

## SEEING THE FOREST THROUGH THE TREES (AND PEOPLE)—URBAN FOREST ECOSYSTEMS

Brooke Anderson<sup>1\*</sup>, Andrew K. Koeser<sup>1</sup>, Allyson B. Salisbury<sup>2</sup>, Deborah R. Hilbert<sup>1</sup>, Hunter Thorn<sup>1</sup> and Richard J. Hauer<sup>3</sup>

<sup>1</sup>Department of Environmental Horticulture, Center for Land Use Efficiency, Institute of Food and Agricultural Sciences, University of Florida–Gulf Coast Research and Education Center, Wimauma, FL, United States

<sup>2</sup>Center for Tree Science, The Morton Arboretum, Lisle, IL, United States

<sup>3</sup>College of Natural Resources, University of Wisconsin–Stevens Point, Stevens Point, WI, United States

### YOUNG REVIEWERS:

6TH GRADE  
MAXI  
MIDDLE  
SCHOOL

AGES: 11–12  
SOMERSET  
ACADEMY  
PREP  
SUNSET

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### URBAN FOREST

A densely wooded area located in a city.

Urban forest ecosystems are the collections of trees and other woody plants such as bushes and shrubs in urban areas, as well as the non-living (sidewalks, buildings, soil) and living (people, insects, wildlife) things that interact with them. Most humans throughout the world (56%) live in urban forest ecosystems, so it is important that these environments are safe, healthy, and sustainable. This article will point out the urban forests in your life. It will also explain the environmental, health, and societal benefits that urban forests create.

### WHAT IS AN URBAN FOREST?

**Urban forest** is a term used to describe a collection of woody plants (trees, shrubs and bushes) growing in and around urban areas like cities

## ECOSYSTEM SERVICES

Benefits humans receive from nature.

### Figure 1

Urban tree at a playground in Tampa Florida.

(Figure 1) [1]. The woody plants found in urban forests are important to cities because they provide **ecosystem services**. An ecosystem service is a good or a service from the natural environment that benefits humans—from something as simple as making an area beautiful, to something as complex as filtering out air pollutants to clean the air [1]. Fifty-six percent of humans live in urban forests ecosystems and, worldwide, the number of people living in or near cities is steadily increasing. Therefore, we should put more effort into protecting and maintaining urban forests now than we ever have before.



Figure 1

## URBAN TREE CANOPY

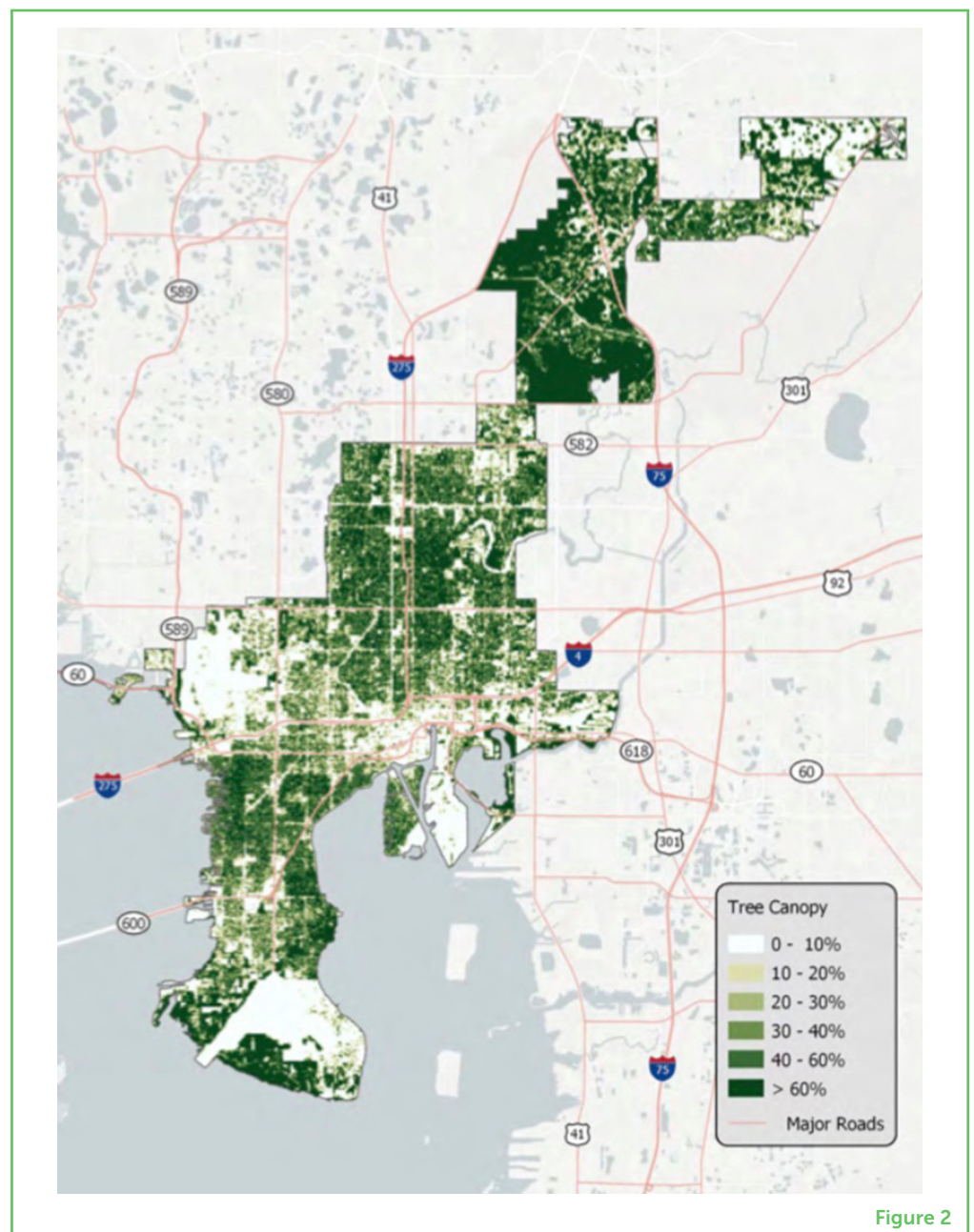
the layer of leaves, branches, and stems of trees that cover the ground when viewed from above.

