Choosing the Right Trees Can Affect Air Quality

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Cities can improve their air quality simply by planting the right mix of trees for their climate, according to a study by researchers at the SUNY College of Environmental Science and Forestry (ESF).

The ideal combination of greenery can increase carbon sequestration and reduce the emission of volatile organic compounds (VOC), such as isoprene, resulting in better-quality air and a reduction in greenhouse gases, the study shows.

“We can make the air a lot healthier for people to breathe,” said Dr. Allan P. Drew, a forest ecologist at SUNY-ESF, in Syracuse, N.Y. “By modifying the planting mixture and using recommended management practices, we could reduce the carbon emissions.”

The ESF researchers supplied their local officials with a list of recommendations based on the city’s typical weather conditions. But city officials anywhere could adapt the methods to their own climate, Drew said.

In Syracuse, a Central New York city with an average annual temperature of 47.4 degrees Fahrenheit, the ideal mixture would consist of 31 species of trees, including American basswood, dogwood, Eastern white pine, Eastern red cedar, gray birch, red maple and river birch.

“Any one of these trees has value in an urban setting for one reason or another,” Drew said. “Some of them are attractive, others will grow in

compacted soil. They all serve a purpose."

While trees perform the beneficial function of removing carbon from the atmosphere, they also emit volatile organic compounds, primarily monoterpenes and isoprene, that are involved in the formation of ozone and carbon monoxide and they can exacerbate smog problems. While ozone in the upper atmosphere is beneficial to humans, providing protection from ultraviolet radiation, it is considered a pollutant at ground level, causing respiratory ailments, damaging vegetation and causing some rubber and plastics to deteriorate.

An increase of carbon in the atmosphere is believed by many researchers to be tied to rising global temperatures. Removing it from the atmosphere and sequestering it in vegetation may help mitigate climate change.

Some tree species are better at sequestering carbon than others. And some emit less VOCs than others. The ideal tree mixture combines the best of both types.
"It all helps," said Dr. Richard C. Smardon, chair of ESF's Faculty of Environmental Studies. "If you reduce carbon emissions, you really can cut down on greenhouse gases."

Studies have been done regarding changes that can be made in automotive emissions and construction practices, he said, but no one knows precisely how much trees affect the equation.

"Nobody has really factored in the effect of vegetation. Trees serve other functions, too. They are aesthetic, they help control runoff, they affect the microclimate," he said. "Trees do a lot of things, but it would take a lot of trees in the right mixture to maximize the benefits."

The researchers considered only native species or non-native species that

are not invasive.

“You wouldn’t want to plant buckthorn out there. Norway maple’s another one you wouldn’t want,” Drew said, referring to two non-native species that spread vigorously. “And you won’t see the tree of heaven on that list.”

To determine the best mix of trees for Syracuse, the researchers used the U.S. Forest Service's Urban Forest Effects Model (UFORE), which helps quantify urban forests and the functions they perform. The model uses field, air pollution and meteorological data to calculate attributes about a particular city's forest, including species composition, diameter distribution, tree health, species diversity and exotic vs. native species distribution. The model can also calculate the effect of an urban forest on air pollution and greenhouse gases.

"Not every city has UFORE data," said David Nowak, a Forest Service project leader who is based at ESF. "In this case, the researchers refined the data in a new way to make recommendations. They went a step further with how they used the information. As far as I know, no one else has done it this way before."

The researchers used Forest Service management recommendations that suggest planting trees with specific qualities: large size (at least 25 feet tall), long life (50 years plus), disease resistance, and native or non-invasive status.

In the case of Syracuse, the 31 species they recommended is less than half the 72 species currently listed as part of the city’s urban forest, which is defined as all the trees on public and private land, along streets, and in residential areas, parks and commercial developments.

The report recommends that the total include a maximum of 10 percent

of any one species, 20 percent of any one genus and 30 percent of any one family.

The species name for Eastern white pine, for example, is Pinus strobus. The genus Pinus comprises about 100 species, and the tree falls into the broader family Pinaceae, which includes pines, firs and larches.

“We have shown that significant reduction in greenhouse gases can be achieved using a few simple recommendations in the urban forest of Syracuse,” the study says. “If the urban forest mixture is changed to include more desirable trees, and the locations of certain trees are chosen carefully, Syracuse can easily become a contributor to the reduction of greenhouse gases in the atmosphere.”

Drew and Smardon worked on the study with four students: John Domm, Eric Ripley, Janet Tordesillas and Richard Greene.

Soruce: SUNY College of Environmental Science and Forestry