AIR QUALITY MONITORING CONSIDERATIONS FOR THE GULF COAST NETWORK

October 2002

Introduction

The NPS Air Resources Division (ARD) contracted with the University of Denver (DU) to produce GIS-based maps and an associated look-up table that provide baseline values for a set of air quality parameters for all Inventory and Monitoring parks in the U.S. These maps and table will serve as the Air Quality Inventory for the parks. Air Quality Inventory products are available on the Internet at http://www2.nature.nps.gov/ard/gas/ (see section called *Air Atlas*). ARD used preliminary DU products to help develop a strategy for expanding NPS ambient air quality monitoring with increased funding from the Natural Resources Challenge. At this time, ARD does not intend to fund additional monitoring at any NPS units in the Gulf Coast Network. The air monitoring strategy will be revisited in FY 2004 if additional funding becomes available.

Data from the Air Quality Inventory, national air monitoring programs described below, and other air quality sources, were used in conjunction with park-specific resource information to evaluate the following needs relative to the Gulf Coast Network: 1) the need for additional ambient air quality monitoring at any Network park, i.e., wet deposition, dry deposition, visibility, and/or ozone monitoring, and 2) the need for air quality effects-related monitoring at any Network park. The results of this evaluation, as well as a brief summary of results of past air quality monitoring at relevant sites, are discussed below.

Wet Deposition

The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) is a nationwide network of precipitation monitoring sites. The network is a cooperative effort between many different groups, including the U.S. Environmental Protection Agency (EPA), U.S. Geological Survey, U.S. Department of Agriculture, and private entities. The NPS is a major participant in NADP/NTN, and the ARD recommends that any new wet deposition site installed in a park meet NADP/NTN siting criteria and follow NADP/NTN protocols. There are currently more than 200 NADP/NTN sites spanning the continental U.S., Alaska, Puerto Rico, and the Virgin Islands.

The purpose of the network is to collect data on the chemistry of precipitation to monitor geographical and temporal long-term trends. The precipitation at each station is collected weekly according to strict clean-handling procedures. It is then sent to the Central Analytical Laboratory in Illinois where it is analyzed for hydrogen (acidity as pH), sulfate, nitrate, ammonium, chloride, and base cations (such as calcium, magnesium, potassium and sodium). NADP/NTN's excellent quality assurance programs ensure that the data remain accurate and precise. The National Atmospheric Deposition Program has also expanded its sampling to include the Mercury Deposition Network (MDN), which currently has over 35 sites. The MDN was formed in 1995 to collect weekly samples of precipitation, which are analyzed for total mercury. The objective of the MDN is to monitor the amount of mercury in precipitation on a regional basis.

None of the Gulf Coast Network parks have an NADP/NTN monitor on-site; all have a monitor within 130 miles. Distance, as well as terrain, intervening pollution sources, and differences in meteorology affect how representative a monitoring site's data are for a park. Based on a rough evaluation of these factors, it appears that Gulf Islands National Seashore (NS), Jean Lafitte National Historical Park and Preserve (NHP), Natchez Trace Parkway, Palo Alto Battlefield National Historic Site (NHS), Padre Island National Seashore (NS), and Vicksburg National Military Park (NMP) are well represented by existing NADP/NTN monitors. The monitors are fairly far away from San Antonio Missions National Historic Park (NHP) and Big Thicket National Preserve (NPres), and in the case of Big Thicket NPres, Houston lies between the monitor and the park. However, unless there is a concern about the effect of atmospheric deposition on park resources, e.g., surface water acidification, park staff should assume current wet deposition monitoring is adequate for San Antonio Missions NHP and Big Thicket NPres. In case the Network is interested in installing a NADP/NTN site, a site costs $5,000 to $8,000 for equipment purchase and installation, and operating costs (including site operation, chemical analysis, and reporting) are about $7,000 per year.

There are nine MDN sites in the Gulf Coast Network area. Stations are located at Longview, Texas (site #TX21); Alexandria, Louisiana (site #LA23); Chase, Louisiana (site #LA10); Hammond, Louisiana (site #LA28); Lake Charles, Louisiana (site #LA05); Oak Grove, Mississippi (site #MS22); Centreville, Alabama (site #AL03); Mobile County, Alabama (site #AL24); and Baldwin County, Alabama (site #AL02). There are no MDN monitors in central or southeast Texas or in the Florida panhandle. Adding mercury sampling to a NADP/NTN site increases annual costs by about $3,000.