### Figure 2

This is a map of the city of Tampa, Florida (United States) and its UTC. The city has two large airfields (Tampa International Airport and MacDill Air Force Base) that must be kept clear of trees, and some non-developed forest land along a river flood plain. Those are the two areas you see without any Tree Canopy.

## MEASURING AN URBAN FOREST

A common way to measure a city's urban forest is by observing the **urban tree canopy** (UTC) [1]. The UTC is a measure of how much land in the area is covered by trees. One way to calculate the UTC is to do on-the-ground tree counts and then estimate the tree's crown size. The crown is made up of the branches, leaves, and reproductive structures extending from the trunk or main stems. Another method often used is to analyze aerial images taken from satellites to determine the tree coverage in an area [1]. Once tree coverage is determined a map is created to show an areas UTC (Figure 2). Knowing a city's UTC is important because it helps scientists and city planners track the changes happening to that city's urban forests.



A city with a low UTC could set urban management plans to increase its UTC, or a city with a high UTC could set plans to maintain its canopy coverage.

## ENVIRONMENTAL BENEFITS OF URBAN FORESTS

One ecosystem service provided by urban forests is an improvement in air quality. This benefit happens because trees can filter out air pollutants. A study done in 2006 found that urban forests in the United States filter out 7,11,000 metric tons of pollution each year [2]. The pollutant with the greatest rate of removal was a gas called ozone, followed by tiny particles called particulate matter, and other potentially dangerous chemicals called nitrogen dioxide, sulfur dioxide, and carbon monoxide [2]. All these air pollutants can cause harm to humans and to the environment. Also, carbon dioxide (CO<sub>2</sub>), a **greenhouse gas**, is stored in trees. It is estimated that 700 million metric tons of CO<sub>2</sub> are removed from the atmosphere by urban trees each year. Reducing greenhouse gases helps to combat global climate change and directly benefits the local community by improving air quality.

### GREENHOUSE GAS

A gas that contributes to global warming by trapping the sun's heat near the Earth.

### RUNOFF

The water or other material that drains freely off the surface of something.

### BIORETENTION BASINS

Shallow areas, often containing trees, used to slow and treat stormwater runoff.

### BIODIVERSITY

The variety of species on Earth.

Another ecosystem service provided by urban forests is that they help to improve water quality. During rainstorms, rainwater can be stored on tree leaves. This is beneficial because excessive water **runoff** from cities can cause erosion in nearby streams and rivers and can transport pollution into those bodies of water. Reducing runoff also helps to reduce flooding by limiting the amount of excess water in an area. Trees can also be planted in stormwater-management systems called **bioretention basins**, which act as living filters that can capture pollutants.

The urban forest can also help to conserve the **biodiversity** in an urban area. Trees can be important sources of food and shelter for city-dwelling animals (Figure 3). Some cities also actively protect critically endangered trees and other plants and animals, which further helps with biodiversity [3]. Clearly, urban trees benefit both the environment and the people who live in urban areas.

## HUMAN HEALTH BENEFITS OF URBAN FORESTS

As we have explained, trees and their leaves serve as filters, absorbing dust, small particles, and other air pollutants. These pollutants negatively affect human health and can cause diseases, particularly diseases that affect the respiratory system. People living in areas with better air quality are less likely to develop respiratory diseases like emphysema or lung cancer [4]. Better air quality has also been linked to fewer birth defects, and it can reduce children's chances of developing asthma.

### Figure 3

As trees grow older and bigger, the benefits they provide increase. This massive tree (called a live oak) shades this park and serves as a home to animals like squirrels and to plants like the Spanish moss seen trailing down from its branches.



