

## Air Pollution Removal

### Summary

The Air Pollution Removal program is based on research conducted by David Nowak, PhD, of the U.S. Forest Service. Dr. Nowak developed a methodology to assess the air pollution removal capacity of urban forests with respect to pollutants such as Nitrogen Dioxide (NO<sub>2</sub>), Sulfur Dioxide (SO<sub>2</sub>), Ozone (O<sub>3</sub>), Carbon Monoxide (CO), and particulate matter less than 10 microns (PM<sub>10</sub>). Pollution removal is reported in pounds and U.S. dollars, on an annual basis.

Removal rates were estimated for 55 cities:

Albany, NY	Honolulu, HI	Phoenix, AZ
Albuquerque, NM	Houston, TX	Pittsburgh, PA
Atlanta, GA	Indianapolis, IN	Portland, OR
Austin, TX	Jacksonville, FL	Providence, RI
Baltimore, MD	Jersey City, NJ	Roanoke, VA
Baton Rouge, LA	Kansas City, MO	Sacramento, CA
Boston, MA	Los Angeles, CA	Saint Louis, MO
Bridgeport, CT	Louisville, KY	Salt Lake City, UT
Buffalo, NY	Memphis, TN	San Diego, CA
Charleston, SC	Miami, FL	San Francisco, CA
Cincinnati, OH	Milwaukee, WI	San Jose, CA
Cleveland, OH	Minneapolis, MN	Seattle, WA
Columbia, SC	Nashville, TN	Tampa, FL
Columbus, OH	New Orleans, LA	Tucson, AZ
Dallas, TX	New York, NY	Tulsa, OK
Denver, CO	Newark, NJ	Virginia Beach, VA
Detroit, MI	Oklahoma City, OK	Washington, DC
El Paso, TX	Omaha, NE	
Fresno, CA	Philadelphia, PA	

CITYgreen will determine the Air Quality city nearest the site, or the user can manually identify a city that better represents their air quality, and the results from that city are used.

The program estimates the amount of pollution being deposited within a certain given study site based on pollution data from the nearest city, and then estimates the removal rate based on the area of tree and/or forest canopy coverage on the site.

### Technical Methodology

The methodology determines a pollutant removal rate or flux (F) by multiplying the deposition velocity ( $V_d$ ) by the pollution concentration (C).

$$F \text{ (g/cm}^2\text{/sec)} = V_a \text{ (cm/sec)} \times C \text{ (g/cm}^3\text{)}$$

The pollutant flux is then multiplied by the area of the surface over periods in which the pollutant is known to exist over that surface in order to estimate total pollutant flux by hour for that surface. Hourly fluxes can be summed to estimate daily, monthly, or yearly fluxes.

Currently, air pollution estimates generated from CITYgreen are designed for urban and suburban forests. Therefore, CITYgreen analyses run on sites in rural areas, far removed from cities, may over estimate tree benefits.

### **References**

Nowak, D.J. 2003. U.S. Forest Service, Unpublished. City specific data produced for American Forests.