

Horseshoe Bend National Military Park

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). Horseshoe Bend National Military Park (HOBEN) is one of 17 parks in the SECN (Figure 1).

About the Park

Horseshoe Bend National Military Park (HOBEN) is comprised of 2,040 acres and is situated near the southern end of the Piedmont Plateau. It contains low rolling hills, which reach elevations from 600 to 711 feet above sea level. The park not only contains many species of plants endemic to the Piedmont

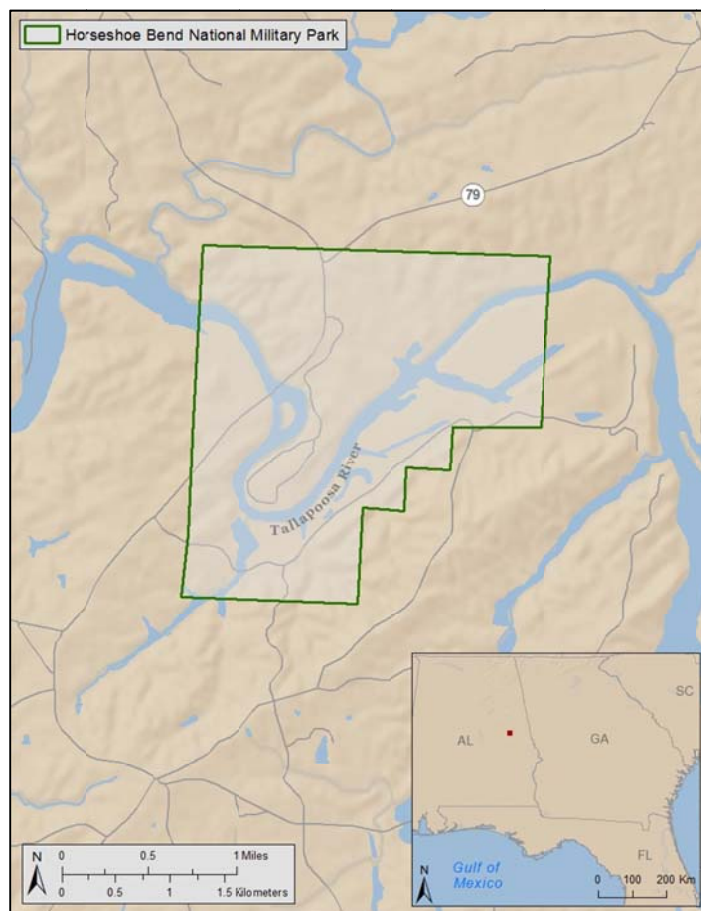


Figure 1. Location of Horseshoe Bend National Military Park, AL.

region, but also species associated with the Southeastern and Southern Coastal Plains. River bottomland borders each side of the Tallapoosa River. This land, which was extensively cultivated from 1832 until the establishment of the park in 1959, is in various stages of ecological succession. The land has undergone some minor changes in the intervening 175 years since the battle. In many places, pines have displaced the climax hardwoods that existed in 1814. The vegetation has been altered by human settlement, logging, and by the introduction of non-native species. The timbered lands that once gave way to agricultural crops have now given way to natural reforestation or open fields. Forest type is mesic beech-oak-hickory with some loblolly pine. Drier areas and ridge tops are dominated by loblolly pine, with scattered longleaf pine along the northern third of the park. The

understory is relatively open and dominated by sapling elms, blueberries, silver bells, muscadines and ferns. The condition of wildlife species was basically unknown upon acquisition of the park. It was found that all wildlife species had been indiscriminately hunted and preyed upon by feral dogs and cats until many species barely continued to exist. Enforcement of resource laws concerning flora and fauna has allowed a diversity of wildlife species to be re-established upon the varied habitats of the park.

