

5TH-8TH GRADE UNIT

LESSON 2 Urban Forest Benefits

NUTSHELL

In this lesson, students participate in “Name That Benefit” to identify some of the benefits urban forests can provide. They also examine two different pictures and decide which matches various statements about urban forest benefits. To conclude, students list urban forest benefits and how the benefits also help people and ecosystems beyond the urban forest.

BIG IDEAS

- The tree canopy retains stormwater, reduces heat island effects, absorbs pollutants, and provides wildlife habitat. These benefits are important and quantifiable. (Subconcept 6)
- Urban forests affect the physical and psychological health of human residents. (Subconcept 7)
- A healthy urban forest can provide economic benefits including reduced energy costs, reduced stormwater runoff, and increased property values. (Subconcept 8)

OBJECTIVES

Upon completion of this lesson, students will be able to:

- Describe benefits the tree canopy provides.
- Explain that urban forests affect the physical and psychological health of human residents.
- List the economic benefits of a healthy urban forest.

SUBJECT AREAS

Language Arts, Social Studies

LESSON/ACTIVITY TIME

- Total Lesson Time: 90 minutes
- Time Breakdown:
 - Introduction40 minutes
 - Activity30 minutes
 - Conclusion20 minutes

TEACHING SITE

Classroom

BACKGROUND

Canopy, or tree canopy, is a term used to describe the leaves and branches of a tree or group of trees. In an urban forest, tree canopy is important to the potential benefits the forest may provide. In general, the more area it covers and the denser the canopy, the more benefits the trees can provide. Although one tree is better than none, 100 are better still. Whether the benefits are from one tree or many trees, they are all still real and most can be quantified in some way. Often, forest benefits are divided into three categories: social, economic, and ecologic. It is difficult to divide the benefits that the urban forest canopy provides into these categories because so many benefits fall into more than one.

SOCIAL BENEFITS

Just as with a rural forest, an urban forest provides many benefits. Numerous studies have been done about the social and psychological benefits of “green” in urban environments. The findings of the studies make a strong case for the importance of urban forests.

Urban public housing residents who lived in buildings without trees and grass nearby were asked about how they cope with major life issues. They reported more procrastination and assessed their issues as more severe than residents with green nearby.

A study done with children with Attention Deficit Disorder (ADD) found that children with ADD were better able to focus and concentrate after playing in natural, green settings, than in settings where concrete was predominant.

MATERIALS LIST

FOR EACH STUDENT

- Copy of Student Page  1, *What's the Difference?*

FOR THE TEACHER

- Teacher Pages  1A-B, *Name that Benefit*
- Teacher Page   2, *What's the Difference? Key*

VOCABULARY

Canopy: The leaves and branches of a tree or group of trees.

Carbon Sequestration: The capture and storage of carbon dioxide from the atmosphere into biotic (e.g., trees) or abiotic (e.g., coal) pools of carbon.

Evapotranspiration: The loss of water by evaporation from the soil surface and by transpiration from plants.

Forest: An ecosystem that is characterized by a dominance of tree cover and contains a variety of other organisms (e.g., other plants, animals).

Green Space: An area in a city, town, or village, containing mostly plants with few buildings, roads, or other structures.

Heat Island: The phenomenon that, because concrete and asphalt absorb and radiate heat, cities are five to nine degrees warmer than rural areas.

Runoff: Water that flows on the surface of the ground.

Urban Forest: A forest ecosystem that includes all the trees and other vegetation in and around a town, village, or city. Plants, people, and animals are part of the urban forest.

Apartment buildings with high levels of greenery have been shown to have approximately half the number of crimes than those with little or no greenery. The results proved true for both property crimes and violent crimes. A similar study found that residents living in areas without nearby nature reported more aggression and violence than those living with nearby green.

In addition to these specific studies, access to nature also provides humans with other social benefits. Parks and other green spaces provide a space for people to play, walk, jog, birdwatch, or just sit quietly. These activities are good for our physical health in a society that is increasingly sedentary. It is also good for our mental health by providing a place to unwind. Trees also reduce noise levels.

