



# 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 April 2014 to October 2014 at Abraham Lincoln Birthplace National Historical Park (ABLI). Ozone and foliar injury reports are available upon request or at <http://go.nps.gov/cupn>.

Ozone concentration data are collected at the ABLI portable ozone monitoring station (POMS) that was located near the park's visitor center (Figure 1 and Figure 2). The site was jointly operated by the network, the park, and cooperators. The relatively low elevation of the site (764 feet [ft] or 233 meters [m]) should result in higher concentrations during the day and lower concentrations at night.

Foliar injury surveys were conducted at the Knob Creek Low Field in addition to the Visitor Center (Figure 1 and Figure 2). The elevation of the Knob Creek Low Field is 587 ft (179 m).



**Figure 2.** Visitor Center POMS and foliar injury sampling site (left) and Knob Creek Low Field foliar injury sampling site (right).

## Significant Findings

### Foliar Injury

In 2014, 643 plants at three CUPN park units were inspected for foliar injury. Of the 246 plants examined at ABLI, no plants were suspected of having ozone-caused foliar injury. Foliar injury surveys were conducted at ABLI on 15 August 2014. The results are summarized in the table below.

**Table 1.** Results of foliar injury surveys at Abraham Lincoln Birthplace National Historical Park in 2014.

| Site Name            | Species           | Inspected | Injured | Ozone-Caused? |
|----------------------|-------------------|-----------|---------|---------------|
| Visitor Center       | Black Cherry      | 5         | 0       | N/A           |
| Visitor Center       | Blackberry        | 16        | 0       | N/A           |
| Visitor Center       | Eastern Redbud    | 30        | 0       | N/A           |
| Visitor Center       | Flameleaf Sumac   | 30        | 0       | N/A           |
| Visitor Center       | Green Ash         | 29        | 0       | N/A           |
| Visitor Center       | Sassafras         | 30        | 0       | N/A           |
| Visitor Center       | Yellow Poplar     | 30        | 0       | N/A           |
| Knob Creek Low Field | Black Locust      | 1         | 0       | N/A           |
| Knob Creek Low Field | Blackberry        | 30        | 0       | N/A           |
| Knob Creek Low Field | Eastern Redbud    | 30        | 0       | N/A           |
| Knob Creek Low Field | Green Ash         | 7         | 0       | N/A           |
| Knob Creek Low Field | New York Ironweed | 2         | 0       | N/A           |
| Knob Creek Low Field | Sassafras         | 1         | 0       | N/A           |
| Knob Creek Low Field | Yellow Poplar     | 5         | 0       | N/A           |

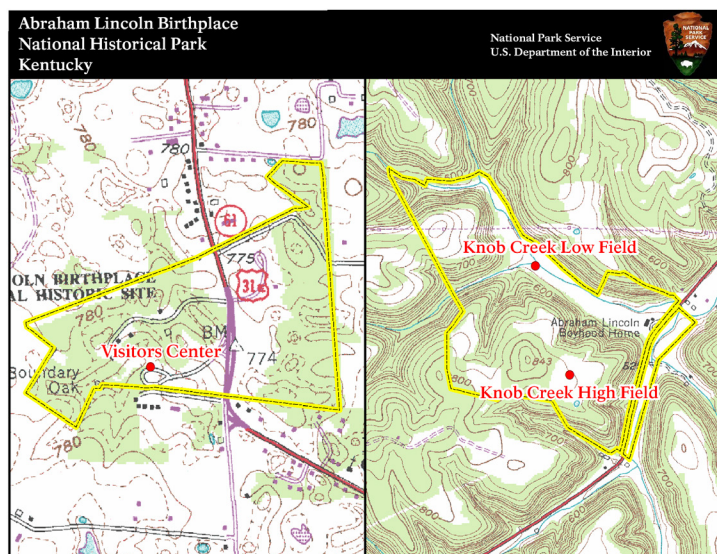


**Figure 1.** Map of ozone and foliar injury sampling sites at Abraham Lincoln Birthplace National Historical Park, Kentucky. NPS map by Lillian Scoggins.

## 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 ABLI in 2014 over periods for which data are available, the eight-hour average never exceeded 75 ppb.

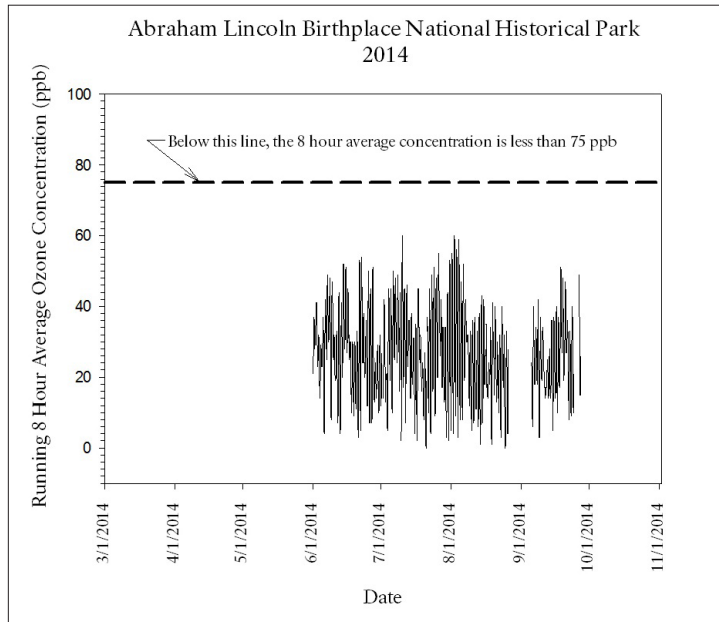


**Figure 3.** Running eight-hour average ozone concentration at Abraham Lincoln Birthplace National Historical Park, Kentucky.

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 ABLI in 2014, the W126 was 2.5 ppm-hrs.

### Future Monitoring

Ozone concentration and ozone-induced foliar injury will be monitored by CUPN 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 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 Division:

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

Data Downloads via the Natural Resource Information Portal:

<http://irma.nps.gov>