Deposition varies with the amount of annual on-site precipitation, and is useful because it gives an indication of the total annual pollutant loading at the site. Concentration is independent of precipitation amount, therefore, it provides a better indication of whether ambient pollutant levels are increasing or decreasing over the years. In general, annual average wet deposition and concentration of sulfate, nitrate, and ammonium are higher in the eastern than in the western U.S. (see attached Air Inventory maps; also see NADP/NTN maps at http://nadp.sws.uiuc.edu). At many NADP/NTN sites across the U.S., concentration and deposition of sulfate have declined in recent years as sulfur dioxide emissions have decreased. Trends have been variable for nitrate and ammonium, with concentration and deposition at various sites increasing, decreasing, or showing no overall change. Results from NADP/NTN sites in and near Gulf Coast Network parks are summarized below.

<u>Edwards County, TX</u>
Edwards County, Texas, has had an NADP/NTN site (site #TX16 (Sonora)) since 1984. Data show a slight increase in all of the following: concentration and deposition of wet sulfate, concentration and deposition of wet nitrate, and concentration and deposition of wet ammonium.

Attwater Prairie Chicken NWR, TX

The Attwater Prairie Chicken National Wildlife Refuge, Texas, NADP/NTN site (site #TX10) has been operating since 1984. Site data show no trend in any of the following: concentration or deposition of wet sulfate, concentration or deposition of wet nitrate, and concentration or deposition of wet ammonium.

Corpus Christi, TX

An NADP/NTN site was installed at Corpus Christi, Texas, (site #TX39) in January of 2002. Trend data are not yet available from the site.

Nacagdoches County, TX

An NADP/NTN site operated in Nacagdoches County, Texas, (site #TX38 (Forest Seed Center)) from 1981 to 2001. It is unfortunate that the site was discontinued. However, trend data from the site are still of interest. These data show that while there was a decrease in concentration and deposition of wet sulfate, there was no overall trend in concentration and deposition of wet nitrate or concentration and deposition of wet ammonium.

Iberia Parish, LA

The Iberia Parish, Louisiana, NADP/NTN site (site #LA12 (Iberia Research Station)) has been operating since 1982. Data show a decrease in wet sulfate concentration and deposition, a decrease in wet ammonium concentration and deposition, but no trend in wet nitrate concentration and deposition.

Washington Parish, LA

The NADP/NTN site has been operating at Washington Parish, Louisiana, (site #LA30 (Southeast Research Station)) since 1983. Site data show a slight decrease in wet sulfate concentration and deposition, but no trend in wet nitrate concentration and deposition and no trend in wet ammonium concentration and deposition.

Clinton, MS

The Clinton, Mississippi, NADP/NTN site (site #MS10) has been operating since 1984. Site data show a slight decrease in wet sulfate concentration and deposition, but no trend in wet nitrate concentration and deposition and no trend in wet ammonium concentration and deposition.

Coffeeville, MS

An NADP/NTN site has been operating at Coffeeville, Mississippi, (site #MS30) since 1984. Site data show no trend in any of the following: concentration or deposition of wet sulfate, concentration or deposition of wet nitrate, and concentration or deposition of wet ammonium.

Hatchie NWR, TN

The Hatchie National Wildlife Refuge, Tennessee, NADP/NTN site (site #TN14) has been in operation since 1984. The site data show a decrease in deposition of wet sulfate; an increase in concentration of wet ammonium; an increase in concentration of wet

nitrate; and no overall trend in concentration of wet sulfate, deposition of wet nitrate, and deposition of wet ammonium.

Sumatra, FL
An NADP/NTN site was installed in Sumatra, Florida, (site #FL23) in 1999. Trend data are not yet available for the site.

Dry Deposition
The Clean Air Status and Trends Network (CASTNet) is considered the nation's primary source for atmospheric data to estimate dry acidic deposition. Established in 1987, CASTNet now comprises over 70 monitoring stations across the U.S. The majority of the monitoring stations are operated by EPA; however, approximately 20 stations are operated by the NPS in cooperation with EPA. Each CASTNet dry deposition station measures: weekly average atmospheric concentrations of sulfate, nitrate, ammonium, sulfur dioxide, and nitric acid; hourly concentrations of ambient ozone; and meteorological conditions required for calculating dry deposition rates. Dry deposition rates are calculated using atmospheric concentrations, meteorological data, and information on land use, vegetation, and surface conditions. CASTNet complements the database compiled by NADP/NTN. Because of the interdependence of wet and dry deposition, NADP/NTN wet deposition data are collected at or near all CASTNet sites. Together, these two long-term databases provide the necessary data to estimate trends and spatial patterns in total atmospheric deposition. The ARD recommends that all new dry deposition sites installed in parks use CASTNet siting criteria and follow CASTNet protocols.