The hydrologic regime of the Tallapoosa River, 3.5 miles of which are within the park boundary, is dam-controlled upstream of the Park by Alabama Power Company. The release schedule is determined by hydroelectric needs and bears no relationship to natural flows, more resembling a “trickle or torrent” that impacts both natural resources and the cultural landscape. The U.S. Fish and Wildlife Service is currently seeking to accelerate reauthorization of the dam in order to negotiate a flow regime less detrimental to river ecology.

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 and 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 conducted at Horseshoe Bend National Military Park [● – Complete; ◐ – In Progress; ✕–Not Yet Scheduled]

Inventory	HOBE
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 HOBE (Table 1; see Tuberville et al. 2005 and Webster 2010 for final reports).

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 HOBE, as well as an evaluation of factors that might affect water resources in the future (Burkholder and Rothenberger 2010).

The assessment indicated that present water quality concerns in the park, which is in the middle Tallapoosa sub-basin, are sedimentation from increased clearcutting, pollution from agriculture and silvaculture, and atmospheric deposition of dust/particulates, toxic contaminants, and other pollutants from larger cities in the state and from Atlanta, Georgia. While the middle Tallapoosa sub-basin, at present, is only about 5% urbanized, the combined pressures of anticipated increased development in both the upper and middle basins are expected to increase land disturbance and water pollution including excessive suspended sediments, nutrients, fecal bacteria, and toxic substances. Although the overall potential for nonpoint source impairment in the middle sub-basin has been evaluated as low, more than half of the sub-watersheds in this sub-basin were estimated by the state environmental agency to have moderate potential of nonpoint source impairment because of runoff from forestry practices, clearcutting, and sedimentation.

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 HOBE. Long-term monitoring of 12 of these Vital Signs has been wholly or partially implemented by the Network at HOBE. 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 total-N wet deposition, total-S wet deposition and visibility levels at HOBE were all considered to be of significant concern, while ozone was of moderate concern (Table 2).

Table 2. Air quality interpolation values for the period 2005–2009 at Horseshoe Bend National Military Park. Red indicates values of significant concern. Yellow indicates values of moderate concern.

Ozone Concentration (ppb)	Total-N Wet Deposition (kg/ha/yr)	Total-S Wet Deposition (kg/ha/yr)	Group50 Visibility (dv)
75.3	4.3	4.88	14.2

A 2011 analysis of nutrient deposition showed HOBE 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 HOBE. The overall moderate risk is due to the moderate sensitivity of resources present at HOBE (Sullivan et al. 2011b).

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 within and around SECN park units; (2) determine the status, trends, and variability of derived weather data (i.e., drought indices) within and around SECN park units; (3) track the location, magnitude, and frequency of extreme weather events that affect SECN park resources (Wright et al. 2011).

Average monthly temperatures at weather stations near HOBE ranged from a low of 37.3°F to a high of 83.6°F. Average monthly temperatures were above normal at most locations during the summer months and below normal during the winter. The average annual temperature was below normal.

Monthly precipitation was above average during January, May, August, and November at the Alexander City Station, and January–March at Lafayette 2W. Precipitation was below average the rest of the year (Figure 2).

Average monthly maximum relative humidity ranged 89–94% with the lowest maximum relative humidity occurring in December. Average monthly minimum relative humidity ranged 28–49% with the lowest minimum relative humidity occurring in October.

Derived climate measures indicated that the growing season length ranged 230–243 days across both weather stations used in this analysis and derived climate measures, such as date of last freeze, varied between stations.

