

CONTACT: John Toon/Ginger Pinholster  
(404) 894-3444

**A NEW REASON TO KEEP THE TREES:**

**For Immediate Release**

**LOST GREEN SPACE CREATES "HEAT ISLAND,"**

**June 11, 1990**

**BOOSTING NATURAL HYDROCARBONS & OZONE**

**Photography Available**

Major cities now have another reason to retain their trees and other green spaces. Rising temperatures caused by the "urban heat island" effect -- which is related to the loss of green space -- may be boosting production of ozone-forming hydrocarbons in major U.S. cities.

The resulting increase in ozone production offers another possible explanation for why the nation's clean air policy has failed to control urban ozone problems, a scientist from the Georgia Institute of Technology suggests. The findings also point out the role land use decisions play in determining a city's environmental quality.

Urban ozone pollution is produced by a chemical reaction between nitrogen oxides and hydrocarbon compounds in the presence of sunlight.

In September of 1988, a team of Georgia Tech scientists reported in Science that natural hydrocarbons from trees play a larger role than originally believed in creating the ozone pollution that plagues many U.S. cities -- suggesting that control strategies aimed at nitrogen oxides might be more effective. At the time, critics argued that if the theory were correct, urban areas could control their ozone problems by cutting down their trees.

Now, a follow-up study to be published in the Journal of Geophysical Research has found that reducing the number of trees in urban areas may actually have the opposite effect -- raising urban temperatures and thereby increasing production of natural hydrocarbons which react chemically with nitrogen oxides to form ozone.

Trees and other plants moderate air temperature through the evaporation of water from their leaves, a natural air conditioning effect known as evapo-transpiration, explained Dr. William Chameides, director of the School of Earth and Atmospheric Sciences. Replacing trees with concrete and other man-made materials helps retain heat and reduces the amount of evapo-transpiration, creating what is called an "urban heat island." Urban heat islands in major U.S. cities can generate temperatures as much as 12 degrees Centigrade higher than nearby non-urban areas.

Because the rate of natural hydrocarbon production is tied closely to temperature, even a slight elevation in temperature can lead to substantially higher emission rates.

- OVER -

In the Atlanta area, the average temperature has risen approximately two degrees Centigrade over the past 15 years. That increase, Chameides reported, may have boosted natural hydrocarbon emissions by 50 percent -- more than offsetting the loss of 20 percent of Atlanta's trees during that same time. He believes other cities may have seen similar increases.

In addition to increasing natural hydrocarbon production, the rising temperatures also speed up the photochemical reaction which produces ozone from hydrocarbons and nitrogen oxides. And the higher temperatures boost the emission of man-made hydrocarbons, primarily from the evaporation of fuels, he noted.

"Observations indicate a strong link between urban ozone and temperature: when temperatures are high, ozone concentrations also tend to be high," said Chameides, who co-authored the study with Research Scientist Carlos Cardelino. "Interestingly, there is also a link between hydrocarbon emissions and temperature. When temperatures are high, both natural and man-made emissions of these compounds also go up."

Trees use carbon dioxide to make carbohydrate food during the photosynthesis process. As the temperature rises, Chameides said, the trees may alter that process to produce larger amounts of hydrocarbons like isoprene, a hydrocarbon emitted by deciduous trees.

Costly federally-mandated emission controls on motor vehicles and industrial sources theoretically should have reduced hydrocarbon emissions in the Atlanta area by 50 percent over the past 15 years. That reduction, in turn, should have cut ozone concentrations.

But actual measurements of ozone show little or no decrease during that time. Chameides argued in the 1988 paper that the large volume of natural hydrocarbons produced by trees and other plants creates a huge reservoir of the reactive chemical -- a reservoir which is not substantially reduced by the controls on man-made hydrocarbons.

He believes ozone control strategy may have to shift its focus to nitrogen oxides, the other side of the chemical reaction. Measurements in remote locations have found relatively low concentrations of naturally-produced nitrogen oxides, suggesting control of man-made sources of these compounds may be feasible, he said.

Limiting nitrogen oxides would require different pollution controls on motor vehicles, as well as new controls on large combustion sources such as electric powerplants.

Chameides also believes that cities must consider the environmental impact of future land use decisions. By replacing trees with concrete and asphalt, cities are altering their climate and therefore affecting hydrocarbon emissions. He believes cities should adopt strategies to retain tree cover, helping maintain air quality by limiting the extent of the urban heat island.

"In the past, the arguments in favor of retaining urban trees have been largely aesthetic," he added. "However, it now appears that trees can have a significant environmental benefit. Thus, land use decisions can have a significant impact on a city's ability to meet air quality standards."

###