

Ocmulgee National Monument

National Park Service
U.S. Department of the Interior

Inventory & Monitoring Program
Southeast Coast Network



Inventory & Monitoring Program Status Report, 2012

Program Overview

In 1999, the National Park Service (NPS) initiated a long-term ecological Inventory & Monitoring (I&M) program to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and determine how well current management practices are sustaining those ecosystems.

To accomplish this, 32 “networks” of park system units were created to develop or acquire key baseline natural resource datasets, and to begin long-term monitoring of select measurements of resource condition (Fancy et al. 2009). The overarching purpose of natural resource monitoring in parks is to support science-based management of NPS resources by:

- Determining the status and trends in selected indicators of the condition of park ecosystems.
- Providing early warning of abnormal conditions.
- Providing data to better understand the dynamic nature and condition of park ecosystems and provide reference points for comparisons with other, altered environments.
- Providing data to meet legal and Congressional mandates.
- Providing means for measuring progress towards management goals.

The Southeast Coast Network (SECN) is one of 32 NPS Networks established to implement an integrated monitoring program under the Natural Resource Challenge. In 2001, the SECN began planning and implementing its long-term Vital Signs Monitoring Program, and completed its long-term monitoring plan in 2008 (DeVivo et al. 2008, 2011). Ocmulgee National Monument is in central Georgia and is one of 17 parks in the SECN (Figure 1).

About the Park

Ocmulgee National Monument (OCMU) sits on the “Fall Line” —the transition between the rolling Piedmont and the flat Atlantic Coastal Plain. A portion of the monument is within the city limits of Macon, GA. The Ocmulgee River comprises the boundary on the southwestern side of the

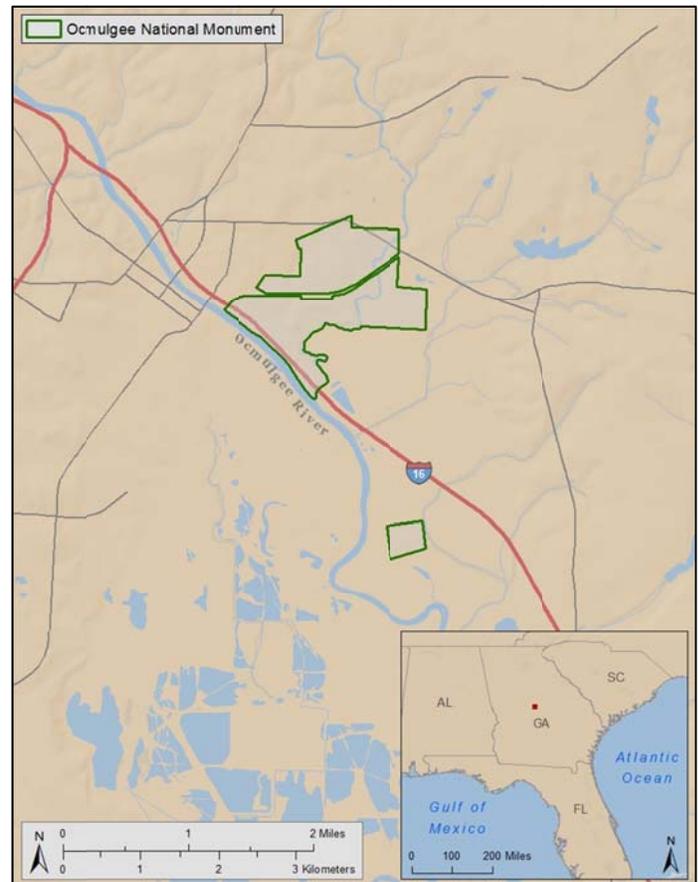


Figure 1. Location of Ocmulgee National Monument, GA.

monument. The natural resources of the park have been heavily impacted by human activities, including Interstate Highway 16 and its associated berm, which has essentially cut off the river from its floodplain and disrupted the natural flow of the area. Despite this, and its proximity to Macon, OCMU has a surprising amount of wildlife present. This is probably a result of a corridor, or what is known locally as the “Greenway,” connecting the monument to other natural areas south of the monument. Numerous bird species are present in the monument throughout the year. Migratory birds utilize the area as a stopover during spring and fall migrations. The endangered wood stork (*Mycteria americana*) feeds here during summer months. Numerous other wildlife live here, including white-tailed deer, beaver, bobcat, alligators, and various reptiles and amphibians. Recreational fishing is allowed, with largemouth bass and bream being two common

catches. Within the last eight years, coyotes have entered the Monument. What effect this will have on the local ecosystem is unknown.

