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Whatever the Soil Conditions, Urban Forest Patches Are Important

There are nearly one million small forest patches in the Northeast United States alone. For many Americans, interacting with these patches is the main way they spend time with trees. Urban forests, large and small, provide numerous environmental benefits to people. According to Nancy Sonti, a research ecologist at the USDA Forest Service, Northern Research Station, "Recent research shows that larger canopy patches provide cooling benefits out of proportion to their size. It's important to preserve and grow patches of forest in the city."

Research has also shown that many urban forests are structurally similar to rural forests and are shaped by many of the same factors. One major difference between rural and urban forests is often the health and composition of the soil. City soils reflect a variety of complex changes, including years of digging, earthmoving, and building, that have altered the landscape and drastically changed the soils.

An article by Sonti and her colleagues in the February 2022 issue of Restoration Ecology describes research on the relationship between urban trees and soils. The study team planted silver maple (*Acer saccharinum*), black birch (*Betula lenta*), red oak (*Quercus rubra*), and Canadian serviceberry (*Amelanchier canadensis*) in four urban soil types and one greenhouse soil mix. They found that while the seedlings grown in the urban soils had the lowest survival rate, an impressive 80 percent of them still made it.

"Seeing how well the tree species did in some of the urban soil types shows these sites are ecologically functioning, productive natural areas in the city." — Sonti

KEY MANAGEMENT CONSIDERATIONS

- Urban soil can host a range of healthy trees if appropriate species are planted.
- Restoring native trees in urban forest patches has many benefits. Trees help cool the environment and enhance water absorption into soils. Urban forests are also the main way that many city dwellers interact with trees.
- Measuring the growth of native tree species in various soil types is helping to determine the best species to plant in urban forest restoration efforts. Matching tree species to soil type saves time and resources.

A Forest Service researcher measures measures chlorophyll fluorescence in tree seedling leaves to assess their photosynthetic capacity. USDA Forest Service photo by Rich Hallett.

Growth Potential

Sonti's research was part of the 10-year "Million Trees NYC" campaign, which successfully planted one million trees across New York City. For the study, Sonti and her colleagues selected tree species that grow naturally in the New York region. While these trees are well studied in a rural context, scientists know less about how they grow in urban soils.

Researchers measured how many trees survived and calculated stress levels based on how well the trees grew and how they were affected at the cellular level. Interestingly, black birch and silver maple seedlings had the highest stress scores despite growing the fastest. Serviceberry had the lowest stress scores. The trees with lower stress levels tend to be healthier and live longer if they are able to overcome challenges such as deer browse and competition from aggressive, nonnative plants.

These findings suggest that urban soils can host successful native forest restoration efforts, Sonti says, if land managers plant species that are compatible with site conditions. Untapped potential exists beneath our feet, even in the most densely populated places in the country.

Sharing Information Across a Network of Researchers

According to Sonti, New York City has an impressive history of natural areas management dating back to the 1980s. "They have amassed a lot of institutional knowledge," says Sonti.

New York City, Baltimore, Philadelphia, and other cities across the country are a part of the Forest Service's Urban Field Station Network. The network promotes exchange of information between cities and encourages multi-city collaborations for tree planting efforts. Within the Urban Field Station Network, the Northeast Urban Silviculture Network promotes the sharing of ideas and experiences among researchers in Northeast urban centers.

> *"Recent research shows that larger canopy patches provide cooling benefits out of proportion to their size. It's important to preserve and grow patches of forest in the city." — Sonti*

Sonti's team hopes that researchers in other cities will use her study's design to examine tree survival rates in different kinds of soils. Sonti is currently working on another study in Baltimore, MD, that will help urban foresters expand the team's work from the greenhouse to the field. The researchers are planting seedlings in canopy gaps and on degraded forest sites to help keep out unwanted, nonnative plants species.

Before using resources on trees that are not likely to survive, Sonti said it's always better to test out common tree species and avoid planting species that are not likely to do well. "I think seeing how well the tree species in our study did in some of the urban soil types shows that these sites are functioning well ecologically, and that they are productive natural areas in the city."

Leaf clips are attached to native tree seedlings before chlorophyll fluorescence is measured. USDA Forest Service photo by Rich Hallett.

A Forest Service researcher collects data from tree seedlings to access their growth. USDA Forest Service photo by Rich Hallett.

Project Lead

Nancy Sonti is a research ecologist with the Communities and Landscapes of the Urban Northeast research unit. Learn more about her work at https://www.fs.usda.gov/research/about/people/nancyfsonti.

FURTHER READING

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