

SLU Ozone Garden Sets National Example

*By Ben Kaldunski, Jack Fishman & Kelley Belina
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The Ozone Garden established by Saint Louis University's (SLU) Center for Environmental Sciences in 2012 has set an example for science education that is being replicated in other cities around the country.

The focus of the project is to share valuable information on the harmful effects of air pollution on plant life and agriculture. The detrimental effect of ground-level ozone (the primary ingredient in smog) on plants is a direct result of fossil fuel combustion. Compared to only a few decades ago there are significantly higher background concentrations of ozone in the air we breathe. In the Midwestern United States ozone pollution levels consistently reach concentrations harmful to plants during the growing season.

The first Ozone Garden in the St. Louis area was started in 2012 by SLU professor and NASA Air Quality Applied Science Team (AQAST) member Jack Fishman. It began providing real-time pollution and meteorological data in May 2012 as part of the Global Ozone (GO3) Network. Dr. Fishman's idea of starting a network of ozone gardens stemmed from his previous work with NASA's Langley Research Center and the GLOBE (Global Learning through Observations to Better the Environment) Project. He paired living ozone garden exhibits with GO3's monitoring capabilities. With collaboration from the Saint Louis Science Center (SLSC), the Missouri Botanical Garden (MBG), and Penn State emeritus professor John Skelley, the St. Louis Ozone Garden Project was established. There are currently three ozone gardens around the St. Louis metro area.

Another primary goal of the SLU project is to stimulate the creation of a network of ozone gardens around the country to increase public awareness of the environmental and crop damage caused by poor air quality. Project manager Kelley Belina has worked with other AQAST members to help start ozone gardens around the U.S. In 2014, ozone-sensitive plants were sent from St. Louis to Philadelphia's Franklin Institute, Loyola University in Chicago, and two high schools in Texas and New Hampshire. AQAST members also started two ozone gardens in Colorado this year, and there are ozone gardens at NASA's Goddard Space Flight Center in Greenbelt, Maryland, and at the Virginia Living Museum in Newport News.

The Franklin Institute (TFI) has tracked the success of SLU's Ozone Gardens as tools for public education and outreach, and used it as a model for TFI's Outdoor Science Park (visit their [website](#)). The exhibit targets high school students with a focus on plant biology, atmospheric science, and experimental research. Photos and links to other ozone gardens can be found on SLU's [website](#).

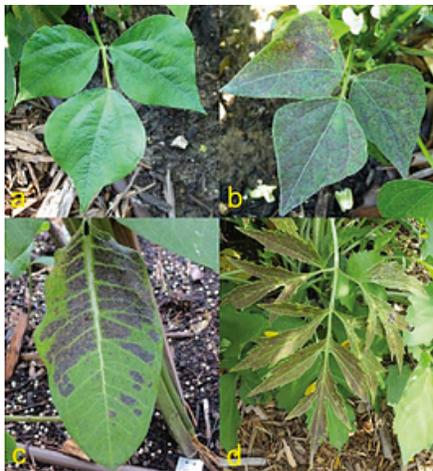
Ozone damages plants in several ways. The pollutant is taken in through the leaves where it reacts with other chemicals to produce toxic compounds. These compounds interfere with a plant's ability to produce and store nutrients, reduce a plant's capacity to fight disease, and decrease reproductive capabilities. Some plant species exhibit unique, visible ozone-induced damage symptoms. These species are called "bio-indicators," which means they can monitor the health of their environment.

At the three St. Louis gardens, ozone-induced leaf damage is recorded throughout the summer using a scale developed by the National Park Service. In 2014, below average temperatures persisted in St. Louis through June and July, resulting in lower ozone concentrations than in any previous years since routine monitoring was established in 1980. The most prolonged heat wave (eleven consecutive days >90°F) of the summer did not take place until mid-August, which coincided with the time period of the highest measured ozone concentrations. Ozone-induced leaf damage

followed these higher ozone levels found unusually late in the summer. Leaf damage was low for much of the growing season, but became more visible in August, when more “typical” ozone levels for St. Louis were recorded.

The original St. Louis Ozone Garden continues to raise awareness of air pollution through its highly visible location near the entrance to the James McDonnell Planetarium, which is a major attraction at the St. Louis Science Center (SLSC). Scheduled to open in 2016, this Ozone Garden will be moved to become part of a larger, permanent exhibit at the SLSC’s main building. SLSC’s new exhibit will focus on how science, technology, and global change affect the efficiency of food production. The SLSC and SLU will continue to collaborate to develop school programs and teacher workshops, as well as allowing students to assist with data collection at the Ozone Garden during the summer months.