ECONOMIC BENEFITS

The economic benefits of urban forests are increasingly being documented. Economics often becomes the language used when it comes to urban forest management. Budgets of municipalities must cover an array of services, and the benefits of an urban ecosystem must often be proven to secure funding. In a study that considered the costs and benefits of municipal forests in five U.S. cities, the researchers found that for every dollar spent, the benefits returned were worth from \$1.37 to \$3.09. A little math tells us this is clearly a good investment.

Trees save money through reduced energy costs. Cities create what is referred to as a heat island. The concrete, asphalt, buildings, and other surfaces absorb and hold heat from the sun. During hot summer days, cities can be five to nine degrees warmer than surrounding areas. Shading, evapotranspiration, and wind speed reduction provided by trees help conserve energy in buildings. A study conducted in Minneapolis, Minnesota, showed that trees placed in the proper location can reduce total heating and cooling costs by eight percent.

Homeowners not only reduce costs of heating and cooling their homes, but increase the value of their property by planting trees. Research suggests that property value can increase three to seven percent when trees are present. Trees also make homes and neighborhoods more desirable places to live.

One economic benefit that urban trees can provide, but often don't, is one based on products. Municipalities and tree services across the country have come up with ways to use the wood that is cut from an urban forest. Products range from specialty furniture, to musical instruments, to lumber for park shelters, to artwork. These products from the wood of trees being removed could be used to defray the cost associated with the removal, making trees an even better investment.

ECOLOGIC BENEFITS

Benefits often fall into more than one category. Such is the case for energy savings. Not only does reducing energy consumption save money, it has ecological benefits as well. With reduced energy consumption comes reduced pollution.

According to a publication by the USDA Forest Service, urban forests provide four main air quality benefits:

- They absorb gaseous pollutants (e.g., ozone, nitrogen oxides, sulfur dioxide) through leaf surfaces.

- They intercept particulate matter (e.g., dust, ash, pollen, smoke).
 - They bind or dissolve water-soluble pollutants onto moist leaf surfaces.
 - They capture and store larger particulates on leaf surfaces which may be waxy, resinous, hairy, or scaly. They also capture and store particulates on rough bark surfaces.
- They capture carbon dioxide and release oxygen through photosynthesis.
- They transpire water and shade surfaces, which lowers air temperatures, thereby reducing ozone levels.

Water runoff from rainfall can be a challenge in cities. Most of the methods used for runoff control create a host of problems such as pollution, failure to recharge groundwater, and loss of wildlife. Trees have a positive impact on this problem. For example:

- Leaves and branch surfaces intercept and store rainfall, thereby reducing runoff volumes and delaying the onset of peak flows.
- Roots create air spaces in soil and therefore increase the rate at which soil absorbs rainfall and the capacity of soil to store water. This reduces runoff.
- Tree canopies reduce soil erosion by diminishing the impact of raindrops on bare soil.
- Transpiration through tree leaves reduces soil moisture, increasing the soil's capacity to store rainfall.
- When runoff is reduced, the number of pollutants entering groundwater, rivers, and lakes decreases.

Reducing water runoff from storms with trees also falls into the economic benefit category. As water is slowed and absorbed or evaporated, it avoids being forced into a storm sewer. Less water entering the storm sewer system means less cost to treat it.

Don't forget that trees provide habitat for animals in urban areas, just as they do in rural forests. This increased wildlife presence makes a healthier ecosystem and certainly makes it a more interesting place for us to live.

More detailed information about the benefits and costs of trees in Wisconsin can be found in *The Midwest Community Tree Guide: Benefits, Costs, and Strategic Planting*. See the Recommended Resources section on page 163 for information on this publication (online).

