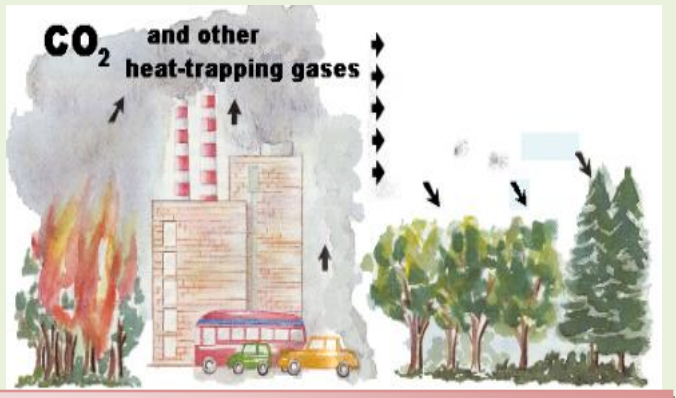
Tree reducing air pollution

Urban vegetation can directly and indirectly affect local and regional air quality by altering the urban atmospheric environment. The four main ways that urban trees affect air quality area:

Temperature reduction and other microclimatic effects
Removal of air pollutants
Emission of volatile organic compounds and tree maintenance emissions
Energy effects on buildings
Source : The effects of urban trees on air quality, David J. Nowak, USDA Forest Service, Syracuse, NY



The burning of fossil fuels for energy and large scale forest fires such as in the tropics are major contributors o the buildup of CO_2 in the atmosphere. Managing and protecting forests and planting new trees reduces CO_2 levels by storing carbon in their roots and trunk and releasing oxygen into the atmosphere.Source : Benefits of Urban trees, South carollna forestry commision

Temperature Reduction

Tree transpiration and tree canopies affect air temperature, radiation absorption and heat storage, wind speed, relative humidity, turbulence, surface albedo, surface roughness and consequently the evolution of the mixing-layer height. These changes in local meteorology can alter pollution concentrations in urban areasb. Although trees usually contribute to cooler summer air temperatures, their presence can increase air temperatures in som instancesc. In areas with scattered tree canopies, radiation can reach and heat ground surfaces; at the same time, the canopy may reduce atmospheric mixing such that cooler air is prevented from reaching the area. In this case, tree shade and transpiration may not compensate for the increased air temperatures due to reduced mixingd. Maximum mid-day air temperature reductions due to trees are in the range of 0.04oC to 0.2oC per percent canopy cover increasee. Below individual and small groups of trees over grass, mid-day air temperatures at 1.5 m above ground are 0.7oC to 1.3oC cooler than in an open areaf. Reduced air temperature due to trees can improve air quality because the emission of many pollutants and/or ozone-forming chemicals are temperature dependent. Decreased air temperature can also reduce ozone formation.

Removal of air pollutants

"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."Overall, the greatest effect of trees on reducing health impacts of $PM_{2.5}$ 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 $PM_{2.5}$ 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."

Emission of volatile organic

Emissions of volatile organic compounds by trees can contribute to the formation of ozone and carbon monoxide. However, in atmospheres with low nitrogen oxide concentrations (e.g., some rural environments), VOCs may actually remove ozonei,j. Because VOC emissions are temperature dependent and trees generally lower air temperatures, increased tree cover can lower overall VOC emissions and, consequently, ozone levels in urban areasl. VOC emission rates also vary by species. Nine genera that have the highest standardized isoprene emission ratem,n, and therefore the greatest relative effect among genera on increasing ozone, are: beefwood (*Casuarina* spp.), *Eucalyptus* spp., sweetgum (*Liquidambar* spp.), black gum (*Nyssa* spp.), sycamore (*Platanus* spp.), poplar (*Populus* spp.), oak (*Quercus* spp.), black locust (*Robinia* spp.), and willow (*Salix* spp.). However, due to the high degree of uncertainty in atmospheric modeling, results are currently inconclusive as to whether these genera will contribute to an overall net formation of ozone in cities (i.e., ozone formation from VOC emissions are greater than ozone removal). Some common genera in Brooklyn, NY, with the greatest relative effect on lowering ozone were mulberry (*Morus* spp.), cherry (*Prunus* spp.), linden (*Tilia* spp.) and honey locust (*Gleditsia* sp.)n.

Energy effects on buildings

Trees reduce building energy use by lowering temperatures and shading buildings during the summer, and blocking winds in winterr. However, they also can increase energy use by shading buildings in winter, and may increase or decrease energy use by blocking summer breezes.Thus, proper tree placement near buildings is critical to achieve maximum building energy conservation benefits.When building energy use is lowered, pollutant emissions from power plants are also lowered. While lower pollutant emissions generally improve air quality, lower nitrogen oxide emissions, particularly ground-level emissions, may lead to a local increase in ozone concentrations under certain conditions due to nitrogen oxide scavenging of ozones. The cumulative and interactive effects of trees on meteorology, pollution removal, and VOC and power plant emissions determine the overall impact of trees on air pollution.

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Some of the major air pollutants and their primary sources are:

1) Carbon dioxide: Burning oil, coal, natural gas for energy. Decay and burning of tropical forests.
2) Sulfur dioxide: Burning coal to generate electricity.

3) Hydrogen floride and silicon tetrafloride: Aluminum and phospate fertilizer production, oil refineries, and steel manufacturing.
4) Ozone: Chemical reactions of sunlight on automobile exhaust gases. Ozone is a major pollutant in smog.
5) Methane: Burning fossil fuels, livestock waste, landfills and rice production.
6) Nitros oxides: Burning fossil fuels and automobile exhausts.
7) Chloroflorocarbons: Air conditioners, refrigerators, industrial foam.

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Quality of trees

1) Help to settle out, trap and hold particle pollutants (dust, ash, pollen and smoke) that can damage human lungs.
2) Absorb CO_2 and other dangerous gasses and, in turn, replenish the atmosphere with oxygen.
3) Produce enough oxygen on each acre for 18 people every day.

Absorb enough CO_2 on each acre, over a year's time, to equal the amount you produce when you drive your car 26,000 miles. Trees remove gaseous pollutants by absorbing them through the pores in the leaf surface. Particulates are trapped and filtered by leaves, stems and twigs, and washed to the ground by rainfall.

Air pollutants injure trees by damaging their foliage and impairing the process of photosynthesis (food making). They also weaken trees making them more susceptible to other health problems such as insects and diseases. The loss of trees in our urban areas not only intensifies the urban "heat-island" effect from loss of shade and evaporation, but we lose a principal absorber of carbon dioxide and trapper of other air pollutants as well.

Source : http://www.dnr.state.md.us/forests/publications/urban2.html