Threats affecting the native plants and animals in the Monument result mainly from human activities, and include non-native species invasion, water quality, air quality, development, and the general proximity to the city of Macon. Non-native species are a disruptive influence in the Monument. Non-native invasive plants at OCMU include privet, Japanese honeysuckle, and kudzu. Non-native animal species include nutria, fire ants, feral pigs, as well as domestic dogs and cats. Feral pigs are responsible for a tremendous amount of resource damage in both the main unit and the detached Lamar unit. Fire ants are also a concern and are spreading across the park.

Baseline Inventories

The primary purpose of natural resource inventories is to document the presence of resources in parks, and to assess and document the current condition and knowledge of natural resources in the parks. Inventories allow comparison of existing conditions to the natural or desired state of parks, establish a solid baseline for making scientifically sound management decisions and for designing long-term monitoring plans that track the health of key park resources.

Table 1. Status of twelve baseline inventories Ocmulgee National Monument [● – Complete; ◐ – In Progress; ✕ – Not Yet Scheduled]

Inventory	OCMU
Air Quality Data	●
Air Quality Related Values	●
Base Cartography Data	●
Baseline Water Quality Data	●
Climate Inventory	●
Geologic Resources Inventory	◐
Natural Resource Bibliography	●
Soil Resources Inventory	●
Species Lists	●
Species Occurrence and Distribution	●
Vegetation Map Inventory	◐
Water Body Location and Classification	●

The NPS I&M Program developed a strategy in 1992 for developing and delivering a minimal set of products for 12 “basic” natural resource inventories that were common to all park units containing significant natural resources; all are

either complete or underway at OCMU (Table 1; see Tuberville et al. 2005 and Webster 2010).

Watershed Condition Assessment

In addition to the 12 basic inventories, the SECN has also conducted a watershed condition assessment, designed to identify the current state of water resources within and upstream of OCMU, as well as an evaluation of factors that might affect water resources in the future.

The overall assessment of this report is that the natural and cultural resources of OCMU are seriously threatened by upstream and encroaching urbanization, and by the multitude of water and air pollutants and other stressors associated with rapid human population growth, land development, and natural resource degradation and destruction (Burkholder et al. 2010). The five streams that flow through OCMU, including three perennial streams, all show signs of degradation from sedimentation, bank erosion, and trash accumulation. The two major streams, segments of the Ocmulgee River and its major tributary Walnut Creek, have been designated as impaired waters for biota and/or general recreation on the state’s 303(d) list. The causes of impairment have been identified as urban nonpoint pollution, in particular, excessive sediment loading and high fecal coliform bacterial densities. The Ocmulgee River segment is also impaired for fish consumption because of high PCB content.

Vital Signs Monitoring

In addition to the baseline inventories, the SECN has selected 17 indicators of ecosystem condition, or Vital Signs, to be monitored at OCMU. Long-term monitoring of 12 of these Vital Signs has been wholly or partially implemented by the Network at OCMU. These Vital Signs include a combination of field efforts being conducted by NPS and its partners, as well as the analysis and interpretation of data being collected by other state and federal programs.

Air Quality

Data from various air quality monitoring programs are summarized regularly including the National Atmospheric Deposition Program – National Trends Network (NADP/NTN), the Environmental Protection Agency’s Clean Air Status and Trends Network (CASTNET), and the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. Data from 2005 to 2009 show that ozone, total-N wet deposition, total-S wet deposition and

visibility levels at OCMU were all considered to be of significant concern (Table 2).

