

Science

BRIEFING

March 5, 2014

OZONE IN MOUNTAIN ECOSYSTEMS

BACKGROUND

Ozone (O₃) in the lower atmosphere is highly reactive and can damage the tissues found in the leaves of plants. However, little is known about ambient O₃ concentrations at remote, non-urban mountainous areas of the western U.S.

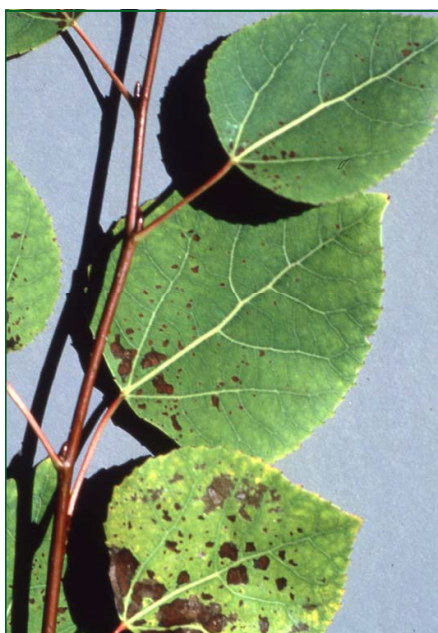
RESEARCH

Research Activity: Ozone levels were measured from 2007-2011 at high elevation sites in national forests in Colorado and northeastern Utah. Data from this monitoring showed that O₃ was primarily in the mid-concentration range, rarely exceeding 100 ppb or dropping below 30 ppb, yet these sites have O₃ concentrations high enough to contribute to exceedance of the current National Ambient Air Quality Standard. The small daily changes in concentration indicate mixing ratios of nitrogen oxides (from fossil fuel combustion, fires, fertilizers, and lightning) and volatile organic compounds (released by industrial processes, car emissions, and vegetation) that favor stable O₃ concentrations and higher nighttime concentrations. Highest nighttime O₃ concentrations occurred at the highest elevations, while there was no relationship between daytime O₃ concentrations and elevation. Higher O₃ concentrations in springtime suggest that stratospheric intrusion may contribute to ambient O₃ at remote sites.

Management Implications: There were significant year-to-year differences in O₃ concentrations at each of the remote locations studied, but even in low O₃ years some of these sites had concentrations above the National Ambient Air Quality Standard. The large number of mid-level O₃ concentrations contributed to a high W126 cumulative O₃ exposure index, a secondary standard proposed to protect sensitive vegetation. This suggests that the proposed W126 secondary standard would be difficult to achieve at most remote national forest sites and other rural locations in the western U.S. These findings will allow National Forests to determine O₃ levels in remote areas, determine if O₃ at these sites exceed the federal standard, and examine long-term changes in O₃ in remote regions.



RMRS researchers are using a portable battery powered monitor to evaluate ozone at Trout Creek Pass, Colorado and several other high-elevation locations in the Rocky Mountain West.



Ozone injury on aspen, a sensitive species used for ozone biomonitoring.

KEY POINTS

- Ozone (O₃) is a widespread air pollutant formed primarily by nitrogen oxides reacting with volatile organic compounds on warm, sunny days.
- O₃ can kill leaf tissue, reduce plant growth, and make plants more susceptible to other stresses such as drought.
- Portable battery powered monitors can be used for determining O₃ values at remote locations.
- O₃ levels increase with elevation and exceed air quality standards in remote ecosystems in Colorado and Utah.

MORE INFORMATION

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