



Opinion

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Teaching Air Pollution Effects on Plants



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Abstract

The Air Quality Learning and Demonstration Center, located on the Penn State University campus, is a unique outdoor educational facility devoted to heightening public awareness of the importance of air pollution impacts on plants. The Learning Center has experienced tremendous growth during the past 15 years but faces an uncertain future as financial support has dwindled in recent years. Effective environmental education in the plant sciences requires continual efforts to secure enhanced funding opportunities in order to prevent the loss of existing and potential future resources.

Keywords: Air pollution; Education; Environment; Funding

Opinion

The Air Quality Learning and Demonstration Center (Learning Center) at the Arboretum at Penn State University encompasses nearly 0.30 ha of open land on a knoll overlooking the 150 ha arboretum [1]. It is ideally situated downwind of air pollution sources located in the geographic area that stretches from Chicago across the Ohio River Valley and into western Pennsylvania. Onsite, a teaching pavilion accommodates up to 80 people and is used for presentations and general discussions. A bioindicator garden provides an outdoor learning lab where air pollution-sensitive plants are grown and monitored for injury symptoms. In addition, open-top chambers are used to demonstrate ozone effects on plants by using a charcoal filter to reduce ambient ozone levels. We also have a Pennsylvania Department of Environmental Protection (PA DEP), Bureau of Air Quality, Monitoring Station at the site that provides air quality and meteorological data on a real-time basis.

The resources of the Learning Center facility have been successfully used to host educational programs directed at a variety of interested clientele including public schoolteachers, college students, youth groups, retired residents, and other environmental and educational professionals [2]. For example, during 2016, approximately 200 individuals attended course lectures or public presentations on air pollution effects on plants at the Learning Center [3]. Our programs are conducted according

to the concept that hands-on, user-friendly experiences have long-term impacts on future behavior and decision-making.

A further outreach effort of the Learning Center is a widely available ozone-teaching module [4]. The module consists of an overview of ozone and the effects of ozone on plants; a homework assignment; an Environmental Crime Scene Investigation (E-CSI) Activity; a quiz to test the students after completing the module; and an answer key for both the in class activity and quiz. The purpose of the E-CSI activity is for students to use the knowledge that they gained about ozone pollution to help solve an environmental crime scene by comparing time lapse photographs of the onset of ozone injury on plants (the crime) recorded during a summer at the Learning Center with the weather quality data (the evidence) during symptom development to determine when and why ozone symptoms on the plants occurred. The module fulfills academic standards for the state of Pennsylvania for Environment and Ecology (Environmental Health; and Humans in the Environment). The ozone module has been tested and is being used in high school classrooms in Pennsylvania.

Environmental education fosters life-long care and concern for the environment [5]. The opportunity to observe a real cause-effect relationship at the Learning Center helps visitors understand and appreciate the risks and impacts posed by

chronic exposure to ambient air pollution. Although some individuals may be aware that air pollution can adversely impact human health, the effects of air pollutants on plant life, especially those resulting from season-long exposures to tropospheric ozone, provide a dramatic example. Through the activities of the Learning Center, we are heightening public awareness of the foliar symptoms and general injury effects that air pollutants cause on cultivated and wild plant species.

While we continue to enjoy public interest in our programming, financial support of the Learning Center has been reduced in the last several years to only grants from the PA DEP Bureau of Air Quality. PA DEP has been instrumental in the establishment and continued operation of the facility because of their interest in seeing monitoring data of Pennsylvania air pollutants used to educate the general public. Previous financial support from a local energy supplier in the form of small annual financial gifts ceased about four years ago due to changes in the company's management structure and philosophy.

In conclusion, support for the Learning Center is subject to various internal (management) and external (political) factors within our past and current funding streams; as a result,

the Learning Center's activities and future existence are also tenuous. Current efforts need to be sustained and new projects implemented to help protect and enhance environmental education in the plant sciences.

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