I've Got You Covered:

The Amount of Pavement Covered by Street Trees

Meet the Scientists

Mr. Maco: ◄ As a research forester, my curiosity about the natural world is encouraged. I am offered opportunities to explore questions for which answers are not known. My favorite experience with science is when answering one of these questions leads to an improvement in how we manage our forests, so that future generations can enjoy what we enjoy today.

Dr. McPherson: ►My favorite science experience is seeing a paper finally in print or giving a presentation to a large group and sensing their interest and excitement. The process of planning and conducting research is long and painstaking. One has to be patient because results don't come quickly. However, the joy of seeing a project completed and knowing that it is valued by others is very gratifying.

Thinking About Science

Scientists work to solve problems. These problems are identified because their solution provides a benefit to people. Sometimes a scientist's research might be a part of a larger problem. By solving a small piece of the problem, scientists can provide information so that the larger problem might one day be solved.

In this study, the scientists wanted to know how much of a city's paved surfaces should be covered by trees. Paved surfaces include streets, sidewalks, and parking lots. Many benefits are provided by urban trees when they cover paved surfaces. To answer their question, they first needed a way to estimate the current amount of ground and pavement that urban trees cover. This is because the amount of benefits provided by urban trees is related to the amount of ground and pavement

Glossary:

global warming (**glo** bul **wôrm** ing): An increase in the average temperature of the Earth's atmosphere.

intercept (**in** tür sept): To stop or interrupt the progress or intended course of something.

canopy (**kan** uh pe): Anything that covers like a roof. On a tree, the area of leaves that cover the ground.

inventory (**in** ven tôr e): A complete list of goods, supplies, possessions, etc.

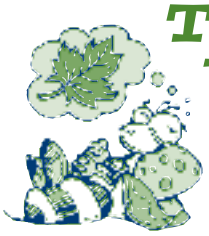
radius (**ra** de us): A straight line that extends from the center to the outside of a circle or sphere.

Pronunciation Guide

a	as in ape	o	as in go	ü	as in fur
ä	as in car	ô	as in for	oo	as in tool
e	as in me	u	as in use	ng	as in sing
i	as in ice				

Accented syllables are in **bold.**

that their canopies cover. Unless the scientists found out how much of the city's paved surfaces were currently covered by trees, they could not determine whether more tree cover was needed.



Thinking About the Environment

Urban trees provide many benefits to people and their communities. Urban trees keep areas cooler in the summer, helping to lower energy use in buildings. Trees keep the air cleaner by reducing the amount of harmful pollutants in the air. They also help to prevent *global warming* by reducing the amount of carbon dioxide going into the atmosphere. Trees hold the soil in place and intercept rainwater. When trees *intercept* rainwater, they reduce the amount of water that runs into stormdrains and washes pollutants into streams and rivers. Urban trees also provide homes for birds and other urban wildlife and make urban areas more beautiful.

Most of these benefits depend on how much of the ground, including paved areas, the tree's *canopy* covers (**figure 1**). Usually, the larger the area of ground or pavement that is covered by urban tree canopies, the greater the benefits to people.

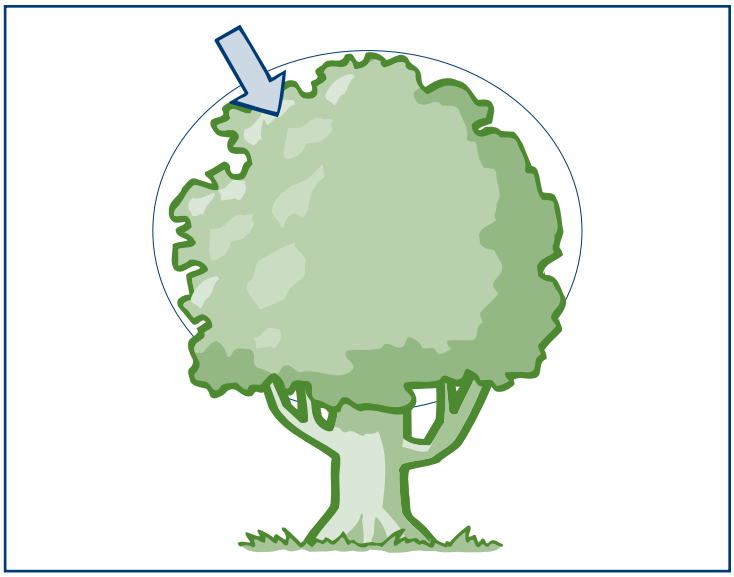


Figure 1. A tree canopy.

Introduction

The trees that grow along urban streets are called street trees. Some street trees are planted between the street and the sidewalk (**figure 2a**). Other street trees are planted in a strip of land called the median, which lies in between the lanes of traffic (**figure 2b**). Trees that grow in front yards are considered street trees if part of their canopy covers public areas, such as the sidewalk or the street (**figure 2c**). Often, sidewalks have cut out areas where trees are planted (**figure 2d**).

Figure 2a. Street tree planted between the street and sidewalk.

Figure 2b. Street tree planted in the median strip.

The scientists in this study wanted to know how much of the sidewalks and streets were covered by tree canopies in a particular urban area. Can you guess why they wanted to know this? If people do not know how much of something they have, then they do not know if they need more or less of it.

Think about your own money. Let's say that you want to buy a new DVD that costs $15. How do you find out if you need more or less money to buy the DVD? To determine this, you must count your money.

When you count your money, you are taking an *inventory* of how much money you have. The scientists in this study wanted to take an inventory of how much ground and pavement was covered by street trees. By estimating this, they eventually will be able to recommend how cities can change the number of trees growing in cities and where the trees are planted. By doing this, cities can increase the amount of benefits people are receiving from street trees.

Figure 2c. Street tree planted in a front yard.

