

# IMPACT

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*IMPACT is a series of publications highlighting how UC Davis' College of Agricultural and Environmental Sciences makes a difference in the lives of Californians. Through research, teaching, and outreach programs, UC Davis research touches almost all aspects of Californian life. Today, millions of people eat safer foods, breathe cleaner air, and drink healthier water with the help of our researchers. We're making discovery work – for California and the world.*

## BRINGING CLARITY TO AIR QUALITY

### THE ISSUE

The Central Valley and Southern California often exceed national air quality standards for ozone and particulate matter. Some areas have high concentrations of hazardous air pollutants, such as pesticides and herbicides, and smog-inducing volatile organic compounds (VOCs) and nitrogen oxides (NO<sub>x</sub>).

Adverse health effects include asthma, lung diseases, and heart problems. According to epidemiological studies, air pollution is responsible for 50,000 deaths in the U.S. each year. In California, approximately 6,500 people die annually from air pollution—more than the total from vehicle accidents and homicides.

According to the California Air Resources Board, 42% of ozone-forming emissions in the San Joaquin Valley come from transportation sources. Industrial sources account for another 31%, followed by agriculture (21%), and consumer products like household cleaners (6%). Fine particulate matter shows a similar pattern: transportation (53%), industry (24%), agriculture (20%), and consumer products (4%).

### WHAT WE'RE DOING

UC Davis has one of the largest groups of air quality experts in the United States. More than 70 researchers, including many in the College of Agricultural and Environmental Sciences, are working on this issue—characterizing air emissions with analytical instruments, examining atmospheric chemistry and



air pollutant transport, investigating air pollutant toxicity, and developing cost-effective policies and innovative technologies. Research aimed specifically at air quality related to agricultural practices is enhancing air quality and saving farmers money:

*Investigating dairy air:* Frank Mitloehner is a UC Davis animal scientist and air quality specialist whose research in 2004 pointed to the great uncertainties of VOC emissions and resulting misguided mitigation recommendations from agencies.

This research set the stage for a \$14 million nationwide and multi-university National Air Emission Monitoring Study. The project continuously monitors commercial livestock and poultry operations for air pollutants and greenhouse gas emissions. A second major study is examining the respiratory health of San Joaquin Valley dairy workers.

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Mitloehner also is director of the Agriculture Air Quality Center at UC Davis. Affiliated faculty conduct research on livestock, waste, agricultural tillage, harvesting, vehicular traffic, and pesticides. The center sponsors an annual conference—Green Acres, Blue Skies—for agricultural groups, government regulators, university researchers, and industry innovators involved in keeping California air clean.

**Letting the dust settle:** A conservation tillage project involving many UC scientists and farmers is examining how reduced plowing, disking, ripping, and chiseling can help reduce dust, as well as fuel use, carbon dioxide, VOCs, and NOx emissions.

UC Davis soil scientist Randal Southard and plant scientist Jeff Mitchell found that conservation tillage practices cut field dust by 70% in a cotton-tomato rotation. They also simulated dust production under a variety of soil conditions in a laboratory dust generator. Results from this work suggest that adoption of conservation tillage methods will reduce dust emissions to a greater extent than currently estimated by the California Air Resources Board.

**Improving on-farm technology:** New technologies are also reducing pesticides in the air. Agricultural engineering professor Ken Giles has been fine tuning a “smart” spraying system that reduces application rates with improved nozzles, use of adjuvants, and sensors that target applications. Some orchard trials have shown 50–70% savings. Growers are encouraged to adopt this technology through the USDA’s Environmental Quality Incentives Program.

Agricultural engineering professor David Slaughter has helped develop two computer vision systems, one for precision guidance of agricultural implements used in row crop cultural practices, and a second for precision herbicide applications.

**Assessing policy decisions:** Agricultural economist Cynthia Lin examined the effects of local regulations on air quality. Her research showed that agricultural burning policies and penalty fees reduce carbon monoxide pollution. Other policies may not have an impact. For instance, prohibitions on visible emissions, fugitive dust, particulate matter, nitrogen, and the reduction of animal waste matter are sometimes correlated with higher carbon monoxide levels. Regulations on orchard and citrus heaters had no significant effect on carbon monoxide and nitrous oxide levels.

## A SHARED VISION

The focal point for this work at UC Davis is the campus-wide Air Quality Research Center, formed in 2005 by atmospheric science professor Anthony Wexler. Through the center, UC Davis has been awarded grants to study the link between emission sources and human toxicity, to develop Web-based tools examining the role of aerosols in climate change, and to create the multi-disciplinary San Joaquin Valley Aerosol Health Effects Center to study toxicity to humans of atmospheric particles.

That’s impact—cutting-edge science and policy development to understand and protect the air we breathe.

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