



Calculating Tree Benefits for New York City

City of New York
Parks & Recreation
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Our street trees work for us every day, providing benefits that directly improve our quality of life. Trees purify and cool the air, reduce stormwater runoff, and conserve energy. They increase property values, beautify neighborhoods, and improve human health and well-being. Until recently, it was very difficult to put a

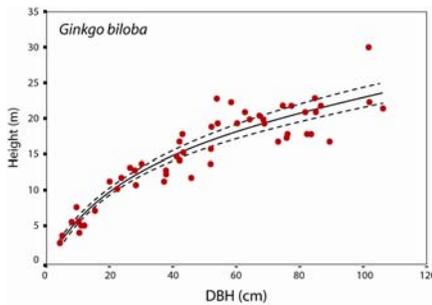
dollar value on these benefits. But now scientists with the U. S. Forest Service have developed a way to assess the bottom line impact of many—but not all—benefits of urban trees.

Benefits are directly linked to tree size. The environmental benefits of trees arise from respiration and transpiration – the biological processes by which trees breathe and absorb water from the environment. Because these processes involve interactions between a tree’s leaves, the environment, and the atmosphere, the benefits increase as trees grow in size. In general, the larger a tree, the more canopy cover and leaf surface area (the total area of the leaf spread) it has.

How do we take tree measurements? Measuring the canopy size, leaf surface area and total organic matter (biomass) for every tree would be impossible. Instead, scientists designed a method to sample a small number of trees that would provide data that could be extrapolated to the entire tree population.

Modeling tree growth to predict benefits.

The U.S. Forest Service can model tree growth by individual species according to different climate regions. When information about tree size and species is fed into the growth model, it yields an estimate of canopy size, leaf area and biomass for every street



tree in that region. Tree benefits can then be calculated using local data including hourly climate and air pollution concentrations, local energy costs, power plant fuel types and emissions, and building construction information. The benefits are detailed below.

Air Quality Improvement.

Leaves absorb gaseous pollutants (carbon dioxide, nitrogen dioxide, and sulfur dioxide), and capture air-borne particles including dirt, dust and soot. Trees also prevent the release of many airborne pollutants by reducing energy generation. Ground level ozone, a contributor to greenhouse gas formation, is reduced through the tree’s ability to lower air temperatures.



ANNUAL BENEFIT VALUE TO NYC: \$5.3 MILLION

Energy Savings. Trees provide shade, reducing the demand for electricity for cooling in the summer. Trees also reduce wind speeds, slowing the loss of heat from interior spaces during the winter. Trees cool the air through the process of transpiration, where moisture is converted to water vapor. An estimate for energy usage for every building in NYC was derived from data on building age, tree shading effects, and local climate. This estimate was drawn with two scenarios—with and without street trees—in order to show the difference in the resulting energy use. Local energy prices were then used to calculate the value of the impact of trees on building energy use.

ANNUAL BENEFIT VALUE TO NYC: \$27.8 MILLION

Carbon Dioxide (CO₂). Trees indirectly reduce emissions of CO₂ from power plants by reducing building energy use. Also as trees grow, they remove CO₂ from the atmosphere and store it in woody plant tissue. At the same time, trees release CO₂ as they decompose. These releases are subtracted from the total amount of CO₂ avoided from power generation and absorbed by tree growth to calculate the net CO₂ benefit.



ANNUAL BENEFIT VALUE TO NYC: \$754,947

Reducing Stormwater Runoff. Trees help reduce flooding and improve water quality, as runoff flowing over impervious surfaces picks up contaminants including oil and metals. Trees intercept rain on their leaf, branch and stem surfaces and by absorbing water through their roots. The water that trees intercept in NYC each year was calculated using local rainfall data.



ANNUAL BENEFIT VALUE TO NYC: \$36 MILLION

Property Value and Other Benefits.

Research has shown that homes with a tree in front sell for almost 1 percent more than similar homes without trees. The difference in sale price indirectly reflects the value buyers place on trees and their more intangible benefits, such as aesthetics. This difference was applied to the median New York City home resale price (\$537,300) to calculate the total value.



ANNUAL BENEFIT VALUE TO NYC: \$52 MILLION

TOTAL ANNUAL BENEFIT VALUE TO NYC: \$122 MILLION

Did you know?

- A large, healthy tree removes almost 70 times more air pollution each year than a small, newly planted tree.
- London planetrees remove more than 77 tons of air pollution each year, over one-quarter of all pollutant removal by NYC’s trees.
- Each year 272 tons—the equivalent of 40 adult elephants—of air pollution are intercepted or absorbed by trees in NYC
- Average electricity and natural gas cost savings in NYC are \$47 per street tree
- Each year 313 tons of air pollution are avoided because of energy savings resulting from reduced emissions
- The average street tree in NYC intercepts 1,432 gallons of stormwater each year; all our street trees capture 890 million gallons per year