



Ozone and Foliar Injury Summary, 2014

Overview

Ozone is a gas that occurs naturally in the lower levels of the earth's atmosphere. However, human-produced pollution can become an unnatural source of additional ozone that results in injury to humans and plants. The Cumberland Piedmont Network (CUPN) has been monitoring ozone and its injury to plants since 2008 to fulfill the National Park Service (NPS) mandate to protect its resources and preserve the enjoyment of these resources.

The CUPN Ozone and Foliar Injury Program is designed to provide a network-wide assessment of status and trends in ozone concentration and foliar injury levels. All 14 CUPN park units are sampled on a rotational schedule (which is outlined in CUPN's ozone concentration and foliar injury protocol).

This brief summarizes data collected from March 2014 to October 2014 at Mammoth Cave National Park (MACA, Mammoth Cave). Ozone and foliar injury reports are available upon request or at <http://go.nps.gov/cupn>.

Ozone concentration data are collected at the Mammoth Cave air quality site at Houchin Meadow. Located near the park's western boundary (Figure 1), Houchin Meadow is the primary of multiple air quality sites within Mammoth Cave that are operated by the park and its cooperators. The site's ozone analyzer is an Environmental Protection Agency (EPA)-equivalent method (EQOA-0880-047), so the site's data are of sufficient quality to be used for permit review. The relatively low elevation of the site (774 feet [ft] or 236 meters [m]) should result in higher concentrations during the day and lower concentrations at night.

A foliar injury survey was conducted at the Great Onyx Job Corps site which is located in the northwestern portion of the park (Figure 1). Ozone sensitive plants were examined along the mown boundary of the field (Figure 2). The elevation of the site is about 650 feet (198 m).

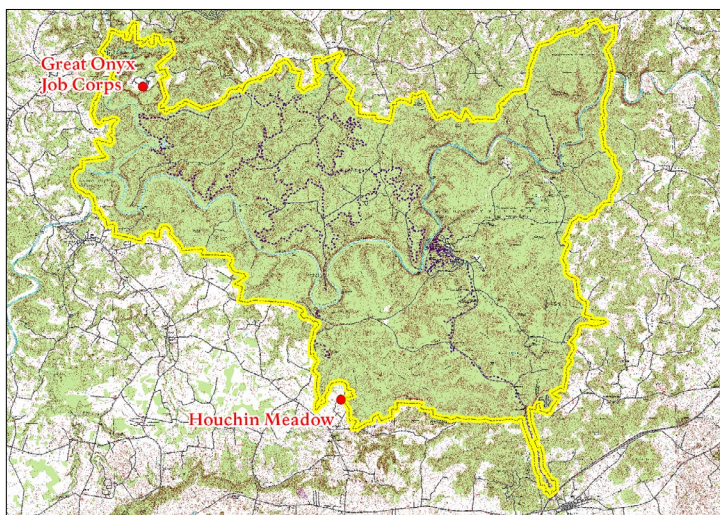


Figure 1. Map of ozone and foliar injury sites in Mammoth Cave National Park, Kentucky. NPS map by Lillian Scoggins.



Figure 2. Great Onyx Job Corps foliar injury site.

Significant Findings

Foliar Injury

In 2014, 643 plants at three CUPN park units were inspected for foliar injury. Of the 107 plants examined at Mammoth Cave, 3 plants were suspected of having ozone-caused foliar injury. However, following visual inspection of voucher specimens by subject matter experts, no injury was confirmed to be ozone-caused. Foliar injury surveys were conducted at Mammoth Cave on 31 July 2014. The results are summarized in the table below.

Table 1. Results of foliar injury surveys at Mammoth Cave National Park in 2014.

Site Name	Species	Inspected	Injured	Ozone-Caused?
Great Onyx Job Corps	Blackberry	30	0	N/A
Great Onyx Job Corps	Milkweed	30	3	No
Great Onyx Job Corps	Spreading Dogbane	17	0	N/A
Great Onyx Job Corps	Sweetgum	30	0	N/A

Significant Findings

Ozone Concentrations

The National Ambient Air Quality Standard (NAAQS) for ozone is set by the EPA. Two standards exist; the primary standard is designed to protect human health while the secondary standard is designed to protect human welfare. Currently, the value of the secondary standard is set to that of the primary standard.

