



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 June 2014 to September 2014 at Cumberland Gap National Historical Park (Cumberland Gap NHP). Ozone and foliar injury reports are available upon request or at <http://go.nps.gov/cupn>.

Ozone concentration data are collected at the park's portable ozone monitoring station (POMS) that was located near the Hensley Settlement site (Figure 1 and Figure 2). The site was jointly operated by the park and cooperators. The relatively high elevation of the site (3,412 feet [ft] or 1,040 meters [m]) should result in relatively stable concentrations from day to night.

Foliar injury surveys were conducted at the Daniel Boone Trail site in addition to the Hensley Settlement site mentioned above (Figure 1 and Figure 3). The elevation of the Daniel Boone Trail site is 1,345 feet (410 m).



Figure 2. Hensley Settlement POMS and foliar injury site.

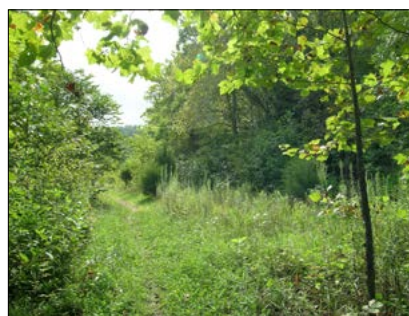


Figure 3. Daniel Boone Trail foliar injury site.

Significant Findings

Foliar injury

In 2014, 643 plants at three network parks were inspected for foliar injury. Of the 290 plants examined at Cumberland Gap NHP, four plants were suspected of having ozone-induced foliar injury. However, following visual inspection of voucher specimens by subject matter experts, no injury was confirmed. Foliar injury surveys were conducted at Cumberland Gap NHP on 19 August 2014. The results are summarized in Table 1.

Table 1. Results of foliar injury surveys at Cumberland Gap National Historical Park in 2014.

Site Name	Species	Inspected	Injured	Ozone-Caused?
Daniel Boone Trail	American Sycamore	30	0	N/A
Daniel Boone Trail	Eastern Redbud	30	0	N/A
Daniel Boone Trail	Green Ash	2	0	N/A
Daniel Boone Trail	Milkweed	30	0	N/A
Daniel Boone Trail	New York Ironweed	6	0	N/A
Daniel Boone Trail	Sweetgum	12	0	N/A
Daniel Boone Trail	Yellow Poplar	15	0	N/A
Hensley Settlement	Black Locust	30	0	N/A
Hensley Settlement	Blackberry	30	2	No
Hensley Settlement	Flameleaf Sumac	2	0	N/A
Hensley Settlement	New York Ironweed	9	2	No
Hensley Settlement	Sassafras	29	0	N/A
Hensley Settlement	Sourwood	22	0	N/A
Hensley Settlement	Spreading Dogbane	30	0	N/A
Hensley Settlement	Yellow Poplar	13	0	N/A

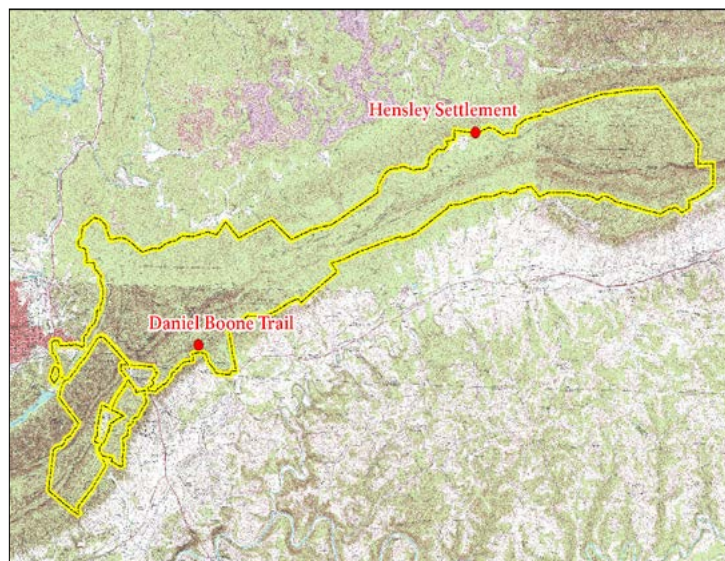


Figure 1. Map of ozone and foliar injury sites at Cumberland Gap National Historical Park. NPS map by Lillian Scoggins.

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). At Cumberland Gap NHP in 2014, over periods for which data are available, the eight-hour average never exceeded 75 ppb.

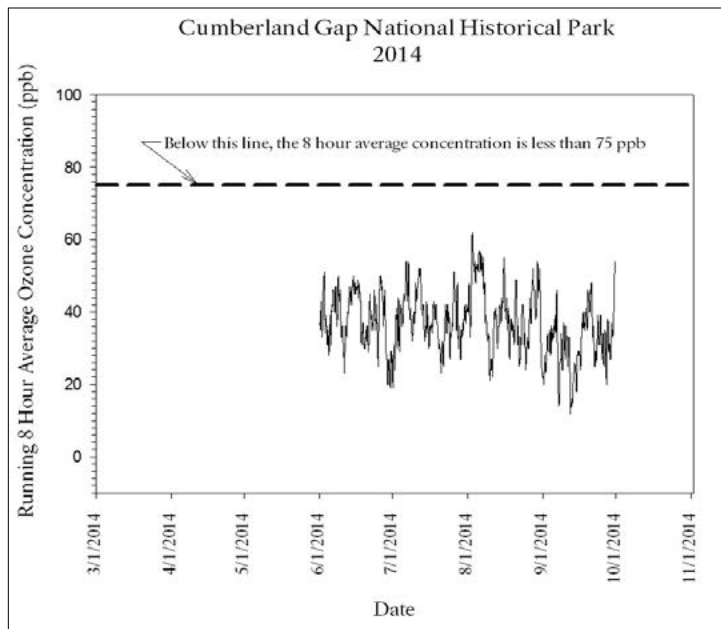


Figure 4. Running 8-hour average ozone concentration at Cumberland Gap National Historical Park.

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 Cumberland Gap National Historic Park in 2014, the W126 was 5.5 ppm-hrs.

Future Monitoring

Ozone concentration and ozone-induced foliar injury will be monitored by Cumberland Piedmont Network per its one year on/ five year off panel design.

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 goals 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 Division:

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

Data Downloads via the Natural Resource Information Portal:

<http://irma.nps.gov>