertime temperatures in cities](#) and households by dramatically reducing air-conditioning bills and help trap some of the greenhouse gases responsible for global warming. In addition to saving energy through cooling in the hotter months, trees provide a wind break during winter. This results in burning less fossil fuel to generate electricity for cooling and heating.

Forests provide natural filtration and storage systems that process nearly two-thirds of the water supply in the United States. Their root systems hold soil in place, preventing erosion and absorbing water that may result in flooding. Trees provide food and shelter for both plants and animals. They reduce noise pollution by buffering sound waves and can even relieve psychological stresses with their beauty.

**CLASSROOM ACTIVITIES**

**Materials**

For each group of students/individual student:

- Notebook paper/journal

- Map of school ground and/or community

#### Optional

- SmartPhone or tablet
- Fan (can be made from paper or powered)

#### Engage

How do trees benefit humans and the environment?

1. Ask students to brainstorm about what trees do for us. Some examples may include a tire swing (recreation), shade from a tree, apples or oranges (food) and a hole in a tree or nest made by an animal (habitat). Explain to students that these are just a few of many examples of what trees do for us every day. Ask students to consider - Why do we plant trees in our yards and in our community? Are there places in the world where there are no trees? What are those places like?
2. Share with students the [Urban Trees \(http://vimeo.com/77792928\)](http://vimeo.com/77792928) overview video.
3. Explain to students that they will work to answer these questions during the lesson. Focus their attention on the guiding questions:
  - a. How do trees benefit humans and the environment?
  - b. What threats do trees face?
  - c. What can people do to protect and promote trees in their community?
4. Display an image of a tree on a windy day and ask students to consider how air benefits from trees. Four different benefits from air can be highlighted and clues can be provided to guide students in identifying each benefit. Students will identify 1) reduce wind 2) tree leaves collect dust and capture pollutants 3) tree roots, wood and leaves absorb carbon dioxide and 4) trees provide oxygen. Sharing an image of photosynthesis may support students in identifying trees absorbing carbon dioxide and providing oxygen as other benefits air has because of trees.
5. Display an image of a tree on a rainy day and ask students to consider how water benefits from trees. Four different benefits from water can be highlighted and clues can be provided to guide students in identifying each benefit. Students will identify 1) filtering pollutants 2) collecting water 3) slowing water to prevent flooding and 4) distributing water over time for drought prevention. An additional image of a tree on a city street may clue students in identifying filtering pollutants.
6. Display an image of a tree with evidence of animal habitats and food and ask students to consider how plants and animals benefit from trees. Three different benefits from plants and animals can be highlighted and clues can be provided to guide students in identifying each benefit. Students will identify 1) habitats 2) food 3) recreation. An additional image of a tree swing or tree rope course can be included for students to identify recreation.
7. View the [Meet the Scientist: Bill Toomey \(http://vimeo.com/77229009\)](http://vimeo.com/77229009) video and then share the scientist video answering the question, "[What benefits do trees bring to our lives?](http://vimeo.com/78368777)" (<http://vimeo.com/78368777>) After the video ask students what other benefits were observed in the video. Anticipated responses may be; wood, jobs, fiber, reducing asthma and trees are pleasing to look at. Ask students if they can brainstorm even more!
8. Provide students with the definition of **Transpiration** – the evaporation of water from plants.
9. Explain that trees not only provide shade from the sun, they also transpire (release water vapor) through their leaves. This is an additional cooling benefit. Have students line up and file by a bucket of water. Ask each student to dip just one hand in the water to wet it, and then hold

both hands briefly in front of the fan. After all students have tried this, ask which hand felt cooler. Explain that the warmth of your skin and the air from the fan caused the water to evaporate. That process cools your skin. Nature uses evaporative cooling every day. When we sweat, our perspiration evaporates, cooling us off. When a tree transpires, releasing moisture, that moisture evaporates, cooling the air.

### OPTIONAL ENGAGE INVESTIGATION

10. Ask students to predict the temperature difference of soil in the shade of a tree versus the sun.
11. If the school grounds have a tree choose a site where the sun location is well away from any structure because the structure might radiate heat onto the soil where the thermometer is located. The thermometer can be concealed and will not affect the reading because the tip of the probe is detecting the soil heat, not the round gauge on top of the probe. The site in the shade should not be too close to a tree trunk. Leave probes in the ground for at least a half hour to adjust to the soil temperature.
12. Visit the site together as a class to record data or small groups of students can rotate each day to collect data. A data table should include information for students to record the date, temperature in sun, temperature in shade, windy or calm air and cloudy or sunny skies. If the school grounds do not have a tree mock data can be provided. Trees in the shade will typically be 5-10 degrees cooler.
13. Ask students to analyze the soil temperatures in each location and form a conclusion. What patterns emerge? Why would a living organism prefer to be in the shade or sun? What could happen if shade was not available? Who could use this data? How could they use it?
14. Provide students with the definition of **Microclimate** – a small local area where the climate conditions differ from the larger surrounding area.
15. Explain to students that the shade from a forest tree creates a microclimate suitable for many species of plants and animals to survive and flourish. Many small plants have adapted to the understory of a forest, and need protection from the direct rays of the sun. The forest soil is cool and moist, which is good for plants and provides cooler temperatures in the surrounding area. Ask students to consider how trees providing cooler temperatures can benefit humans. How could trees impact energy costs of buildings?
16. Provide students with the definition of **Energy** – anything that can carry out an action or maintain a process.
17. The [Tree Benefit Calculator](https://www.arborday.org/calculator/index.cfm?) (<https://www.arborday.org/calculator/index.cfm?>) allows students to make a simple estimation of the benefits individual street-side trees provide. Patterns and trends with the type of tree planted, size, location and their energy savings can be investigated using this web tool. Ask students to consider; Do larger diameter trees provide greater energy savings? Why or why not? Is there a relationship between the size of the tree and the gallons of storm water runoff a tree can intercept?