Gulf Islands NS, Natchez Trace Parkway, and Vicksburg NMP have CASTNet monitors within 135 miles that can provide representative data. The closest monitors for other Gulf Coast Network parks are 280 to 460 miles away and can not be considered representative of the parks. However, given the expense of dry deposition monitoring, unless there is a need to better quantify dry deposition in a park, the ARD does not recommend the Network fund CASTNet monitoring. Installation and annual operating costs for a CASTNet site are about $50,000 and $15,000, respectively.

Because CASTNet uses different monitoring and reporting techniques than NADP/NTN, the dry deposition amounts are reported here as nitrogen and sulfur, rather than nitrate, ammonium, and sulfate. In addition, because CASTNet calculates dry deposition based on measured ambient concentrations and estimated deposition velocities, there is greater uncertainty in the reported values. Due to the small number of CASTNet sites nationwide, use of dry deposition isopleth maps is not advised at this time. CASTNet data collected at sites closest to Gulf Coast Network parks are summarized below.

Big Bend NP, TX
The Big Bend NP, Texas, CASTNet site (site #BBE401) has been in operation since 1995. There has been an increasing trend in dry nitrogen deposition but no trend in dry sulfur deposition at the site. Total nitrogen deposition at Big Bend NP is composed of 62 percent dry deposition and 38 percent wet deposition, while total sulfur deposition is 53 percent dry and 47 percent wet.

Sumatra, FL

A CASTNet site has been operating in Sumatra, Florida, (site #SUM156) since 1990. Data indicate no trends in either dry nitrogen or dry sulfur deposition. CASTNet estimates total nitrogen deposition at the site is composed of 26 percent dry deposition and 74 percent wet deposition, while total sulfur deposition is 19 percent dry and 81 percent wet.

Coffeeville, MS

A CASTNet site has been operating at Coffeeville, Mississippi, (site #CVL151) since 1988. While there has been no trend in dry sulfur deposition, dry nitrogen deposition increased through 1995, and then leveled off. CASTNet estimates total nitrogen deposition at the site is composed of 31 percent dry deposition and 69 percent wet deposition, while total sulfur deposition is 23 percent dry and 77 percent wet.

Caddo Valley, AR

The Caddo Valley, Arkansas, CASTNet site (site #CAD150) has been operating since 1989. Site data indicate no trends in either dry sulfur or dry nitrogen deposition. Total nitrogen deposition at the site is composed of 24 percent dry deposition and 76 percent wet deposition, while total sulfur deposition is 16 percent dry and 84 percent wet.

Edgar Evins State Park, TN

A CASTNet site has been operating at Edger Evins State Park, Tennessee, (site #ESP127) since 1988. Site data show a decrease in dry sulfur deposition, but no trend in dry nitrogen deposition. CASTNet estimates total nitrogen deposition at the site consists of 25 percent dry deposition and 75 percent wet deposition, while total sulfur deposition is 24 percent dry and 76 percent wet.

Air Toxics

Air toxics, e.g., mercury, dioxins, and benzene, may be a concern for Network parks, particularly those that are located in areas with petroleum or chemical manufacturing. Some states conduct air toxics monitoring. In most cases, the monitoring is focused primarily on urban areas and/or industrial sites. Due to time constraints, air agencies in Florida, Louisiana, Mississippi, and Texas were not contacted regarding potential toxics monitoring near Gulf Coast Network parks prior to preparation of this report. However, the states of Alabama and Tennessee have been contacted in the past six months regarding their monitoring programs. Tennessee started monitoring toxics in Kingsport, in the northeast corner of the state, this summer. The state has no plans to expand their toxics monitoring program at this time. Alabama currently monitors airborne mercury near Mobile, and the state may expand their toxics monitoring program in the future (contact is Elvin Lang at Alabama Department of Environmental Protection (334-271-7905)).