Figure 3

A higher UTC in cities is associated with increased exercise for city residents. This is because cities with higher UTCs generally have neighborhoods that are better for taking walks [5]. Neighborhoods that are more walkable encourage people to walk places instead of taking cars or buses. Walking daily has known health benefits, including lower cholesterol, decreased risk of heart disease, and a healthier resting heart rate. Overall, walkable cities promote a healthier lifestyle. The more green spaces people have available, the more they will take advantage of such spaces.

Green spaces also reduce stress and anxiety. Studies have linked longer levels of exposure to nature with lower levels of stress [5]. Lower stress levels increase a person's overall wellbeing, because we are more likely to feel refreshed after enjoying outdoor space. In fact, doctors sometimes prescribe time in forests or other natural spaces for patients coping with stress! Cities with high UTCs give residents more green spaces to enjoy.

## SOCIETAL BENEFITS OF URBAN FORESTS

When people enjoy urban forests, communities see benefits. A higher UTC creates a stronger sense of community and safety. Studies show that improving UTC leads to increased self-esteem, increasing a community's overall social identity. Residents feel empowered when they realize they can control their surrounding environment [4].

Also, cities with higher UTCs provide more opportunities for kids to play outside. A study in Chicago found that urban forests increase the amount of time that children spend playing outside, and that these

children were healthier than children who do not. This is because higher levels of outdoor play provide health benefits for children [4]. Some studies have found that more green space around schools can improve student grades and test scores, though more research is needed to better understand the relationship between urban forests and school performance [6].

The Chicago study mentioned above also found a relationship between children spending more time playing outside and a decrease in the city's overall crime rate. The crimes that decreased ranged from disorderly conduct all the way to violent crimes [4]. Lower crime rates improve the safety of neighborhoods, which makes residents want to be more involved in the community. These benefits have been proven to increase property values in the area as well, because people want to live in safe areas [4]. This connects back to the stronger sense of community.

## THE BENEFITS ARE CLEAR

Urban forests positively impact residents by providing ecosystem services like cleaner air and water. Cleaner air and water can improve the health of city residents. Not only that, people who live in well-developed urban forests live an overall healthier lifestyle, and they even have lower levels of stress. Furthermore, high-UTC areas are safer and have a stronger sense of community, which increases property values. The higher a city's UTC, the more these benefits are amplified. These benefits clearly demonstrate that urban forests are extremely valuable ecosystems that should be protected and enhanced whenever possible.

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## YOUNG REVIEWERS



### 6TH GRADE MAXI MIDDLE SCHOOL, AGES: 11–12

Within the Maxi Middle School program we spend time every week learning about ourselves and our communities. Learning about how science works and new discoveries happening is a fun way to engage with the world, and improve our English!



### SOMERSET ACADEMY PREP SUNSET, AGES: 10–11

At Somerset Academy Prep we are excited to learn about all things science! Living in Miami has really influenced our interest in urban ecosystems. Participating in different STEM activities is our JAM! We love to work as a team and inquire about the world around us. We feel lucky to collaborate together to review this journal and hope to participate in more projects in the future.

## AUTHORS



### **BROOKE ANDERSON**

I am an environmental scientist who also teaches high school. I love education and enjoy teaching my students about how to live more sustainably. In my free time I do urban forestry research for the University of Florida. When I am not working, I love going to the beach, hiking, and reading. \*[brookeanderson@ufl.edu](mailto:brookeanderson@ufl.edu)



### **ANDREW K. KOESER**

Andrew Koester is a scientist at the University of Florida who investigates how humans and nature impact trees and green spaces in cities. When not doing science, Andrew loves playing with his daughters, riding his bike, walking his dog, and practicing martial arts.



### **ALLYSON B. SALISBURY**

I am an environmental scientist who studies how to help trees grow in difficult places such as the side of highways or in small cutouts in sidewalks. I love that my job as a research scientist requires me to use my knowledge of plants, water, and soil along with other skills like writing and making graphs and illustrations. When not at work, I enjoy being outdoors, cooking, knitting, playing board games, and spending time with my friends and family.



### **DEBORAH R. HILBERT**

I am a scientist who studies how to grow trees in cities and how people impact urban forests. My research is used to help create cities where people and trees can coexist together long into the future. When I am not doing science, I like planting trees with friends, writing poetry, exploring swamps, and taking my tabby cat for walks on a leash.



### **HUNTER THORN**

My name is Hunter and I work for the University of Florida in a lab studying urban trees. I travel to different parts of Florida's cities to inventory and assess the trees there. Whether deep in a swamp or in your neighbor's front yard, understanding the trees that make our cities thrive is my job.



### **RICHARD J. HAUER**

Rich's current role as a Forestry Professor started from his childhood explorations of fields and forests near his home. He took this curiosity into his career and understanding the management of trees in communities, technically called urban and community forestry. He enjoys educating university students and others about how trees grow and what you can do to best grow urban tree populations. His curiosity still drives his professional endeavors today.