Forest Service study finds urban trees removing fine particulate air pollution, saving lives

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A new study by Forest Service scientists and colleagues finds that trees play an important role in reducing fine particulate air pollution. Credit: US Forest Service

In the first effort to estimate the overall impact of a city's urban forest on concentrations of fine particulate pollution (particulate matter less than 2.5 microns, or PM2.5), a U.S. Forest Service and Davey Institute

study found that urban trees and forests are saving an average of one life every year per city. In New York City, trees save an average of eight lives every year.

Fine particulate air pollution has serious health effects, including premature mortality, pulmonary inflammation, accelerated atherosclerosis, and altered cardiac functions. In a study recently published on-line by the journal *Environmental Pollution*, researchers David Nowak and Robert Hoehn of the U.S. Forest Service and Satoshi Hirabayashi and Allison Bodine of the Davey Institute in Syracuse, N.Y., estimated how much fine particulate matter is removed by trees in 10 cities, their impact on PM2.5 concentrations and associated values and impacts on human health.

The study, "Modeled PM2.5 Removal by Trees in Ten U.S. Cities and Associated Health Effects," is available at: http://www.nrs.fs.fed.us/pubs/43676

"More than 80 percent of Americans live in urban areas containing over 100 million acres of trees and forests," said Michael T. Rains, Director of the Forest Service's Northern Research Station and Acting Director of the Forest Products Lab. "This research clearly illustrates that America's urban forests are critical capital investments helping produce clear air and water; reduce energy costs; and, making cities more livable. Simply put, our urban forests improve people's lives."

Cities included in the study were Atlanta, Baltimore, Boston, Chicago, Los Angeles, Minneapolis, New York City, Philadelphia, San Francisco, and Syracuse, NY.

Overall, the greatest effect of trees on reducing health impacts of PM2.5 occurred in New York due to its relatively large human population and the trees' moderately high removal rate and reduction in pollution

concentration. The greatest overall removal by trees was in Atlanta due to its relatively high percent tree cover and PM2.5 concentrations.

"Trees can make cities healthier," Nowak said. "While we need more research to generate better estimates, this study suggests that trees are an effective tool in reducing air pollution and creating healthier urban environments."

The removal of PM2.5 by urban trees is substantially lower than for larger particulate matter (particulate matter less than 10 microns – PM10), but the health implications and values are much higher. The total amount of PM2.5 removed annually by trees varied from 4.7 metric tons in Syracuse to 64.5 metric tons in Atlanta, with annual values varying from $1.1 million in Syracuse to $60.1 million in New York City. Most of these values were dominated by the effects of reducing human mortality; the average value per reduced death was $7.8 million. Reduction in human mortality ranged from one person per 365,000 people in Atlanta to one person per 1.35 million people in San Francisco.

Researchers used the U.S. Environmental Protection Agency's BenMAP program to estimate the incidence of adverse health effects, such as mortality and morbidity, and associated monetary value that result from changes in PM2.5 concentrations. Local population statistics from the 2010 U.S. Census were also used in the model. i-Tree, a suite of tools developed by the Forest Service and Davey Institute, was used to calculate PM2.5 removal and associated change in concentrations in the study cities.

Provided by USDA Forest Service

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