PROCEDURE

INTRODUCTION (↑↓)

1. Tell students they are going to play a quick game of "Name That Benefit." The benefits they will name are from urban forests.
 2. Explain the rules of the game:
 - The class will be divided into four teams. Two teams will be paired to play against each other. Each pair of teams will face each other in a warm-up round and one more round. The team with the highest score from each pair will face off with a final question.
 - For the warm-up round, a coin toss will decide which team goes first. A clue will be written on the board that hints at the word(s) to be guessed. Each word or group of words describes a part of an urban forest. (This is review from Lesson 1.) For the rest of the rounds, the word(s) guessed describe a benefit of an urban forest.
 - Once the teams have seen the clue, they may discuss their choices. The team that won the coin toss will be given a chance to decide how many letters of the benefit word they need to see to be able to identify it. If the opposing team thinks they can name it with fewer letters they will counter with that number. This will continue until one team says, "Name That Benefit" or there are no letters left. The team that thinks they can name the benefit in the fewest letters gets to guess the word.
 3. Divide the class into four groups. Have the members of each group gather in one spot where they can see the board and quietly discuss their answers. Write teams' names on the board in columns to keep score. **NOTE:** If the class is too large for all students to participate in the four groups, assign some students to other tasks (i.e., scorekeeper, applauding audience member, etc.).
 4. Use Teacher Pages 🍌1A-B, *Name That Benefit* to conduct the game. Draw lines on the board to represent the spaces for each letter of the word(s) they are guessing (the number of letters are listed on the teacher page). Allow teams to discuss and decide how many letters they need to see to name the benefit the clue indicates. When the team has told you the number of letters they need, either fill in the blanks beginning with the first letter, or let the group choose which blanks they would like to fill in. If no team guesses correctly, continue to fill in the blanks, letter by letter, and give the points to the first team that answers correctly. As each benefit is named, use Teacher Pages 🍌1A-B, *Name That Benefit* to lead a discussion as to why the things listed as benefits qualify.
- If the team that gets the first chance to name the benefit fails to do so, the other team gets to try. The team that successfully names the benefit gets the points.
 - If neither of the teams names the benefit, the two teams not playing in this round get a chance to steal by being the first to raise their hands and name the benefit.
 - When the first pair of teams has completed their round, the second pair of teams will play their round by the same rules.
 - Play the next round for each pair of teams, this time allowing the team that did not start the first round to start and award points for the correct answer.
 - Winners of each of the pairs face off for a final round. The final round is a winner-take-all question.

ACTIVITY – TREES OR NO TREES (↑↓)

1. Hand out Student Page  1, *What's the Difference?* to each student. As a group, discuss what some of the differences they see in the pictures are. (*One has lots of trees, one has more cars and streets, and there are people in one and not in the other.*) Tell students that they will be matching the statements to the appropriate picture. Ask them to read the directions on the worksheet and begin.
2. When students have filled out their own worksheets, use Teacher Page  2, *What's the Difference? Key* to lead a class discussion about the answers. Read each question to the class and allow students to discuss why they think their answer is right. Discuss the correct answer and ask if it surprised them. Ask students to list the questions that relate to economic benefits of trees. (*Questions 3, 4, and 6.*) Ask students to list the questions that show trees affect humans' mental and physical health. (*Questions 1, 5, and 7.*) Ask how your town or neighborhood compares to the pictures.

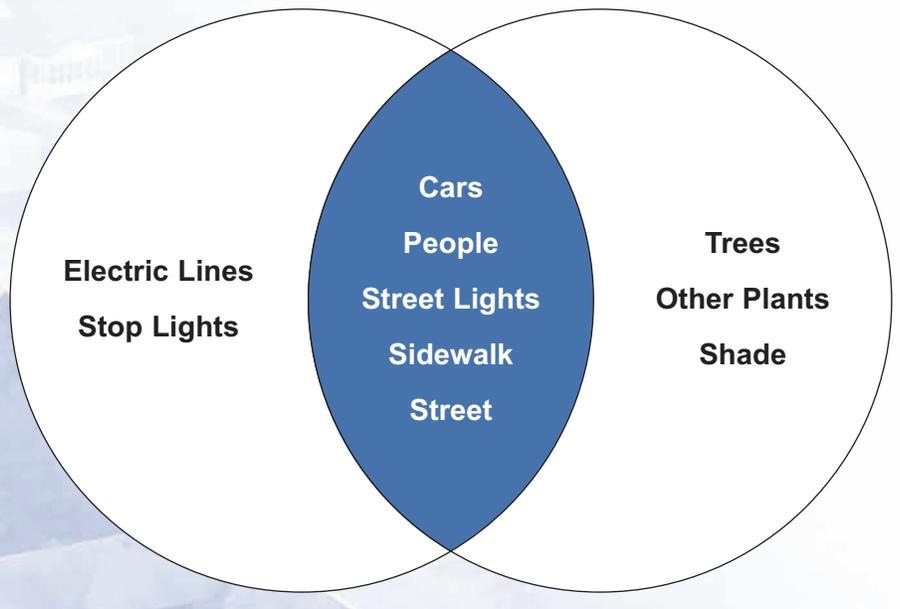
(*Same as one or the other or a combination.*)
Ask which benefits mentioned would they like to have, or have more of, in their town or neighborhood.