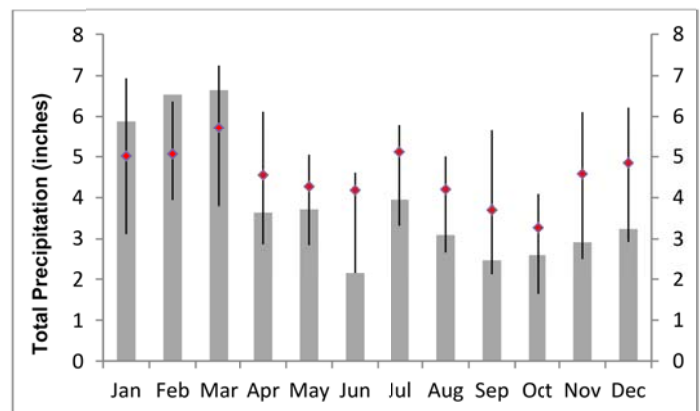
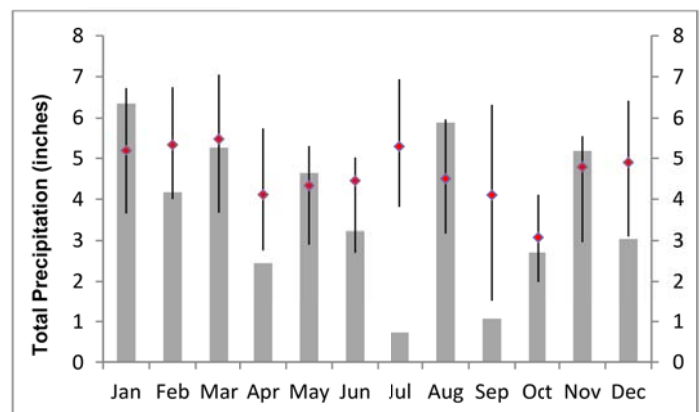


Figure 2. Total monthly precipitation during 2010 and the 30-year (1981 - 2010) monthly averages for Alexander City (above) and Lafayette 2W (below) stations. The gray columns represent 2010 total monthly precipitation. The red circles represent the 30-year average; the lines indicate the 25th and 75th percentile of the 30-year normal data for each month.

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.

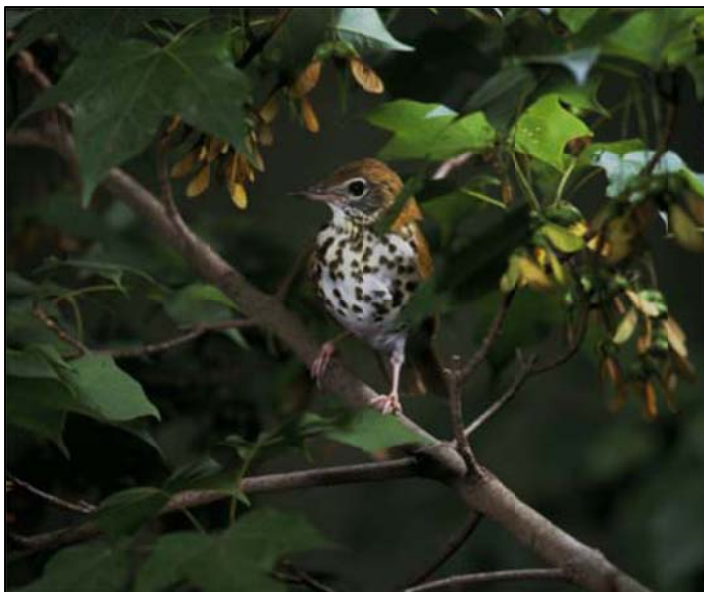


Figure 3. Wood thrush (*Hylocichla mustelina*) was a priority species detected at HOBE in 2009. Photo by Steve Maslowski.

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 800 birds representing 53 species were detected at Horseshoe Bend National Military Park during surveys in 2009 (Byrne et al. 2011).

Northern cardinal and Northern parula were the most widely distributed species at the Park. No non-native species were detected. Monitoring efforts resulted in the addition of cliff swallow and yellow warbler to the Park's official species list.

Several priority species were detected during the sampling effort including Kentucky warbler, Louisiana waterthrush, Northern bobwhite, Northern parula, prothonotary warbler, summer tanager, white-eyed vireo, wood thrush (Figure 3), worm-eating warbler, yellow-billed cuckoo, yellow-throated vireo, and yellow-throated warbler.