Surface Water Chemistry

The Water Resources Division's *Baseline Water Quality Data Inventory and Analysis* reports were reviewed for four Gulf Coast Network parks--Big Thicket NPres, Jean Lafitte NHP, Palo Alto Battlefield NHS, and San Antonio Missions NHP. The report for Padre Island NS should be available in a few months. Air pollution concerns relative to

surface water chemistry include acidification due to sulfur and nitrogen deposition in fresh water, eutrophication from excess nitrogen deposition in fresh or brackish water, and deposition of toxic air pollutants such as mercury, other metals, and organics. In general, acid-sensitive surface waters have a pH below 6.0 and an acid neutralizing capacity (ANC) below 100 microequivalents per liter (μeq/l). Results for the four Network parks are summarized below.

Big Thicket NPres

The 1995 Big Thicket NPres *Baseline Water Quality Data Inventory and Analysis report* indicates water quality standards have been exceeded for cadmium, copper, lead, silver, zinc, and mercury. Sources of contaminants include sewage treatment plant discharge, oil and gas production, and agriculture. There is no indication that eutrophication is a concern in the area. Data collected at Pine Island Bayou (through 1987) and the Neches River (through 1993) show surface waters are not sensitive to acidification from atmospheric deposition.

Jean Lafitte NHP

The 1994 *Baseline Water Quality Data Inventory and Analysis report* for Jean Lafitte NHP shows cadmium, copper, mercury, arsenic, chromium, and lead water quality standards have been exceeded. Sources of contaminants are typical of those encountered in an urban coastal area. There is no indication that eutrophication is a problem. As expected, data show the Mississippi River, its tributaries, and bayous are well buffered against acidification.

Palo Alto Battlefield NHS

The 2000 *Baseline Water Quality Data Inventory and Analysis report* for Palo Alto Battlefield NHS does not contain any data collected in the park. While the report indicates chromium, copper, mercury, silver, zinc, and nickel water quality standards have been exceeded, it acknowledges that 99 percent of the data were collected downstream of the park. Therefore, it is not possible to assess the sensitivity of park surface waters to air quality without performing synoptic sampling.

San Antonio Missions NHP

The 1999 *Baseline Water Quality Data Inventory and Analysis report* for San Antonio Missions NHP contains data for only one monitoring site in the park. This site is on the San Antonio River. While data indicate the San Antonio River and other rivers, creeks, and streams in the area are not sensitive to acidification from atmospheric deposition, the San Antonio River has had nitrate and nitrite samples that exceeded water quality standards. Potential sources of the contamination include wastewater discharge, agriculture, and atmospheric deposition. Chromium, cadmium, copper, lead, mercury, silver, zinc, DDD, DDT, dieldrin, toxaphene, and other organic pollutants have also exceeded water quality standards in samples collected in the area.

Visibility

In 1985, in response to the mandates of the Clean Air Act, Federal and regional/state organizations established the Interagency Monitoring of Protected Visual Environments

(IMPROVE) program to protect visibility in Class I air quality areas. Class I areas are national parks greater than 5,000 acres and wilderness areas greater than 6,000 acres, that were established prior to August 7, 1977. All other NPS areas are designated Class II. The objectives of the IMPROVE program are: to establish current visibility conditions in all Class I areas; to identify pollutants (particles and gases) and emission sources responsible for existing man-made visibility impairment; and to document long-term trends in visibility. In 1999, there were 30 official IMPROVE sites and 40 protocol sites. Because of recently enacted regulations that require improving visibility in Class I areas, the number of visibility monitors is increasing. Protocol sites are being upgraded to full IMPROVE sites and 80 new sites are being added to the IMPROVE network.

While the IMPROVE program has focused on Class I air quality areas, a great deal of visibility monitoring has been conducted in Class II areas. The ARD recommends that new visibility monitoring in NPS areas be conducted in coordination with the IMPROVE program (the IMPROVE program is managed out of the NPS ARD office in Fort Collins, Colorado). Installation and annual operating costs for a full IMPROVE site are about $15,000 and $30,000, respectively. Some Networks are considering monitoring visibility at scenic vistas with digital cameras. While this type of monitoring would not be appropriate for regulatory purposes, it is useful for documenting visibility conditions and trends and provides an excellent means of sharing that information with the public. Moreover, digital camera visibility monitoring would cost less than $5,000 per year.