3. Use a Venn diagram to illustrate the things that are found in each picture and in both. See the example below.

CONCLUSION – BEYOND THE URBAN FOREST (↑↓)

Assign students to take 15 minutes to list three benefits that an urban forest can provide at the top of a piece of paper. Below their list, have students write several sentences to give their impression of how well the urban forest in their city or town provides these benefits. Finally, ask students to describe, in one or two sentences, how they think these benefits might also benefit people and ecosystems outside of their urban forest. Assign students to write these descriptions to a specific audience. (*Younger students, older students, adults, etc.*)

VENN DIAGRAM EXAMPLE



LEAF LINKS

The lessons listed below, for the *LEAF Wisconsin K-12 Forestry Education Lesson Guide*, contain possible enhancements, extensions, or replacements for *Urban Forest Lesson Guide: 5-8 Lesson 2*.

UNIT 5-6 LESSON 5: WE ALL NEED TREES

Students learn about the values of forests and their impact on the environment by categorizing values and writing and producing a commercial.

Use 5-6 Lesson 5 Activity and Conclusion after *Urban Forest Lesson Guide: 5-8 Lesson 2* to broaden the idea of forest values for students. The lesson includes values outside urban forests.

UNIT 5-6 FIELD ENHANCEMENT 1: WOOD'S WORTH

Students make their own tree scale sticks and use them to calculate the number of projects that can be made from individual trees. They also go on a scavenger hunt to explore many ways that forests are valuable.

Use the Pre-activity, Introduction, and Activity 1 of 5-6 Field Enhancement 1 in any area with several trees with a 10-inch diameter or more. The lesson can be used as additional information about the economic benefit of rural trees for products. Activity 2 can be used if you have a wooded site.

UNIT 7-8 LESSON 5: MANY FORESTS, MANY VALUES, MANY REASONS

Students assess forest values and discover how forests shape the economy, environment, and society using games, story analysis, and brainstorming.

Use 7-8 Lesson 5 as written or use the Introduction and choose activities as time allows to expand the value discussion in your class to the values of all forests.



NAME THAT BENEFIT

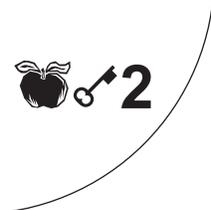
WARM-UP ROUND (1 POINT)		
	CLUE	URBAN FOREST PART
Example Clue	Shelters	Buildings (9 letters)
Team 1 vs. Team 2	You and Me	People (6 letters)
Team 3 vs. Team 4	Big and Green	Trees (5 letters)
Team 1 vs. Team 2	We All Need It	Water (5 letters)
Team 3 vs. Team 4	Green Carpet	Grass (5 letters)
Team 1 vs. Team 2	Furry Friends	Animals (7 letters)
Team 3 vs. Team 4	Hot Stuff	Sun (3 letters)
Team 1 vs. Team 2	Drive On	Roads (5 letters)
Team 3 vs. Team 4	Under Foot	Sidewalks (9 Letters)

ROUND ONE (2 POINTS)			
	CLUE	BENEFIT	BENEFIT'S IMPORTANCE
Team 1 vs. Team 2	Cool Effect	Shade (5 letters)	Trees shade homes, businesses, cars, and more. This makes it take less energy to cool the buildings, and parked cars emit fewer pollutants when they are cooler.
Team 3 vs. Team 4	Happy Critter Homes	Habitat (7 letters)	City trees provide places for animals to find shelter and food.

