



Ozone and Foliar Injury Summary, 2019

Overview

Ozone is a gas that occurs naturally in the lower levels of the earth's atmosphere. However, human activities can become an unnatural source of pollutants which react to produce 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. Ozone concentration sampling was discontinued in 2017 but foliar injury sampling continues uninterrupted.

The CUPN Ozone Foliar Injury Program is designed to provide a network-wide assessment of status and trends in ozone 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 the foliar injury data collected in August 2019 at Ninety Six National Historic Site (NISI). Additionally, interpolated ozone concentration data for the park computed by NPS Air Resources Division are presented. Ozone foliar injury reports are available upon request or at <https://www.nps.gov/im/cupn/index.htm>.

Foliar injury surveys were conducted at two sites: Bumble Bee Hill and Charleston Road (see map, Figure 1) where ozone sensitive plants were examined within and around the area. The Bumble Bee Hill (Figure 2) elevation is about 479 feet (146 meters). The Charleston Road (Figure 3) elevation is about 512 feet (156 meters).

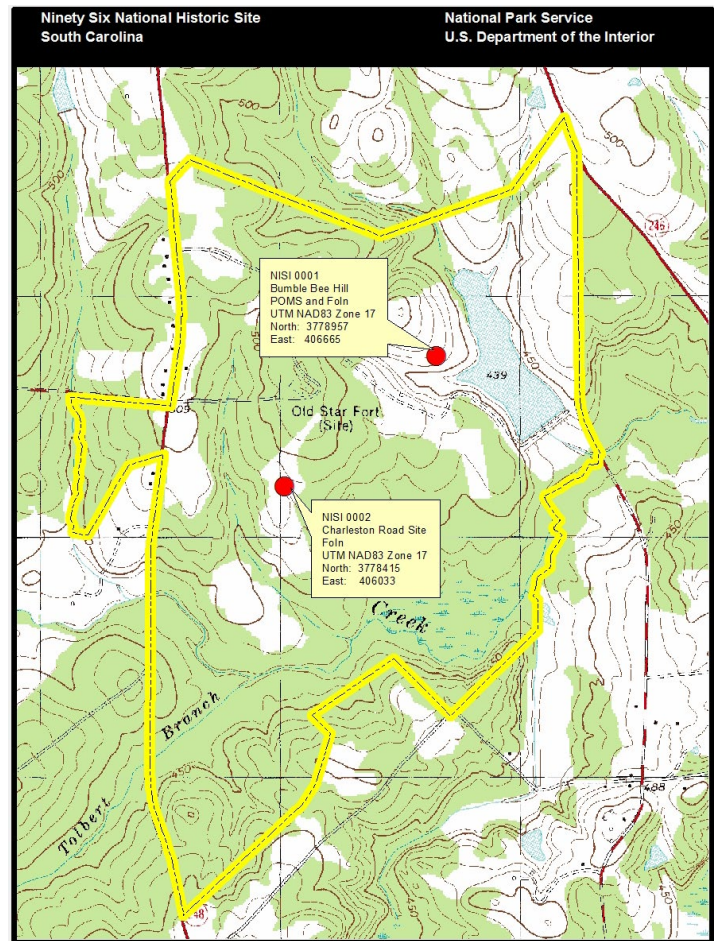


Figure 1. Map of NISI foliar injury sites. NPS / Lillian Scoggins.

Significant Findings

Ozone Concentration and Foliar Injury

The NPS Air Resources Division periodically evaluates status and trends of air pollutants in parks using monitors in and near those parks. The results of an evaluation of ozone concentration and ozone foliar injury at Ninety Six NHS in 2019 are shown in Figure 4.



Figure 2. Bumble Bee Hill foliar injury site. NPS / CUPN.

In 2019, 801 plants at four CUPN parks were inspected for foliar injury. Of the 237 plants examined at Ninety Six, three plants across three species were suspected to have foliar injury (all species were subsequently confirmed to have ozone-caused injury). Additionally, dogbane at the Bumble Bee Hill site was observed to have injury, though the sampler did not suspect that it was ozone-caused but collected a voucher. The injury on the voucher was subsequently determined to be ozone-caused.

Foliar injury surveys were conducted at Ninety Six NHS on July 30, 2019. The results are found in Table 1.

