CONTRIBUTED PHOTO

Jason Surratt—
Exploring the dark side of the forest

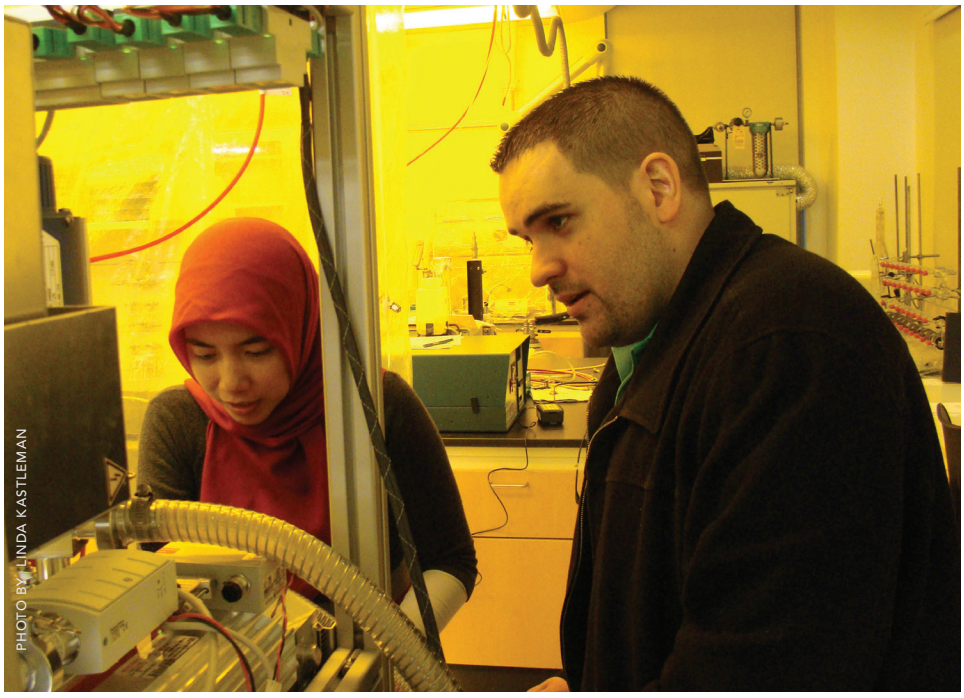
Trees are likely responsible for the misty haze that gave name to the Smoky Mountains—and for much of the smog that hangs over cities. Wait! Aren't trees the world's best air fresheners, producers of oxygen that make our atmosphere healthier? Yes and no.

The fragrance of evergreens and less-noticeable odors from hardwoods stem from hydrocarbons called terpenes, which are emitted by all trees. These natural chemicals mix with nitrogen oxide and sulfur dioxide, pollutants from automobile exhausts and coal-burning power plants. Sunlight combines with the mixture to cause a chemical reaction in the atmosphere, producing fine particulates that may reduce visibility in many national parks and – more significantly – may lead to or worsen cardiopulmonary disease, asthma and other serious health problems.

"Man-made pollutants perturb the natural chemistry of our atmosphere," Dr. Jason Surratt says. "Sunlight sparks a reaction that creates the brown smog that hangs over cities and is likely more harmful than original pollutants on their own."

Surratt and colleagues conduct atmospheric research at Look Rock Mountain, near the city of Knoxville and several Tennessee Valley Authority coal-fired power plants. The study is supported by the Electric Power Research Institute and the Environmental Protection Agency (EPA). Surratt received an early-career grant from EPA, as well as the Walter A. Rosenblith New Investigator Award from the Health Effects Institute, to fund further research on the impact of human-caused pollutants and isoprene, the most abundantly emitted terpene.

Surratt examines these pollutants in air chambers at UNC-Chapel Hill – one on the roof of McGavran-Greenberg Hall and the other in Pittsboro, N.C., south of Chapel Hill. The team also examines them in Surratt's Michael Hooker Research Center laboratory. Fine particulates generated from the chambers are examined using a device developed by Dr. William Vizuete. The device exposes living lung tissue to pollutants to determine potential human health effects (See page 8.)



Dr. Jason Surratt is assisted in his UNC laboratory by Dr. Ying-Hsuan Lin, ESE postdoctoral fellow (top), and ESE doctoral student Sri Hapsari Budisulistiorini (bottom). His team also conducts research at Look Rock Mountain, near Knoxville, Tenn. (center).

In the past, it was not possible to test individual components involved in the formation of aerosols. Subsequent interactions with human populations have not been possible because the relevant compounds were not available. Collaboration between Surratt's laboratory, which specializes in atmospheric chemistry, and the laboratory of Surratt's mentor, Dr. Avram Gold, who has expertise in synthesis, could yield important insights into both the atmospheric reactions leading to aerosol formation and the human health effects resulting from exposure to aerosol. Ultimately, the research could lead to development of rational strategies to control atmospheric aerosol formation and minimize adverse health effects.

Surratt compares the importance of making this link between natural and human-made particles in the air with the discovery of the threat to the ozone layer from chlorofluorocarbons (CFCs) used as coolants in refrigerators and air conditioners and as aerosols in many household products.

"In the 1980s, there was public outcry about how CFCs were destroying the ozone layer that protects us from harmful effects of the sun," Surratt said. "The result was a ban on CFCs."

Surratt's research may inspire similar widespread control measures to reduce health threats related to the compounding of tree emissions, human-made pollutants and sunshine. "However," – he quickly points out, laughing – "banning trees won't be the solution!"

—Ramona DuBose

RESEARCHERS FEATURED IN THIS ARTICLE:

Avram Gold, PhD, is professor of environmental sciences and engineering (ESE).

Jason Surratt, PhD, is assistant professor of ESE.

William Vizuete, PhD, is associate professor of ESE.