A 2011 analysis of acid deposition showed OCMU to be at high risk of nutrient exposure, and a high risk of atmospheric nutrient enrichment (Sullivan et al. 2011a). Although considered to be at a high risk of pollutant exposure, the overall risk of threats to resources from acid deposition is only moderate at OCMU. The overall moderate risk is due to the low sensitivity of resources present at OCMU (Sullivan et al. 2011b).

Table 2. Air quality interpolation values for the period 2005-2009 at Ocmulgee National Monument. Yellow indicates values of moderate concern. Red indicates values of significant concern.

Ozone Concentration (ppb)	Total-N Wet Deposition (kg/ha/yr)	Total-S Wet Deposition (kg/ha/yr)	Group50 Visibility (dv)
80	3.25	3.55	12.3

Birds

Birds are an important component of park communities and their ecological position in most food webs allows them to be good indicators of local and regional ecosystem changes. Long-term trends in the community composition, relative abundance, distribution, and occurrences of breeding-bird populations provide a measure for assessing the ecological integrity and sustainability in southeastern systems. Further, long-term patterns in community composition, relative abundance, distribution, and occurrences in relation to current management practices, will improve our ability to implement effective management strategies in the future.

More than 650 birds representing 71 species were detected at Ocmulgee National Monument during surveys in 2009 (Byrne et al. 2011).

- Carolina wren, Northern cardinal, and tufted titmouse were the most widely distributed species at the Monument and were detected at all sampling locations. Red-bellied woodpecker, Carolina Chickadee, American crow, and white-eyed vireo were the second most widely distributed species at the Monument and were detected at 70–90% of sampling locations.
- Two non-native species were detected: European starling and house finch.

- Monitoring efforts resulted in the addition of three new species to the Monument’s official species list: alder flycatcher, cliff swallow, and tree swallow (Figure 2).



Figure 2. Tree swallow (*Tachycineta bicolor*) was a new species added to OCMU’s official list in 2009. Photo by Thomas G. Barnes.

Amphibians

OCMU has 25 known amphibian species; 9 in Caudata (salamanders, newts, amphiumas, sirens), and 16 in Anura (frogs and toads; NPSpecies 2012). Because of their complex life histories, habitat requirements, anatomy, and physiology, amphibians are considered to be good indicators of changes in ecosystem conditions as they are affected by climate change, land use development and conversion, contaminants, and changes in hydrology.

During monitoring efforts conducted in 2009, 11 native anuran species were detected (Byrne et al. 2011, Figure 3). No non-native species were detected. Bird-voiced tree frog (*Hyla avivova*) was the most widely distributed amphibian. Southern toad (*Bufo terrestris*), cricket frog (*Acris crepitans/gryllus*), green treefrog (*Hyla cinerea*), and green frog (*Rana clamitans*) were detected at more than five locations. Species accumulation curves indicated that sampling locations/methods are adequate to characterize and sample the amphibian community at OCMU. These data will serve as a baseline for future monitoring efforts of vocal anurans at the Monument.

The SECN also conducted surveys for chytrid fungus (a pathogen linked to amphibian population declines around the world) and did not find evidence of its presence in any species (Byrne and Moore 2011).



Figure 3. Eastern narrow-mouthed toad (*Gastrophysone carolinensis*). Photo by SECN Staff.

Plant Communities

Plant communities are the primary drivers for a range of ecological processes and are integral to the proper function of park ecosystems. They serve as the foundation for food webs and wildlife habitat for many species, and function as a carbon sink, produce oxygen, cycle nutrients and energy through an ecosystem, influence the local climate, improve water quality, and moderate flooding and erosion. Given the widespread anthropogenic influences in SECN parks and the importance of vegetation communities, determining trends in vegetation communities is vital to understanding the ecological processes and identifying stressors and their impacts.

OCMU has 406 known vascular-plant species, subspecies, and varieties (NPSpecies 2012). The SECN conducted plant surveys during the summer of 2011 and the data are currently being processed. The data summary report is expected to be complete in summer 2012.