Table 1. Results of foliar injury surveys at Ninety Six National Historic Site in 2019. *Sampler did not think that injury observed was ozone-caused but submitted a voucher for inspection. Injury was subsequently determined to be ozone-caused.

Site Name	Species	Scientific Name	Number of Plants Inspected	Injury Confirmed?	Number of Plants with Observed Injury
Bumble Bee Hill	Blackberry	<i>Rubus</i> spp.	30	N/A	0
Bumble Bee Hill	Dogbane	<i>Apocynum</i> spp.	30	Yes	0*
Bumble Bee Hill	Sweetgum	<i>Liquidambar styraciflua</i>	30	N/A	0
Bumble Bee Hill	Yellow crownbeard	<i>Verbesina occidentalis</i>	30	Yes	1
Charleston Road	Blackberry	<i>Rubus</i> spp.	30	Yes	1
Charleston Road	Dogbane	<i>Apocynum</i> spp.	1	N/A	0
Charleston Road	Milkweed	<i>Asclepias</i> spp.	26	N/A	0
Charleston Road	Sweetgum	<i>Liquidambar styraciflua</i>	30	Yes	1
Charleston Road	Winged sumac	<i>Rhus copallinum</i>	30	N/A	0



Figure 3. Charleston Road foliar injury site. NPS / CUPN.

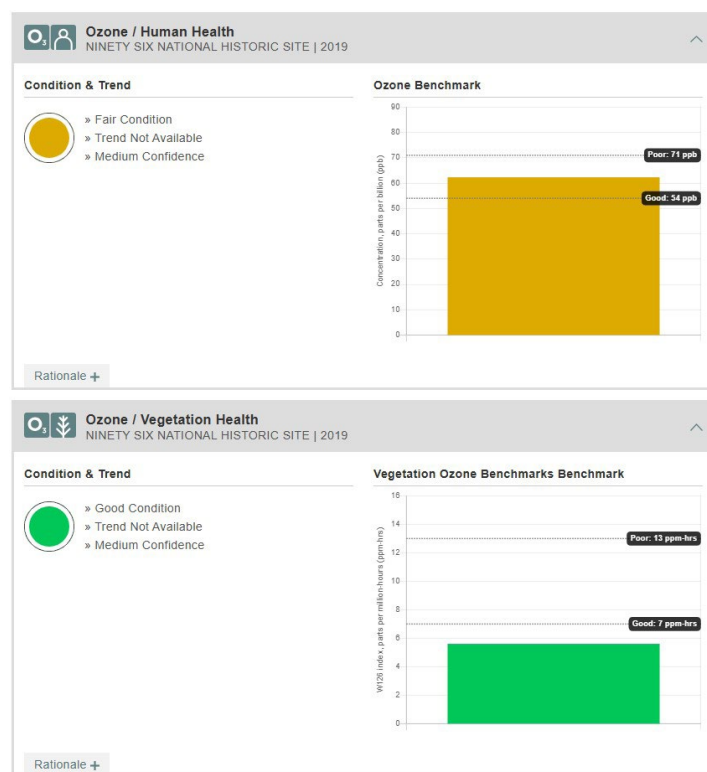


Figure 4. Status and trends in ozone concentration and ozone foliar injury for Ninety Six NHS (end year 2019). Image obtained from <https://www.nps.gov/subjects/air/park-conditions-trends.htm>

Future Monitoring

Ozone-induced foliar injury will be monitored by the 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 inventory and monitoring program in more than 280 National Park Service units. This program monitors fundamental elements and processes in park ecosystems to help indicate the overall health or condition of park resources. Data generated allows us to better understand natural processes and the results of management actions, and help guide parks in the successful protection and use of park resources. Information gathered is shared widely through the production of technical reports, resource briefs, and journal publications.

The Cumberland Piedmont Inventory and Monitoring Network, one of 32 networks across the country, includes 14 parks that share geographic proximity and common natural resources. Parks within each of the networks work together to plan, design, and conduct inventories and long-term monitoring. The Cumberland Piedmont Network provides long-term monitoring for water quality, cave bats, crickets and meteorology, Allegheny woodrats, forest vegetation, ozone foliar damage, and invasive species.

For More Information

CUPN Home Page:

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

CUPN Reports & Publications:

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

About the NPS Inventory & Monitoring Program:

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

Data Downloads via the Natural Resource Information Portal:

<https://irma.nps.gov/Portal/>