

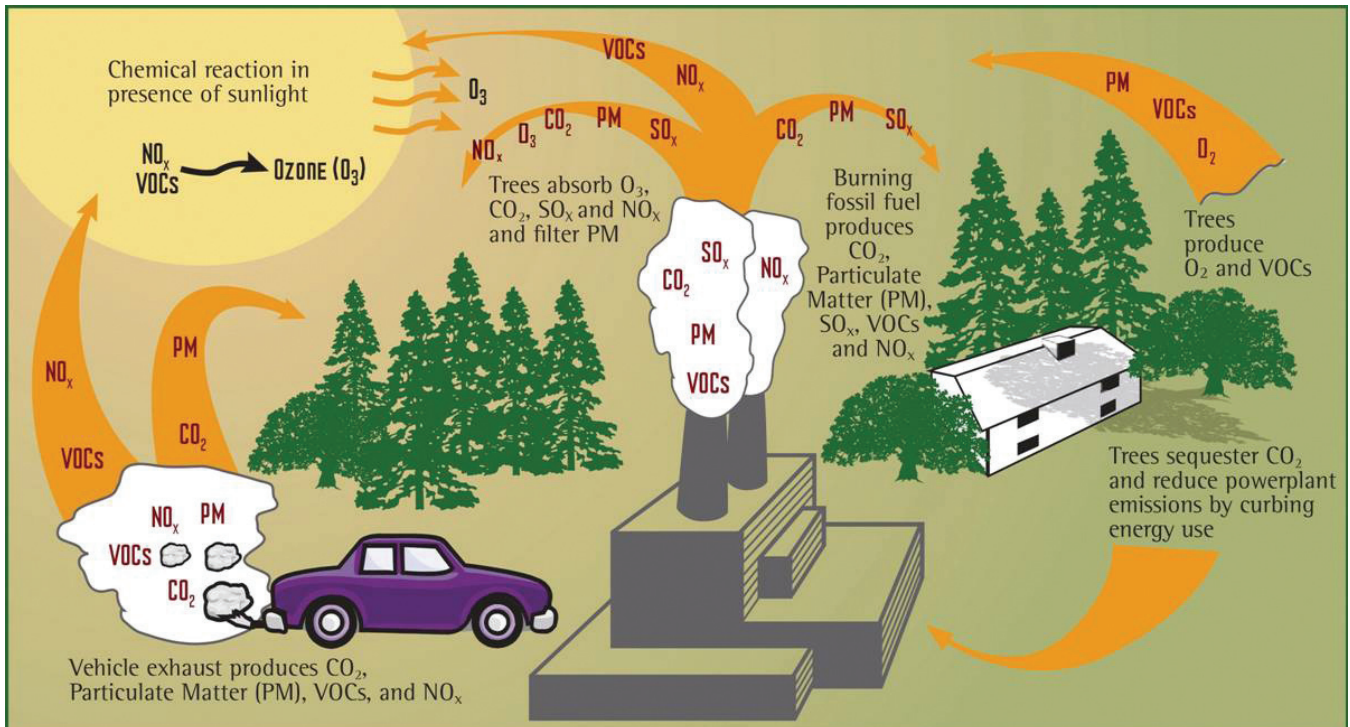
Trees and the Clean Air Act: Strategic tree planting in Sacramento

Trees, the EPA, and cleaner air

The Clean Air Act requires that all states with unhealthy levels of air pollutants submit a State Implementation Plan (SIP) that describes the methods that will be used to meet federal air quality standards. Until recently, SIPs have aimed mainly at reducing pollutant output at the source: power plants, factories, and vehicles. Recently, the Environmental Protection Agency (EPA) has begun to encourage new, innovative measures to fight air pollution and **trees** are being considered as **one part of the solution**.

of sunlight to produce ozone, Sacramento's biggest air quality problem. The Sacramento metropolitan area is among the ten most ozone-polluted areas in the country, exceeding the accepted levels as many as 40 days a year depending on weather conditions.

Vehicles and power plants also produce small particulate matter (PM) and carbon dioxide. Particulate matter has been linked to increased severity of asthma attacks and can have serious consequences for the elderly, children, and people suffering from lung and heart disease. Carbon dioxide contributes to global warming.



Sacramento's air quality problem

Vehicles, including cars, trucks, buses, trains, and agricultural and construction equipment, cause the majority of Sacramento's air pollution with most of the remainder emitted by power plants. Vehicles and power plants give off nitrogen oxides (NO_x) and volatile organic compounds (VOCs), which combine in the presence

How trees can help

California has long been in the forefront of the battle to fight air pollution with strict vehicle emissions laws, high fuel efficiency standards and innovative programs to reduce pollutants at the source; and important strides have been made. Still, because the population of California is growing so fast, there are more and more vehicles on the



road, and more and more energy is needed. Innovative ways to clean the air are necessary.

Trees fight air pollution in several ways. First, they absorb or intercept pollutants on their leaves, branches, and trunk. Second, by lowering air temperatures, trees reduce our need for energy for air conditioning, which reduces the production of pollutants at the power plant. Third, by shading streets and parking lots, trees also reduce temperatures of parked vehicles, which reduces the amount of pollutants leaking from hoses and fuel tanks.

Although trees have many positive effects on air quality, some species also give off their own VOCs, one of the building blocks of ozone. These are known as biogenic volatile organic compounds or BVOCs. The impact of BVOCs on air quality is not well understood: scientists are not sure how BVOCs react with NO_x or what impact the temperature-lowering effects of trees have on the reaction. In our studies, we consider BVOCs to have the same effect on air pollution as other VOCs.



The project

The Center for Urban Forest Research is working with the Sacramento Tree Foundation and the Sacramento Metropolitan Air Quality Management District to study the feasibility of using trees to clean the air. We have recently completed a preliminary study that

- Assessed the current urban forest.
- Modeled the changes in air pollutants that could be expected from five different planting scenarios.
- Developed a tree planting plan for inclusion in the State Implementation Plan.

For each scenario, 1 million trees were planted by 2018 and only species known to be low emitters of BVOCs

were included; the five scenarios varied according to the number of new versus replacement trees.

The results

Air quality results varied according to the scenario. If the goal of the planting is to reduce BVOC emissions, then the scenario in which all 1 million trees were planted as replacements for high emitters had the greatest impact, lowering BVOC emissions by about 1 ton per day (tpd). On the other hand, this scenario had the least impact on other types of pollutants, as it merely involved replacing fully grown trees that are working to absorb air pollutants

and provide shade with younger, and therefore, smaller and less efficient replacements.

The scenario in which all 1 million trees were new had the greatest overall impact on air quality. In this case, BVOC emissions were increased slightly by 0.13 tpd, but other pollutant reductions were substantial:

- Nitrogen oxides: 0.24 tpd
- Particulate matter: 1.2 tpd
- Ozone: 1.5 tpd

Clean Air Act regulations require that the Sacramento metropolitan area reduce its VOC emissions by 12 tpd and NO_x emissions by 21 tpd from forecasted 2018 levels. The urban forest-related changes projected here would **help meet air quality goals**, achieving as much as 8% of the required reductions in VOCs and 1.1% of the required reductions in NO_x , depending on the scenario.

The new trees won't just be cleaning the air. They will also be providing the residents of Sacramento and the surrounding area with **numerous benefits**: less spending for energy, reduced atmospheric carbon dioxide levels, cleaner stormwater, increased property values, improved physical and mental health, a greater sense of place, and a more beautiful environment.

For more information on this and other urban forestry projects, visit: <http://www.fs.fed.us/psw/programs/cufr/>