Weather and Climate

Weather and climate are key drivers for ecosystem patterns and processes, affecting both biotic and abiotic components alike. Continuous weather monitoring is an important factor in separating the effects of climate from the effects of human-induced disturbance on other Vital Signs (e.g., plant and animal communities and population dynamics). In support of these efforts, the SECN has compiled and analyzed data from existing sources to (1) determine status, trends, and variability of precipitation and temperature over time inside and around

SECN park units; (2) determine the status, trends, and variability of derived weather data (i.e., drought indices) inside and around SECN park units; (3) track the location, magnitude, and frequency of extreme weather events that affect SECN park resources.

Average monthly temperatures at weather stations near OCMU ranged from a low of 27.7°F to a high of 94.6°F; temperatures were above normal at most locations during the spring, summer, and early fall months and below normal during the winter, though not outside the range of variation for the long-term average.

Total annual precipitation at Macon Airport was 43.99 inches, which is 1.69 inches below normal (Figure 4).

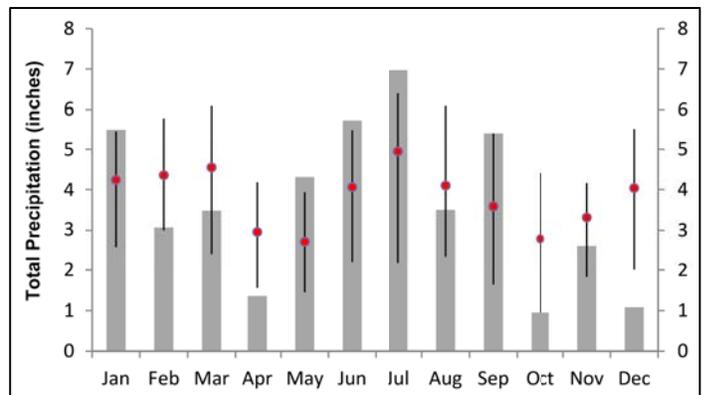


Figure 4. Total monthly precipitation during 2010 and the 30-year (1981 - 2010) monthly averages for Macon Middle Georgia Regional Airport station. The gray columns represent 2010 total monthly precipitation. The red circles represent the 30-year average; the lines indicate the 25th and 75th percentile of the 30-year normal data for each month

Streamflow Characteristics

The SECN evaluated stream flow variability and the magnitude and timing of specific flow events at OCMU during 2010 (Gregory et al., *in review*). Flow patterns were characterized and put in historical context using U.S. Geological Survey stream flow data, The Nature Conservancy's Indicators of Hydrologic Alteration software, and the program Flow (Dowd 2011).

Two stations were observed for the Ocmulgee River (Figure 5). Flows on the Ocmulgee River near the Monument were much higher during the winter and early spring months from January to March. Flow on the Ocmulgee River from January to February exceeded the 75th percentile for flows typically observed during that time of year.

During the fall months from September to December, however, flows were the lowest observed during the year, but

this pattern is normal and not outside what is typically observed on the Ocumlgee. Small flooding was observed over a 32-day period beginning on January 26 and flows over 24,000 cfs were observed.