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 HOBE annually using data from two wells in the vicinity of HOBE (Wright et al., *in review*). Both wells showed a significant trend, one positive and one negative, for groundwater levels over the period of record (Figure 4). Only well 322047086214301 has a long period of record (>50 years); both wells collect a significant number of observations (>12 per year).

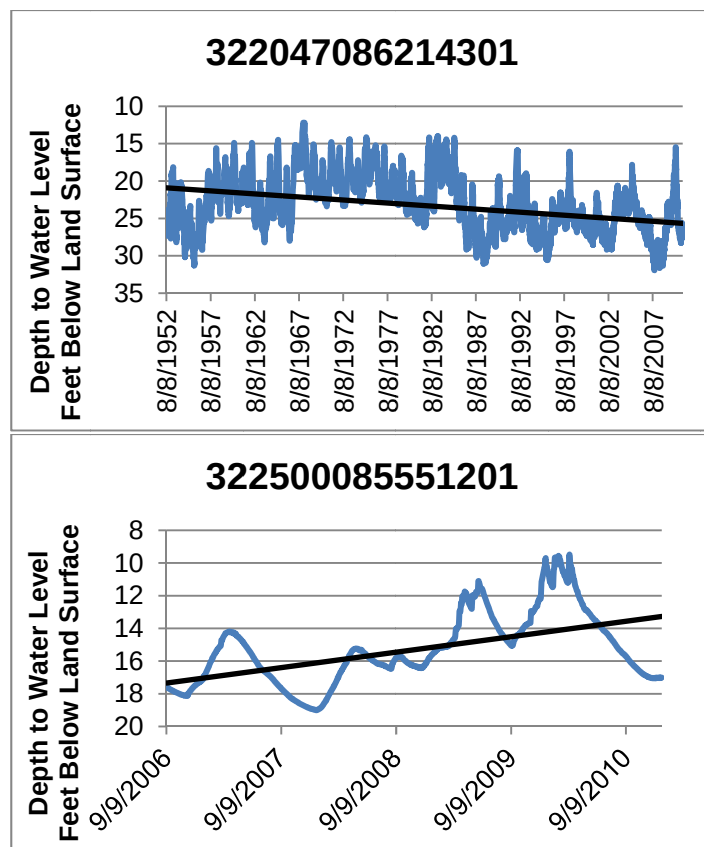


Figure 4. Water levels and calculated trend line for groundwater well 32204786214301 (above) and groundwater well 322500085551201 (below) (Eutaw Formation Aquifers near HOBE).

Stream Flow Characteristics

The SECN evaluated stream flow variability and the magnitude and timing of specific flow events at HOBE during 2010 (Gregory et al., *in review*). Flow patterns were

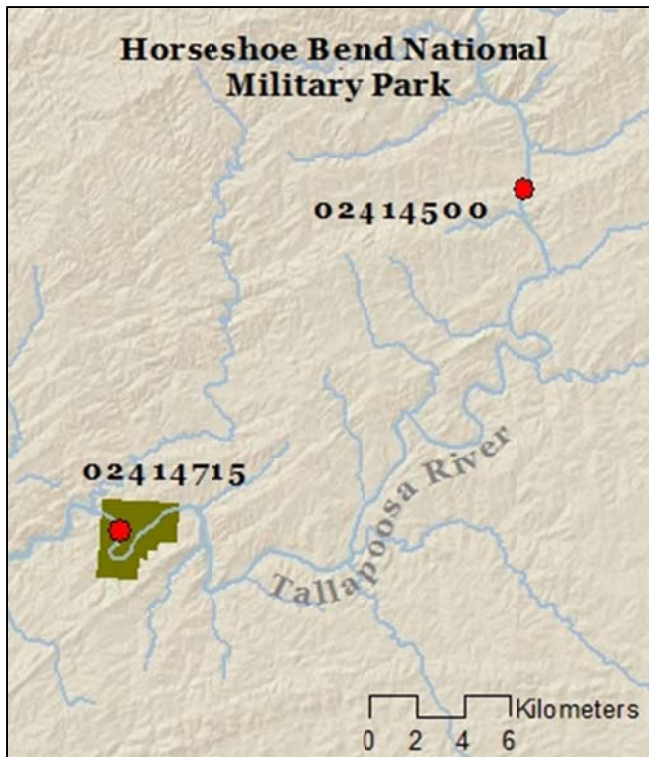


Figure 5. USGS gaging stations near Horseshoe Bend National Military Park, Alabama.

