



Ozone and Foliar Injury Summary, 2018

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. In 2017, ozone concentration sampling was discontinued but foliar injury sampling continues.

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 (outlined in CUPN's ozone concentration and foliar injury protocol). This brief summarizes data collected in August 2018 at Guilford Courthouse National Military Park (GUCO). Ozone foliar injury reports are available upon request or at <https://www.nps.gov/im/cupn/reports-publications.htm>

There were two ozone foliar injury sites at the park in 2018: the Francisco Monument site (site elevation 848 feet or 258 meters) and the Kotis Tract site (site elevation 881 feet or 269 meters). Site map and photographs are shown in Figures 1, 2, and 3, respectively.



Figure 2. Ozone foliar injury sampling site at the Francisco Monument. NPS photograph by Johnathan Jernigan.



Figure 3. Ozone foliar injury sampling site at the Kotis Tract. NPS photograph by Johnathan Jernigan

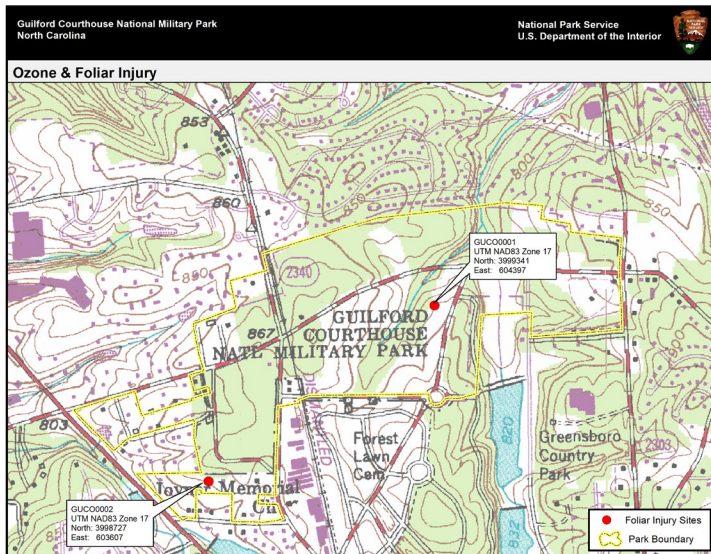


Figure 1. Map of ozone and foliar injury sites. NPS map by Lillian Scoggins.

Significant Findings

Foliar injury

In 2018, 383 plants at three CUPN parks were inspected for foliar injury. Of the 142 plants examined at the park, no plants were suspected to have foliar injury. The results of the survey are summarized in Table 1.

The NPS Air Resources Division periodically evaluates status and trends of air pollutants in parks using monitors in and near those parks. The most recent evaluation for ozone concentration and ozone foliar injury was in 2015. The results for Guilford Courthouse NMP are shown in Figure 4.

Significant Findings

Future Monitoring

Ozone-induced foliar injury will be monitored by the network per its one year on/five year off panel design

Table 1. Results of the 14 August 2018 ozone foliar injury survey at Guilford Courthouse National Military Park.

Site Name	Species common name	Species or genus scientific name	Number Inspected	Number w/ Injury?	Ozone-Caused?
Francisco Monument	Dogbane	<i>Apocynum</i> sp.	30	0	N/A
Francisco Monumnet	Sweetgum	<i>Liquidambar styraciflua</i>	30	0	N/A
Francisco Monument	Blackberry	<i>Rubus</i> sp.	5	0	N/A
Kotis Tract	Dogbane	<i>Apocynum</i> sp.	16	0	N/A
Kotis Tract	Common Milkweed	<i>Asclepias</i> sp.	1	0	N/A
Kotis Tract	Sweetgum	<i>Liquidambar styraciflua</i>	30	0	N/A
Kotis Tract	Blackberry	<i>Rubus</i> sp.	30	0	N/A

Air Quality Indicator	Specific Measure	Condition Status/Trend*	Rationale
Ozone	Human Health: Annual 4th-highest 8hr concentration		Condition: Human health risk from ground-level ozone warrants moderate concern at Guilford Courthouse NMP. This status is based on NPS Air Resources Division benchmarks and the 2011–2015 estimated ozone of 68.9 parts per billion (ppb). Trend: For 2006–2015, the trend in ozone concentration at Guilford Courthouse NMP improved (AQ5 Monitor ID: 370810013, NC). Confidence: The degree of confidence at Guilford Courthouse NMP is high because there is an on-site or nearby ozone monitor.
	Vegetation Health: 3-month maximum 12hr W126		Condition: Vegetation health risk from ground-level ozone warrants moderate concern at Guilford Courthouse NMP. This status is based on NPS Air Resources Division benchmarks and the 2011–2015 estimated W126 metric of 10.6 parts per million-hours (ppm-hrs). The W126 metric relates plant response to ozone exposure. A risk assessment concluded that plants in at Guilford Courthouse NMP were at high risk for ozone damage (Kohut 2007 ; Kohut 2004). See list of ozone-sensitive plant species . Trend: For 2006–2015, the trend in the W126 metric at Guilford Courthouse NMP improved (AQ5 Monitor ID: 370810013, NC). Confidence: The degree of confidence at Guilford Courthouse NMP is high because there is an on-site or nearby ozone monitor.

* Condition assessments for contiguous U.S. parks use the Inverse Distance Weighted (IDW) interpolation method is used to estimate 5-year average (2011–2015) values. Trend analyses use 10 years (2006–2015) of data from on-site or nearby monitors.

Symbol Legend

Condition Status	Trend	Confidence In Assessment
 Indicator is in Good Condition	 Improving	 High
 Warrants Moderate Concern	 Unchanging	 Medium
 Warrants Significant Concern	 Deteriorating	 Low

Figure 4. Status and trends in ozone concentration and ozone foliar injury for Guilford Courthouse NMP (end year 2015). Image obtained from <https://www.nature.nps.gov/air/data/products/parks/index.cfm>.

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://www.nps.gov/im/cupn/index.htm>

CUPN Reports & Publications:

<https://www.nps.gov/im/cupn/reports-publications.htm>

About the NPS Inventory & Monitoring Division:

<https://www.nps.gov/im/index.htm>

Data Downloads via the Natural Resource Information Portal:

<http://irma.nps.gov>