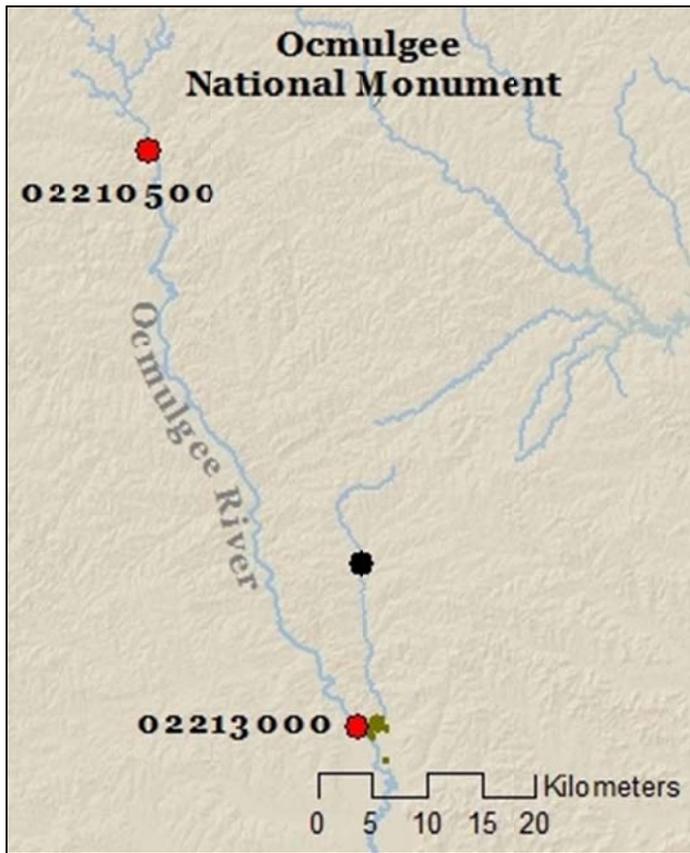


Figure 5. USGS gaging stations along Ocmulgee National Monument in Macon, Georgia. Red Stations were used in the report, black stations were not evaluated.

Groundwater

All Southeast Coast Network (SECN) parks and ecosystems are linked to the groundwater system (i.e., aquifers). These aquifers are affected by modifications to surface waters (e.g., impoundments), long-term weather patterns (e.g., flooding and drought), and extraction (e.g., anthropogenic influences). Because aquifers serve as a water supply for industrial, commercial, residential, and agricultural needs, anthropogenic demands on this freshwater resource are high. Aggregate influences of changes in groundwater can influence hydrologic processes, wetland function, freshwater availability for fish and wildlife, plant-community species distribution, composition, diversity, and structure, and potentially affect the integrity of park ecosystems.

An inventory of existing wells that are within or in proximity to SECN parks has been conducted and applications to retrieve and analyze existing long-term periods of record have

been developed (Rasmussen et al. 2009). The SECN assesses trends in groundwater dynamics at OCMU annually (Wright et al., *in review*). In 2011, Ocmulgee National Monument had one relevant groundwater well included in this analysis, which showed a significant, negative trend in groundwater levels over the period of record (>50 years; Figure 4).

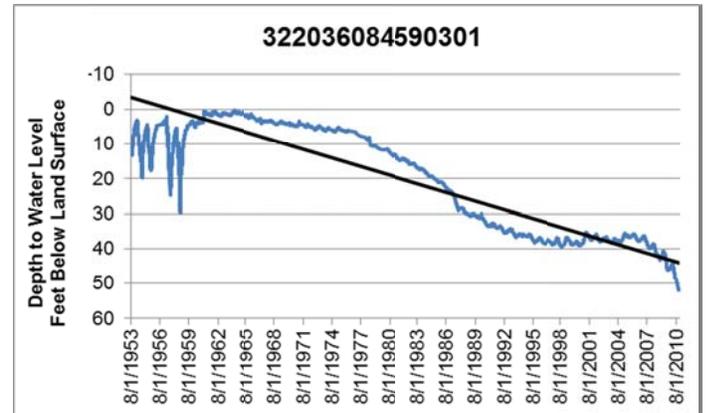


Figure 6. Water levels and calculated trend line for groundwater well 322036084590301 (Blufftown Formation Aquifer near OCMU).

Stream Habitat

Beginning in FY 2012, stream habitat monitoring will be conducted at OCMU. The monitoring protocol is being developed by the USGS National Water Quality Assessment (NAWQA) program and is an extension of existing NAWQA and USDA protocols. A combination of reach- and transect-level flow, geomorphic, and physical instream and riparian habitat measurements will be included in the protocol. Watershed-scale monitoring efforts have been eliminated since the landscape dynamics vital sign currently addresses these issues.

In addition, panoramic 360° still photography will be conducted on timed intervals along the length of major park riverine waterbodies and will be synced with both GPS and core water quality parameters (temp, DO, pH, conductivity). This will allow the generation of a full-river map of potential sites of management concern (such as erosion features). This dataset also has many potential outreach uses such as virtual river tours. A video surveillance component is planned to augment data collected by traditional means and will consist of simultaneous filming of both banks with geotagged footage.