Dr. Jack Fishman is the Director of the Center for Environmental Sciences at St. Louis University and a member of ACAST, a NASA-funded team of air quality experts that strives to use advanced air quality science to develop new tools for air quality managers. Learn more about ACAST at this [website](#). More information about the St. Louis Ozone Garden project can be found at this [website](#).



The left image shows leaf damage caused by ozone (lower left corner) at the SLU garden. The right image progress in planting the new ozone garden at the Franklin Institute in Philadelphia.

Sources and media coverage

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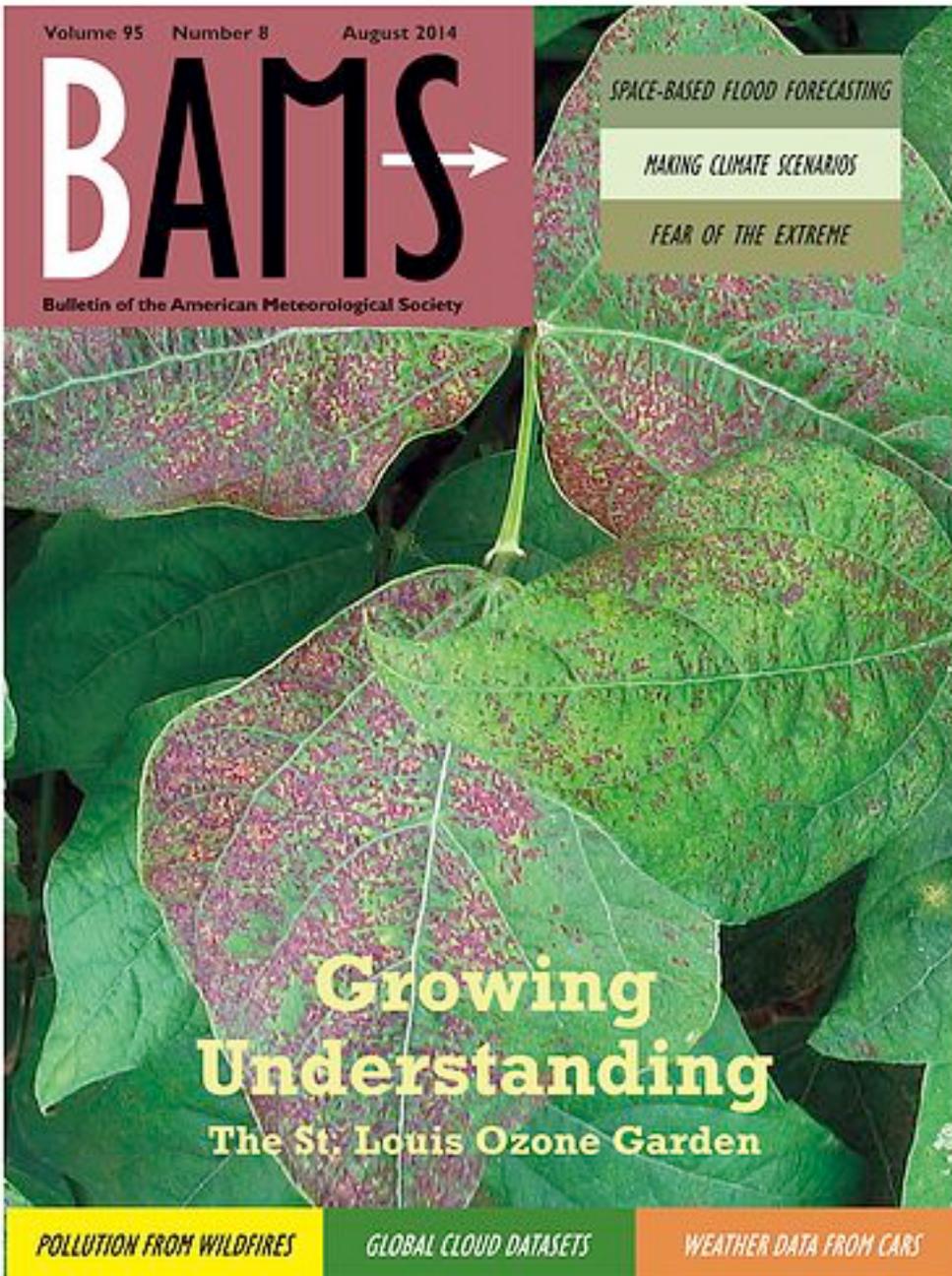
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An article on the research and outreach efforts underway at the SLU ozone garden was published in the August 2014 issue of the Bulletin of the American Meteorological Society, which featured the story on the issue's cover (Image courtesy of BAMS and SLU).