There are six IMPROVE sites in the Gulf Coast Network area. An IMPROVE site has been operating at Big Bend NP (site #BIBE) since 1988, and a site has been operating at the Sipsey Wilderness Area, Alabama (site #SIPS) since 1992. Recently installed sites include Wichita Mountains National Wildlife Refuge, Oklahoma (site #WIMO); Sikes, Louisiana (site #SIKE), Breton National Wildlife Refuge, Louisiana (site #BRET); and Saint Marks National Wildlife Refuge, Florida (site #SAMA). Gulf Islands NS, Jean Lafitte NHP, Natchez Trace Parkway, and Vicksburg NMP have IMPROVE sites within 100 miles that likely represent visibility conditions in the parks. The closest monitors to the four Texas parks in the Gulf Coast Network are 160 to 460 miles away and may not be representative of the parks. Installing an IMPROVE monitor at Padre Island NS, for example, might improve regional coverage for those parks.

Data have been collected at Big Bend NP long enough to assess long-term visibility trends. The data show that views on the days with worst and average visibility improved between 1988 and 1998. There was no trend on days with the best visibility. As for the sources of visibility impairment, 1996-1998 aerosol data from Big Bend NP and Sipsey Wilderness Area show that, on an annual basis, visibility impairment is primarily due to sulfates (sources include coal combustion and oil refineries), then organics (sources include automobiles and chemical manufacturing), then soil (from windblown dust), then nitrates (sources include coal and natural gas combustion and automobiles), and then light absorbing carbon (sources include wood burning). At both sites, visibility was best in the winter and worst in the summer.

Ozone

All Gulf Coast Network parks have one or more ozone monitors within 35 miles. For Padre Island NS, monitors at Corpus Christi are probably fairly representative of ozone conditions at the northern end of the park. However, the only ozone monitor near the southern end of the park is in Brownsville, 45 miles away, so that monitor may not be representative. For Natchez Trace Parkway, monitors are located in Natchez, Jackson, Tupelo, Farview (Tennessee), and Nashville. While these monitors characterize ozone concentrations in urban areas along the parkway, they may not be representative of rural conditions. Big Thicket NPres, San Antonio Missions NHP, Gulf Islands NS, and the parts of Natchez Trace Parkway in Tupelo and the Nashville area are in ozone nonattainment areas (see attached maps), meaning that the ozone levels in those areas exceed EPA's human health-based 8-hour National Ambient Air Quality Standard (NAAQS). In areas with high ozone concentrations, an ozone nonattainment designation can actually benefit the parks, because the designation requires the local or state air pollution control agency to take measures to reduce ozone levels. In case the Network is interested, installation and annual operating costs for a permanent, continuous ozone-monitoring site are about $90,000 and $14,000, respectively. In some cases, it may be preferable to conduct short-term or seasonal (typically May-October) ozone monitoring. While this type of monitoring can not be used for regulatory purposes, i.e., for ozone attainment designation, it can provide useful information about ozone concentrations, and it is much less expensive and labor-intensive than operating a permanent ozone site. ARD staff can explain the pros and cons of various short-term monitoring options.

Vegetation

For vegetation, the focus is on ozone sensitivity because 1) ozone is a regional pollutant and is, therefore, more likely to affect park resources than other gaseous pollutants such as sulfur dioxide and nitrogen oxide which quickly convert to other compounds, and 2) the literature on ozone sensitivity is more recent and more reliable than that for other pollutants. Park vascular plant lists contained in the May 2001 NPSpecies database were compared to the lists of Ozone-Sensitive Plant Species contained in the NPS Synthesis information management system (see attached Synthesis species lists). The Synthesis lists were developed by an expert in the field of ozone effects on vegetation. Note that the Synthesis lists provide a general guide to ozone sensitivity. Differences in plant genetics, weather conditions, soil water availability, and ozone concentrations will affect whether or not a species exhibits injury in a particular park. In particular, studies have shown that plants will not take up ozone unless there is sufficient soil moisture. Ozone sensitive species of natural vegetation were identified for seven of the parks in the Gulf Coast Network (see attached tables of sensitive species for Network parks).