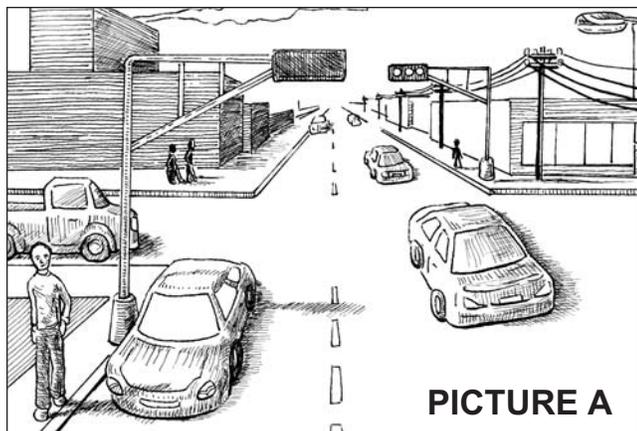
NAME THAT BENEFIT

ROUND ONE (2 POINTS)			
	CLUE	BENEFIT	BENEFIT'S IMPORTANCE
Team 1 vs. Team 2	Soaking It In	Water Retention (5 letters + 9 letters)	As rain falls on hard surfaces, it must run off into stormwater collection systems. If rain falls on trees, it slows down the water and gives the soil the time the tree is growing in to absorb the water.
Team 3 vs. Team 4	Visual Shield	Block Views (5 letters + 5 letters)	Trees and other plants can be used to screen things we don't want to look at, such as highways, parking lots, and buildings. We also use plants to make areas more attractive.
Team 1 vs. Team 2	Shhhhhh!	Reduce Noise (6 letters + 5 letters)	The leaves of trees act as a sound buffer. They are good at reducing higher-pitched sounds, which tend to be most troubling to humans.
Team 3 vs. Team 4	Breathe Easy	Absorb Dust (6 letters + 4 letters)	The leaves of trees can trap dust and other pollutants. This removes them from the air and prevents them from harming us as we breathe.

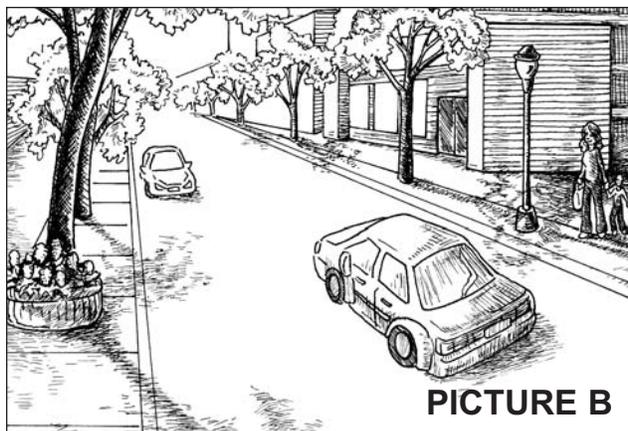
FINAL ROUND (WINNER-TAKE-ALL)			
	CLUE	BENEFIT	BENEFIT'S IMPORTANCE
Team 1 or Team 2 vs. Team 3 or Team 4	Cheapskate	Save Money (4 letters + 5 letters)	When trees are used to retain water, shade, and absorb pollutants, they save us money. All these jobs would have to be performed by human-built systems, which cost money to build and maintain.