The primary standard uses a metric defined by the EPA as the “annual fourth-highest daily maximum eight-hour concentration, averaged over three years.” In 2014, the value for the primary standard was 75 parts per billion (ppb). The eight-hour average never exceeded 75 ppb in 2014.

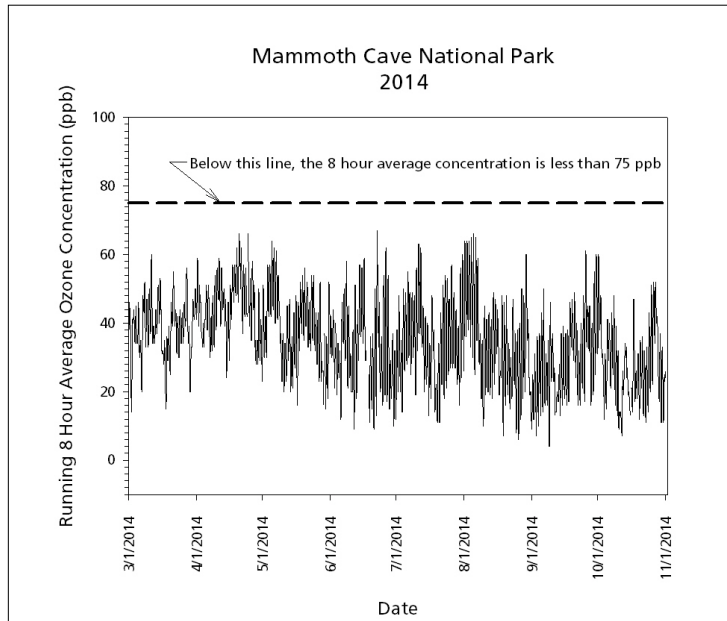


Figure 3. Running eight-hour average ozone concentration at Mammoth Cave.

However, plant species show signs of ozone sensitivity at concentrations below the primary standard. For that reason (along with others), many scientists argue that the W126 would be a better metric to protect plants. The W126 preferentially weighs the higher ozone concentrations most likely to affect plants and sums all of the weighted concentrations during daylight hours. The highest three-month period that occurs during the growing season is reported in parts per million-hours (ppm-hrs). The NPS Air Resources Division recommends a W126 of less than 7.0 ppm-hrs to protect most sensitive trees and vegetation. At Mammoth Cave in 2014, the W126 was 6.6 ppm-hrs.

Future Monitoring

Ozone concentration is measured throughout the year by Mammoth Cave and the NPS Air Resources Division. The network conducts foliar injury sampling on an annual basis at Mammoth Cave.

About the Cumberland Piedmont Network

In 1999, the National Park Service initiated a long-term ecological monitoring program, known as “Vital Signs Monitoring,” to provide the minimum infrastructure to allow more than 270 national park system units to identify and implement long-term monitoring of their highest-priority measurements of resource condition. The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

The NPS Vital Signs Monitoring Program addresses five goals for all parks with significant natural resources:

- Determine the status and trends in selected indicators of the condition of park ecosystem,
- Provide early warning of abnormal conditions,
- Provide data to better understand the dynamic nature and condition of park ecosystems,
- Provide data to meet certain legal and Congressional mandates, and
- Provide a means of measuring progress towards performance goals.

Effective long-term management and stewardship of natural resources in the Cumberland Piedmont Network begins with baseline knowledge of these resources. To acquire this knowledge, an inventory program was established by the National Park Service with the goal of acquiring baseline information for a variety of resources, from bibliographic information to species occurrence and distribution.

For More Information

CUPN Home Page:

<http://science.nature.nps.gov/im/units/cupn/index.cfm>

CUPN Reports & Publications:

<http://science.nature.nps.gov/im/units/CUPN/publications.cfm>

About the NPS Inventory & Monitoring Program:

<http://science.nature.nps.gov/im/index.cfm>

Data Downloads via the Natural Resource Information Portal:

<http://irma.nps.gov>