It is generally agreed that plant foliar injury occurs after a cumulative exposure to ozone. One ozone statistic that is used to evaluate the risk of plant injury is SUM06. SUM06 is the sum of all hourly average ozone concentrations greater than or equal to 60 parts per million (ppm). In 1997, a group of ozone effects experts recommended 3-month, 8:00 a.m. to 8:00 p.m., SUM06 effects endpoints for natural vegetation, i.e., 8 to12 ppm-hrs for foliar injury to natural ecosystems and 10 to 15 ppm-hrs for growth effects on tree seedlings in natural forest stands. According to a SUM06 map generated by DU, with the

exception of Palo Alto Battlefield NHS and Padre Island NS, Gulf Coast Network parks have ozone concentrations, during some years, that are high enough to harm native vegetation. 1995 to1999 seasonal average SUM06 values at Big Thicket NPres, Jean Lafitte NHP, San Antonio Missions NHP, and Vicksburg NMP were as high as 16-20 ppm-hrs. At Gulf Islands NS, values were16-20 ppm-hrs in Florida and 21-25 ppm-hrs in Mississippi. On the Natchez Trace Parkway, SUM06 values were 16-20 ppm-hrs in Mississippi, 26-34 ppm-hrs in southern Tennessee, and 35-39 ppm-hrs in the Nashville area. Network staff may want to conduct foliar injury surveys on sensitive plant species in those parks with high SUM06 ozone values. Good survey species are black cherry (*Prunus serotina*) and milkweed (*Asclepias spp*) because 1) ozone injury symptoms for these species are well described and 2) standardized survey protocols and training manuals can easily be adapted for Network parks.

Conclusions

None of the Gulf Coast Network parks have an NADP/NTN monitor on-site; all have a monitor within 130 miles. It is likely that all parks except Big Thicket NPres and San Antonio Missions NHP are well represented by existing monitors. However, unless atmospheric deposition is a concern at either park, installation of an NADP/NTN monitor is not necessary.

Gulf Islands NS, Natchez Trace Parkway, and Vicksburg NMP have CASTNet monitors within 135 miles that can provide representative data. The closest monitors for other Gulf Coast Network parks are 280 to 460 miles away and can not be considered representative of the parks. However, given the expense of dry deposition monitoring, unless there is a need to better quantify dry deposition in a park, installation of a CASTNet monitor is not recommended.

Air toxics may be an issue for some Gulf Coast Network parks, e.g., Big Thicket NPres, Gulf Islands NS, Padre Island NS. Therefore, monitoring of air toxics or monitoring contaminants in biota may be desirable.

Park water quality data were reviewed for four Gulf Coast Network parks. The data indicated surface waters at Big Thicket NPres, Jean Lafitte NHP, and San Antonio Missions NHP are not sensitive to acidification. Nitrogen deposition may be contributing to nitrogen problems in the San Antonio River at San Antonio Missions NHP. Toxics and/or heavy metals are a potential concern in surface waters at all four parks. The *Baseline Water Quality Data Inventory and Analysis report* for Palo Alto Battlefield NHS did not provide sufficient information to assess the sensitivity of surface waters in the park to air pollutants.

Gulf Islands NS, Jean Lafitte NHP, Natchez Trace Parkway, and Vicksburg NMP have IMPROVE sites within 100 miles that likely represent visibility conditions in the parks. The closest monitors to the four Texas parks in the Gulf Coast Network are 160 to 460 miles away and may not be representative of the parks. Installing an IMPROVE monitor at Padre Island NS, for example, might improve regional coverage for those parks.

All Gulf Coast Network parks have one or more ozone monitors within 35 miles that likely characterize ozone concentrations in the park. Although the Brownsville ozone monitor may be too far away to be representative of the southern end of Padre Island NS (45 miles away), given that 1) Brownsville is in attainment with the ozone NAAQS, and 2) the DU Air Inventory maps indicate ozone levels in the park are not high enough to harm vegetation, installation of an ozone monitor in the southern end of the park is not recommended. For Natchez Trace Parkway, all monitors are located in urban areas and may not be representative of rural conditions along the Parkway. If park staff want to characterize ozone concentrations in rural segments of the park, they may be interested in using temporary monitors rather than installing a permanent monitoring station.

Ozone sensitive vascular plant species have been identified for seven of the parks in the Gulf Coast Network. Ozone concentrations are high enough in six parks to warrant foliar injury surveys. Black cherry and milkweed are good candidates for such surveys.

Relevant Websites
NPS Air Inventory (Air Atlas) - http://www2.nature.nps.gov/ard/gas/
NADP - http://nadp.sws.uiuc.edu/
CASTNet - http://www.epa.gov/castnet/
IMPROVE - http://vista.cira.colostate.edu/improve/
Ozone - http://www.epa.gov/air/data/index.html
Pollution sources and monitors (maps) - http://www.epa.gov/ttn/naaqs/ozone/areas/