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A mixture of urban tree species best for removing atmospheric ozone

Planting trees in urban areas has been recognised as a cost-effective means of reducing air pollution for several major cities worldwide. In a new study, the impact of tree species diversity on levels of ozone pollution in Rome was assessed. The results suggest that different species of tree complement each other in providing this important ecosystem service.

Urban forests provide important ecosystem services, such as lowering local temperatures, changing wind patterns and removing pollutants from the air. Tropospheric ozone, found in the lowest portion of the atmosphere, is among the air pollutants removed by forests. Ozone dominates air pollution during summer periods in towns and cities, with negative effects on public health.

Previous studies have found that the number and distribution of trees within the city affects how much ozone they remove from urban air. However, little is known about the effects of tree species diversity on the size and stability of this ecosystem service. The aim of the study, therefore, was to quantify the effects of urban tree diversity on the removal of ozone in the city of Rome, Italy. The researchers tested the seasonal and annual removal of ozone by three groups of trees, evergreen broadleaf, deciduous broadleaf and conifer. Ozone removal occurs through pores, known as stomata, found in the leaves of these trees; with smaller amounts of ozone also absorbed directly across the leaf surface.

The two years measured in the study, 2003 and 2004, experienced very different climatic conditions and ozone pollution levels. Average monthly levels of ozone across the city frequently exceed the 70 micrograms per cubic metre ($\mu g/m^3$) threshold proposed by the World Health Organization.

The different groups of trees took up ozone at different rates throughout the year. In the spring of both 2003 and 2004, the deciduous broadleaf trees took up the most ozone and conifer the least. In the hot summer of 2003, deciduous broadleaves had a reduced ozone uptake, but evergreen broadleaves maintained a high level of ozone uptake and conifers actually increased uptake under these drought conditions. During the two autumn periods, the deciduous broadleaves took up the most ozone.

The total ozone uptake by urban trees was 311.1 megagrams (Mg) in 2003 and 306.9 Mg in 2004, a difference of just 2%. However, when the ozone uptake for each of the three groups of trees was considered separately, it was found that annual uptake fell by 25% for evergreen broadleaves between 2003 and 2004. For deciduous broadleaves and conifers, ozone uptake increased between the two years by 4.5% and 23%, respectively. The results demonstrate that tree groups play complementary roles in stabilising ozone removal over time and across different environmental conditions.

The results could have important implications for developing future management strategies, such as targeted tree planting in selected locations. As the results indicate that some species are less effective in removing ozone during drought conditions, planners may wish to consider planting more drought-tolerant species to help stabilise this ecosystem service. The study suggests that tree diversity can bring significant positive benefits for human health in terms of pollution reduction.

Source: Manes, F. Incerti, G., Salvatori, E., *et al.* (2012) Urban ecosystem services: tree diversity and stability of tropospheric ozone removal. *Ecological Applications.* 22(1): 349-360.

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