WHAT'S THE DIFFERENCE? KEY



PICTURE A

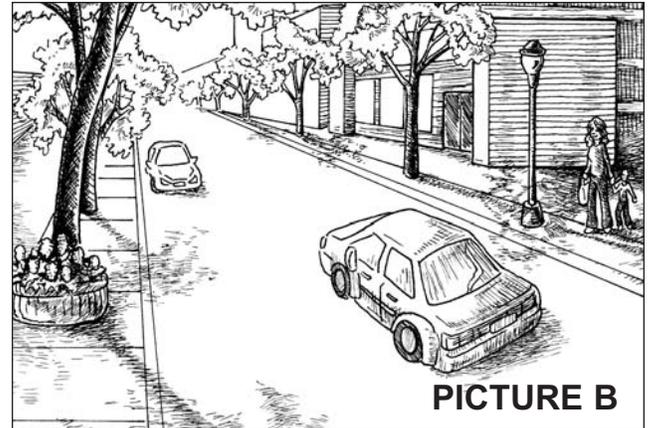
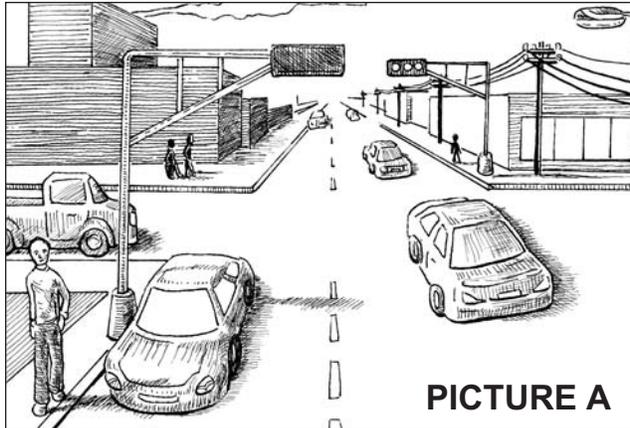


PICTURE B

USING THE PICTURES ABOVE, ANSWER THE FOLLOWING QUESTIONS:

- In which picture is Maria having trouble sleeping because of noise?**
Picture A. Trees help to reduce noise. Since picture A has no trees it will be louder there than it is in picture B.
- When Jim takes his dog, Willow, for a walk in the summer, where does Willow hurt her paws on the hot concrete?**
Picture A. Without trees to shade the sidewalk, it gets hot. The shade of a tree helps reduce the sunlight hitting concrete and asphalt. That keeps the surface cooler so Willow doesn't hurt her feet.
- Two apartments are for rent, one in each photo. They are similar in size and price. Which one rents first?**
Picture B. Green space and trees make a more desirable neighborhood where people want to live.
- In which picture does rain flow faster into the storm drains?**
Picture A. Trees and other plants help slow the water that falls to the ground during a heavy rain. Also, where there is a tree, there is at least some soil. Soil can absorb the rain, while concrete or asphalt channels it into the stormwater system. Since picture A doesn't have trees to slow water down, or soil to absorb water, water has to go into storm drains.
- Which place would be better for Lee to live in to avoid asthma attacks?**
Picture A or B. Trees help remove air pollution with their leaves. Air pollution contributes to asthma attacks. However, trees produce pollen which can contribute to asthma attacks.
- Where does it cost most to run an air conditioner?**
Picture A. When trees are used to shade a building, energy costs are reduced because the air conditioner doesn't have to run as much. Without trees it will be hotter in picture A.
- In which picture do people spend more time outside, which helps reduce crime?**
Picture B. People prefer to be outside where there are trees and flowers. When people are outside more and see what is happening, criminals typically avoid that area.
- Where do more animals live?**
Picture B. Trees provide shelter and food for animals to live in the city.

WHAT'S THE DIFFERENCE?



USING THE PICTURES ABOVE, ANSWER THE FOLLOWING QUESTIONS:

1. In which picture is Maria having trouble sleeping because of noise?
2. When Jim takes his dog, Willow, for a walk in the summer, where does Willow hurt her paws on the hot concrete?
3. Two apartments are for rent, one in each photo. They are similar in size and price. Which one rents first?
4. In which picture does rain flow faster into the storm drains?
5. Which place would be better for Lee to live in to avoid asthma attacks?
6. Where does it cost most to run an air conditioner?
7. In which picture do people spend more time outside, which helps reduce crime?
8. Where do more animals live?