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## NCAR News Release

[2003-38](#)

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# NCAR Explores Link Between Climate Change and Air Quality

BOULDER--The National Center for Atmospheric Research (NCAR) and other institutions are launching a far-reaching project this month to help the government keep polluted areas in compliance with Clean Air Act standards in the event of rising global temperatures. The three-year project will focus on modeling air quality in the United States in the middle of the 21st century.

The National Science Foundation, Environmental Protection Agency, and U.S. Forest Service are funding the project.

As the climate warms, the population increases, and forests and croplands are altered, scientists expect the potential for air pollution in coming decades will change in significant and sometimes subtle ways. Policymakers, already concerned about curbing industrial emissions, also must factor in the possibility of more wildfires and the differing impacts that tree plantations and natural forests have on the formation of pollution.

"When conditions are changing, all your strategies have to be adjusted," explains NCAR scientist Alex Guenther, who is part of the research team. "For the government to make sure that air quality doesn't worsen, it needs to take into account changes in temperature and vegetation as well as industrial emissions."

Guenther will look into the impact of higher temperatures on plant emissions of certain chemicals, known as volatile organic compounds (VOCs). The compounds, which smell of pine and other familiar vegetation, are harmless in a natural setting. But they can react with human-generated industrial emissions of nitrogen oxides to form ground-level ozone, an important component of smog.

Research has shown that VOC emissions increase by 15% to 25% with every 1 degree Celsius (1.8 degree Fahrenheit) temperature increase, potentially leading to more smog. When natural vegetation is cleared to make room for plantations of fast-growing trees, such as poplars, VOC emissions can increase as much as 20 times.

The team plans to answer several questions, including

- How will global warming affect air quality, both directly through higher temperatures and indirectly through changes in air circulation patterns and land cover?
- How will wildfires affect regional air quality and haze?
- How will changes in land use, such as tree plantations, suburban landscapes, and agriculture affect regional air quality?
- What is the likely effect of Asian pollution on U.S. air quality?

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The researchers will use the NCAR Climate System Model, along with scenarios of future wildfires and land use, to simulate the atmosphere over regions of the United States during a 10-year period in the middle of this century. They will compare their projections with a national EPA analysis of air pollution in 1996 and a model of air quality in 2000, when wildfires burned extensively.

The team will explore air quality across the country using coarse, 36-kilometer (22-mile) grid cells in the models. In the Northwest and upper Midwest, however, it will use much finer-scale, 12-kilometer (7-mile) modeling. The Northwest is of interest both because climate change could affect its extensive wooded and agricultural areas and because its dense forests could fuel major wildfires. The upper Midwest has contended with significant pollution levels and, like the Northwest, has large wooded and agricultural areas.

Researchers will then turn to an even finer-resolution grid (4 kilometers or 2.5 miles) to look at air pollution in certain urban areas, such as Chicago. This will enable them to capture the nuances of how local lake or sea breezes can nudge pollution plumes over areas adjacent to cities.

"The result of this project will be a greater understanding of how future climate may impact urban and regional air quality," Guenther explains. "The knowledge should be very valuable for long-term planning efforts to improve and maintain clean air well into the future."

Participants include scientists from Washington State University, the University of Washington, and the U.S. Forest Service, as well as NCAR.

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Industrial emissions can combine with chemicals from trees and other plants to aggravate smog. (Photo courtesy Carlye Calvin.)

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Industrial emissions can combine with chemicals from trees and other plants to aggravate smog. (Photo courtesy UCAR/NCAR/NSF.)

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**Prepared for the web by Carlye Calvin**

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