

Trees—an Innovative Solution to Air Pollution



California has come a long way from the time when the street lights came on during the day to light our way through the smog, but much work remains to be done. Our state continues to perform poorly on the American Lung Association's list of cities with the dirtiest air. We'll keep working to improve our industry, clean up our cars, and find greener ways of making energy, but as our population grows, so too will the challenges. We can't afford to overlook any solutions.

Air pollution knows no boundaries and reaches us where we work, live and play. Trees can combat air pollution across boundaries and work toward giving us the cleanest air to breathe.

How do trees help clean the air?

- Leaves of trees absorb or intercept air pollutants, including small particulate matter and the components of smog
- Trees planted in strategic locations around buildings help conserve energy, particularly in areas with more extreme climates; reduced energy use means reduced emissions of pollutants from power plants
- Trees can be planted to shade parked cars, lowering temperatures and reducing evaporative emissions—a significant source of the pollutants that cause smog

Why trees are a good solution...

- A 2003 study by the Center for Urban Forest Research determined that strategically increasing the tree canopy in California by **30% to reduce energy consumption** would eliminate the need to build seven 100-MW power plants and all the associated pollution.ⁱ
- An astonishing 16% of vehicle-related pollution is produced when cars are *not running*; high temperatures cause fuel and oil to vaporize and leak from tanks and hoses.ⁱⁱ By shading asphalt and parked cars, trees reduce the temperature of both the atmosphere and the vehicle itself, reducing evaporative emissions.
- One large tree in the San Joaquin Valley can absorb more than 5 lbs of smog-causing pollutants each year and intercept 3 lbs of small particulate matter. The same tree, planted strategically to conserve energy, can help avoid the production of another 1 lb of pollutants at the power plant.ⁱⁱⁱ
- At the larger scale, a recent study estimating the environmental benefits of the trees to be planted in the Million Trees LA campaign calculated a total reduction in air pollutants over the lifetime of the project of 3,100 tons of ozone, 2,500 tons of

nitrogen dioxide, 400 tons of sulfur dioxide, 2,400 tons of small particulate matter, and 500 tons of volatile organic compounds. This ecosystem service provided by the trees is valued at \$68 million.^{iv}

- The EPA has begun to allow tree planting programs to be included in State Implementation Plans as a strategy to reduce air pollution levels and meet air quality standards.^v

Three things to remember:

We'll get the greatest air quality improvements from our urban forest by keeping these factors in mind:

(1) Tree size and species—big trees are able to intercept and absorb the greatest amount of pollutants^{vi}

(2) Tree location—target sites that maximize energy conservation to reduce pollution emissions at the power plant^{vii}; plant trees to shade parking lots and driveways as a way to reduce evaporative emissions from fuel tanks and hoses.^{viii}

(3) Tree health—make sure trees have enough soil and room to grow and give them the proper care, especially in the early years.^{ix}

We've made great strides towards cleaning up our air. We'll need every strategy available to reach our goals, and trees should be one of the solutions.

Sources for more information

- Air quality improvements of the urban forest can be estimated using the i-Tree Suite. Design allows you to estimate the air quality improvements for one tree at a time. Streets uses data collected in the field to calculate the environmental benefits of a municipality's street trees. Eco estimates the environmental benefits of the entire urban forest or of any defined area and also requires field data collection. [www.itreetools.org]
- US Forest Service Northern Research Station's website on Urban Tree Effects on Air Quality and Climate: http://nrs.fs.fed.us/units/urban/focus/air_quality_climate/
- The Urban Ecosystems and Processes team (formerly the Center for Urban Forest Research) of the US Forest Service: <http://www.fs.fed.us/psw/programs/uesd/uep/research/studies.php?TopicID=11>
- For information on including trees in a State Implementation Plan: http://www.wflccenter.org/ts_dynamic/research/22_pdf_file.
- California Urban Forests Council: <http://www.caufc.org/>
- Invest From the Ground Up: <http://www.investfromthegroundup.org>

ⁱ McPherson EG, Simpson JR (2003) Potential energy savings in buildings by an urban tree planting programme in California. *Urban Forestry & Urban Greening*. 2: 73-86.

ⁱⁱ Scott KI, Simpson JR, McPherson EG (1999) Effects of tree cover on parking lot microclimate and vehicle emissions. *Journal of Arboriculture* 25:129–142.

References

ⁱⁱⁱ McPherson EG, Simpson JR, Peper PJ, Xiao Q (1999) Tree Guidelines for San Joaquin Valley Communities. Western Center for Urban Forest Research and Education, US Forest Service, Davis, CA.

^{iv} McPherson EG, Simpson JR, Xiao Q, Wu C (2008) Los Angeles 1-Million Tree Canopy Cover Assessment. General Technical Report 207. US Forest Service, Pacific Southwest Research Station, Albany, CA.

^v US EPA (2004) Incorporating emerging and voluntary measures in a State Implementation Plan. EPA Office of Air and Radiation, Research Triangle Park, NC.

^{vi} Center for Urban Forest Research (2004) The Large Tree Argument.

http://www.fs.fed.us/psw/programs/uesd/uep/products/cufr_511_large_tree_argument.pdf

^{vii} Center for Urban Forest Research (2002) Green plants or power plants?

http://www.fs.fed.us/psw/programs/uesd/uep/products/3/cufr_148.pdf

^{viii} Center for Urban Forest Research (2002) Where are all the cool parking lots?

http://www.fs.fed.us/psw/programs/uesd/uep/products/3/cufr_151.pdf

^{ix} The Urban Ecosystems and Processes team has published a series of community tree guides (http://www.fs.fed.us/psw/programs/uesd/uep/tree_guides.php) with great tips for tree planting and care.

^x Carlton AG, Pinder RW, Bhave PV, Pouliot GA (2010) To what extent can biogenic SOA be controlled? *Environmental Science and Technology*. 44:3376–3380.