characterized and put in historical context using U.S. Geological Survey stream flow data, The Nature Conservancy's Indicators of Hydrologic Alteration software, and program Flow (Dowd 2011). This analysis was conducted for two stations near the park (Figure 5).

Flows on the Tallapoosa River near Horseshoe Bend were much higher during the winter and early spring months January–March compared to the rest of the year.

Flow on the Tallapoosa from January to March exceeded the 75th percentile for flows typically observed during that time of year. Smaller events exceeding the 75th percentile of all historical observations were also experienced during the month of May.

During the summer, fall, and early winter months from June to December, however, flow was much lower, but within the range of normal variability typically observed. The first peak extreme low flows occurred during September and the longest small flood event began on March 12 and continued for 17 days.

Stream Habitat

Beginning in FY 2012, stream habitat monitoring will be conducted at HOBE. 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.

Amphibians

HOBE has 30 known amphibian species: 11 in Caudata (salamanders, newts, amphiumas, sirens), and 19 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.

Seven of the 19 anurans known to occur at HOBE were detected during sampling. No non-native species were detected. Fowler's toad (*Bufo fowleri*) was most widely distributed amphibian followed by Cope's gray treefrog (*Hyla chrysoscelis*; Figure 6), and green frog (*Rana clamitans*).

Species accumulation curves indicated that additional sampling locations/methods are needed to adequately sample the amphibian community at HOBE. These data will serve as an information baseline for future monitoring efforts of vocal anurans in the Park.

The SECN also conducted surveys for chytrid fungus (a pathogen linked to amphibian population declines around the world [Byrne and Moore 2011]). Evidence of the fungus was found in several larval and post-metamorphic frogs

(*Lithobates clamitans* and *Eurycea cirrigera*). None of the individuals showed clinical signs of the disease, however.



Figure 6. Cope's gray treefrog (*Hyla chrysoscelis*)
Photograph by J.D. Wilson.

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.

HOBE has 431 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.

Fire Fuels and Dynamics

The SECN conducted fire fuel surveys during the summer of 2011 and the data are currently being processed, and 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).

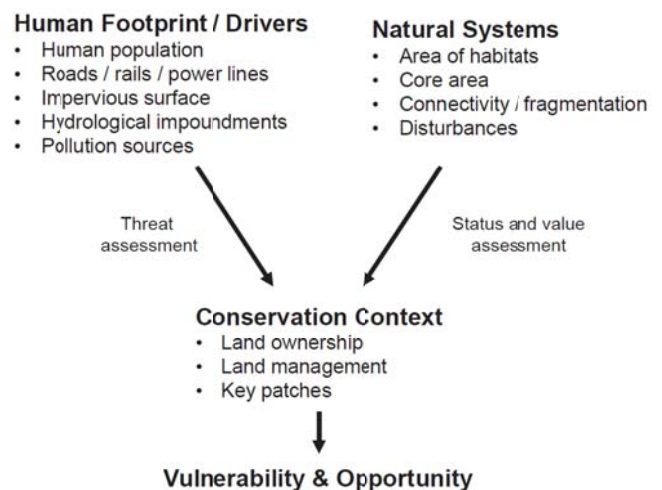


Figure 7. Example measures of landscape dynamics included in the NPScape program
(<http://science.nature.nps.gov/im/monitor/npscape/>).

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 20 parks, 17 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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