Fire Fuels and Dynamics

The SECN conducted fire fuel surveys during the summer of 2011 and the data are currently being processed. A summary data report is expected summer 2012.

Other Monitoring Efforts

NPScape is a landscape dynamics monitoring project that produces and delivers to parks a suite of landscape-scale data sets, maps, reports, and other products to inform resource management and planning at local, regional, and national scales. Changes in the composition and configuration of different land cover types within and adjacent to national parks has been shown to greatly affect biological and physical processes within those parks, such as habitat availability, animal movements, potential for invasion by non-native plants, water quality, and in-stream habitat for fish and other aquatic organisms. Information about changes and trends in landscape-scale indicators in and around parks can help park managers anticipate, plan for, and manage associated effects to park resources.

At its core, NPScape delivers a suite of products that focus on a set of information-rich, landscape-scale indicators for 270+ parks with significant natural resources. The initial analyses summarized and delivered measures in six major categories (population, housing, roads, land cover, pattern, and conservation status) that broadly address the environmental drivers, natural attributes, and conservation context of NPS units (Figure 7). In aggregate, these measures contribute to assessments of current natural resource status, potential threats, and conservation vulnerability and opportunity.

Further information on NPScape, including access to all products, is available through the NPScape website (<http://science.nature.nps.gov/im/monitor/npscape/>) and the NPS Integrated Resource Management Applications (IRMA) data system (see below).

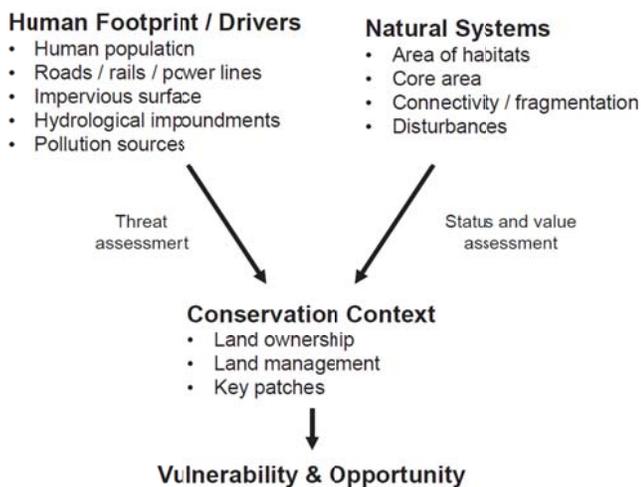


Figure 7. Example measures of landscape dynamics included in the NPScape program (<http://science.nature.nps.gov/im/monitor/npscape/>).

Where to Find Information

The NPS I&M Program was created as part of the National Park Service's effort to "improve park management through greater reliance on scientific knowledge." A primary role of the I&M Program is to collect, organize, and make available natural resource data and to contribute to the Service's institutional knowledge by facilitating the transformation of data into information through analysis, synthesis, and modeling. Information about the program can be found at <http://science.nature.nps.gov/im/index.cfm>.

About the Southeast Coast Network

The SECN includes twenty parks, seventeen of which contain significant and diverse natural resources. In total, SECN parks encompass more than 184,000 acres of federally-managed land across North Carolina, South Carolina, Georgia, Alabama, and Florida. The parks span a wide diversity of cultural missions also, including four national seashores, two national historic sites, two national memorials, seven national monuments, two national military parks, as well as a national recreation area, national battlefield and an ecological and historic preserve. The parks range in size from slightly more than 20 to nearly 60,000 acres, and when considered with non-federal lands jointly managed with NPS, the Network encompasses more than 253,000 acres.

Information on activities of the SECN can be found at <http://science.nature.nps.gov/im/units/secn/>, including the Network's monitoring plan, descriptions of inventory and monitoring efforts, and links to data and final project reports.

Get Data

The NPS Integrated Resource Management Applications (IRMA) portal (<http://irma.nps.gov>) is the start of a web-based "one-stop" for data and information related to National Park Service natural and cultural resources. IRMA allows users to search, view, download, and print information from multiple sources and systems, all from a consistent user interface. No logins or passwords are required.

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