

Teaching students how to think, not what to think, about the environment.

Air pollution comes in various forms. In Texas, ozone comprises one of the worst air quality issues in the state. Texas has several areas in the state that have high ozone pollution rates. These areas are in and near large cities. The counties around Houston, Dallas/Ft. Worth and the San Antonio/Austin area often reach ozone levels that are high enough to be considered nonattainment by the EPA. Ozone damages the health of people, plants, and animals. In a state where agriculture is a large part of its economy, ozone damage in plants can become an economic issue. Plant damage in Texas can be extensive from ozone if not controlled. Students can build ozone gardens or examine plants in their area for signs of ozone damage.

The ozone enters the plant's leaf through stomata (pores in the plant leaf) and oxidizes tissue — this changes biochemical and physical processes in the plant. Stoma allows gases to enter the leaf. Stomata have two guard cells that, when filled with water, pull away from each other and the stomatal pore is opened. When they lose water, they collapse and close the pore. When stomata are open carbon dioxide enters the leaf. Water goes out in a process called transpiration. If ozone is present, it will follow the same path as the carbon dioxide and enter the leaf. Ozone will go to the cells that are responsible for photosynthesis — palisade and spongy mesophyll tissues of the leaf. As soon as the ozone gets in the leaf, it reacts with molecules in the cell wall that trigger production of molecules which damage the cell. The ozone generally does not travel far into the cell. The plant's cell walls may contain antioxidants that will stop the ozone. The most common antioxidant is vitamin C.

The effects of the ozone can cause premature leaf loss, and reduced photosynthesis. Additionally, weakened plants are more susceptible to disease. In natural ecosystems other factors such as soil moisture, presence of other pollutants, insects, diseases, and other environmental stresses can magnify the affect of the ozone.



Links

Texas Commission on
Environmental Quality

[https://
www.tceq.texas.gov/
agency/air_main.html](https://www.tceq.texas.gov/agency/air_main.html)

Forestry Images

[http://
www.forestryimages.org/
search/action.cfm?q=ozone](http://www.forestryimages.org/search/action.cfm?q=ozone)

USDA
Ozone Sensitive Species

[http://www.nrs.fs.fed.us/fia/
topics/ozone/species/](http://www.nrs.fs.fed.us/fia/topics/ozone/species/)

Pollution Search continued

What to look for:

Stippling (purpling) on upper surface looks like small spots of pepper. Color will vary with plant species. Environmental conditions will affect amount of stippling.

Plants that are sensitive to ozone can be planted and monitored for damage to infer ozone amounts. Common Texas plants for this are cutleaf coneflower and common milkweed.

Genes are being developed to help make ozone-tolerant plants. One surprising fact is that the plants are also drought resistant.

