California’s strict air quality regulations don’t just make clean air—they make more productive farms

Ground ozone lowers crop yields. As it’s been cleaned up in California, farms have produced hundreds of millions of dollars more fruits and nuts.
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Ground ozone, explains Steven Davis, an associate professor at the University of California Irvine and coauthor of the study published Monday in *Nature Food*, is formed in Earth’s lower atmosphere when pollutants, such as nitrogen, react with temperature and sunlight. It can be a harmful air pollutant, contributing to asthma and other complications when people breathe it in. It’s also harmful to plants. “It comes in through the pores of plants, which are called stomata, and sort of burns their cells and inhibits their ability to photosynthesize,” he says.

Previous research has already looked at the effect of ground ozone on staple crops such as wheat, soy, and rice (the presence of this pollution is seen as a threat to that food production). Davis and the other researchers wanted to focus on different crops, though—perennials such as almonds, grapes, nectarines, peaches,

strawberries, and walnuts, what Davis calls “the sweet things in life.”



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These crops can be more valuable than staples such as wheat and corn, and they also have longer lifespans, which means they may be more vulnerable to climate change and pollution. “When you plant an almond tree, it’s going to be around and producing for 20 or 30 years maybe.”

For the study, researchers analyzed pollution exposure and crop yields from 1980 to 2015, and also looked at the effects of warming on these perennial crops. While warming hasn’t had a big effect on the crops, that ground ozone has. The researchers’ models suggest that ozone damage has led to production losses as high as $1 billion per year. Air pollution is still harming these crops, and reducing air pollution could provide immediate benefits for farmers. The good news: Because California already has stringent air quality standards, the decreases in ground ozone that the state has seen in the past 35 years have led to $600 million in increased crop production each year.

“The farming community, if they’re looking at this, can actually see over history, see improvements in yields related to a decrease in this ground-level ozone,” Davis says. “If that were to continue, we could even see further improvements in the yields of these sensitive crops, and maybe farmers would pause a little bit and not oppose all environmental policies.” (Though, of course, not all farmers do oppose environmental efforts, he adds).

Next, the researchers hope to look at the trajectory of California's energy systems and what benefits they might have for specific crops. "We can start analyzing trade-offs of water use and energy and try to inform the policy makers about the most cost-effective and beneficial ways to go," he says. This research doesn't just benefit California, either. These findings can translate to other farming areas, and also, California crops are a big part of the food system; the state produces 80% of the world's almonds. "This is not just a California issue," Davis says. "This is something that affects the world."

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