Thinking About Ecology

All living things grow and develop. This happens for individual living things, such as you and your classmates. Development means that as living things get older, they are able to do different and more complex things. When you think about it, you can see that infants do not just grow. They also develop. You can see this by watching infants learn to walk, talk, and then ask more complex questions. The idea of development can be demonstrated by urban forests. As urban forests get older, they are able to "do" things that they could not do when they were younger and smaller. For example, as tree crowns get larger, they are able to shade more of the pavement. They are able to slow more of the rainfall and prevent more pollution of streams and rivers. They keep larger areas cooler and provide places for different kinds of urban wildlife to live. They are able to produce flowers, nuts, and seeds and, therefore, reproduce. As you read this article, think about how the development of urban forests affects their ability to provide benefits to people. ■

Figure 2d. Street tree planted within a sidewalk cut out.

Reflection Section

- What were the scientists trying to do in this study?
- Can you think of two other items that you took an inventory of this past week? What were they?

Method

The scientists estimated three types of tree canopy cover. First, they measured the *radius* of the area beneath each street tree canopy in the community. They assumed that this area would be roughly shaped in a circle. Then, they estimated the amount of canopy cover over streets alone. Finally, they estimated the amount of cover over streets and sidewalks together. They used mathematical equations to estimate the amount of cover over streets and sidewalks.

The scientists used existing information to estimate the total amount of pavement making up streets and sidewalks. For example, they added up all of the street lengths. They found that there were 240 kilometers of streets in the community. (How many miles is this? To calculate, multiply the number of kilometers by .621.) Then, they multiplied 240 by 10.7 meters (or 35 feet) to calculate the total area of street pavement. They estimated that the city had 256 hectares of street pavement. (How many acres is this? Multiply 256 by 2.47 to find out.) They also estimated that there were 58 hectares of sidewalks in the community. (How many acres of sidewalks?)

Reflection Section

- What do you think the numbers 10.7 meters and 35 feet represent?
- Do you think that the amount of tree canopy area covering streets and sidewalks was equal to the total amount of area that street tree canopies covered? Why or why not?

Findings

Overall, about 14 percent of the community's streets and sidewalks were covered by street trees. Of this, about 23 percent of the tree canopy was over streets. (What percentage of the tree canopy was over sidewalks and other surfaces? Hint: Subtract 23 from 100 to find out.) When the scientists compared sidewalks with streets, they found that about 24 percent of the community's sidewalks were covered by street tree canopies.

Reflection Section

- Why do you think a greater percentage of sidewalk area than street area was covered by tree canopies?
- Did this tell the scientists how many benefits people were receiving from street trees? Why or why not?

Implications

Using studies like this one, people can find out how much of their streets and sidewalks are covered by street tree canopies. This will help them to determine whether they might want to plant more street trees to shade more of the pavement. For example, what if the community in this study would like to have 25 percent of their streets and sidewalks covered by trees? They now know that only 14 percent of their streets and sidewalks are covered by street trees. What might they do to reach their goal of 25 percent? ■

Reflection Section

- What is one reason it is important to know how much paved area street trees cover?
- Do you think it might be important to also estimate the amount of grassed areas that street trees cover? Why or why not?

From Maco, S. E. and McPherson, E. G. (2002). Assessing canopy cover over streets and sidewalks in street tree populations. *Journal of Arboriculture*, (286): 270-276.

FACTivity

The question you will answer in this FACTivity is: Were there more acres of streets or sidewalks covered by street tree canopies in this study? Before you answer this question, review the first Reflection Question under "Findings." To answer this question, go to the "Method" and "Findings" sections. Using the information from those sections, complete the table below.

Now that you have these numbers, answer the question posed at the beginning of the FACTivity. Why is the percentage of sidewalk coverage higher than street coverage? Why are there more acres of street coverage than sidewalk coverage?

	Number of Acres in Streets	Number of Hectares in Streets	Number of Acres in Sidewalks	Number of Hectares in Sidewalks	Total Number of Acres in Streets and Sidewalks	Total Number of Hectares in Streets and Sidewalks
Number from "Methods"						
Add Street Numbers and Sidewalk Numbers						
Apply Percent from "Findings"						
Apply Percent from "Findings"						
Subtract Sidewalk Numbers from Total Numbers						

Alternate FACTivity

In this FACTivity, you will adopt-a-tree in your schoolyard. (Depending on how many trees there are around the school, you may need to adopt trees in pairs or groups rather than individually.) Create a tree journal from a notebook. Set time aside to make observations of the adopted tree. While observing the tree, perform some of the following activities:

1. Create bark rubbings.
2. Collect dried leaves from the tree.
3. Conduct leaf identification.
4. Draw the tree during different seasons, focusing specifically on tree canopy.
5. Measure the diameter (diameter at breast height, or dbh) of the tree. (Visit **http://www.cnr.vt.edu/dendro/forsite/si4.htm** for instructions on measuring dbh.)
6. Record insects and animals that live on or around tree. (Place a bed sheet on the ground underneath the tree. Shake the tree vigorously and then record insects that have fallen on to the bed sheet.)
7. Create a photo-biography of the tree.
8. Write a poem about the tree.
9. Develop a song about the tree and perform it for the class or other students in the school.
10. Celebrate Arbor Day by giving students in school a tour of all of the trees on the school grounds and provide information that you have collected about each tree.
11. Research the type of tree and create a Web page or PowerPoint® on the vital statistics of the tree.
12. Create a schoolyard map with tree location and types.
13. Calculate the amount of land covered by trees in your schoolyard. This could be tracked over time.
14. Identify a list of benefits provided by the trees at your school.

Teachers—

See the Schoolyard Tree Inventory and Biodiversity Project Lesson Plan on page 69 for more schoolyard tree activities.