



The Vital Signs Monitoring Program is designed to be an integral link in the adaptive management cycle, providing critical natural resources trend information to decision-makers

IMPLEMENTATION

Detailed monitoring protocols will document step-by-step guidance for collecting, analyzing, and reporting information for each Vital Sign. In some cases monitoring will be carried out by Network personnel; in other cases data being collected by other agencies and organizations will be regularly gathered, analyzed and interpreted for reports to the parks.



INTEGRATION WITH MANAGEMENT

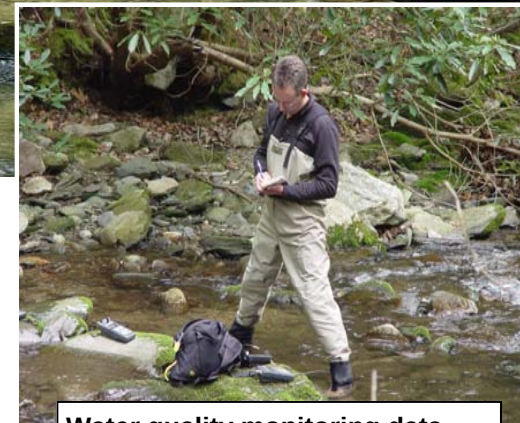
As part of the Service's efforts to improve park management through greater reliance on scientific knowledge, a primary purpose of the monitoring program is to develop, organize, and make available natural resource data by transforming data into useful information through analysis, synthesis, modeling, and reporting. Vital signs monitoring will be an integral part of the adaptive management cycle by providing critical information about trends in natural resource conditions. The information will be used by decision-makers to identify desired conditions and evaluate management effectiveness.

National Park Service

APPALACHIAN HIGHLANDS INVENTORY AND MONITORING NETWORK



Vital Signs Monitoring Program



Water quality monitoring data can help identify pollution sources and enable parks to better meet wildlife resource needs and ensure visitor safety

Knowing the condition of natural resources in national parks is fundamental to the National Park Service's ability to manage park resources "unimpaired for the enjoyment of future generations". The challenge of protecting and managing a park's natural resources requires a broad and ecosystem-based knowledge of the status and trends of park resources. Most parks are open systems, vulnerable to threats such as air and water pollution and invasive species, which originate outside the park's boundaries. Understanding the dynamic nature of park ecosystems and the consequences of human activities is essential for management decision-making aimed toward maintaining, enhancing or restoring the ecological integrity of park ecosystems and avoiding, minimizing, or mitigating ecological threats to these systems.

"We have to know what we have, how and why it is changing, what changes we can accommodate, and which we must combat."

-Fran Mainella
Director, National Park Service, 2001-2006



The mission of the Appalachian Highlands Network Monitoring Program is to monitor the status and trends of park Vital Signs, and to provide information that enables the parks to better manage and interpret their natural resources.



Photo by Jayme Miller, BLRI



NATIONAL PARK SERVICE
APPALACHIAN HIGHLANDS INVENTORY & MONITORING NETWORK

Network parks harbor 10 Federally-listed fish and freshwater mussels, as well as many rare aquatic macroinvertebrates; monitoring their populations along with water quality and quantity will help ensure the long-term survival of these extremely rare and imperiled animals by providing early warning if populations start to decline.



THE APPALACHIAN HIGHLANDS
NETWORK

Parks of the
Appalachian
Highlands I&M Network

- BISO—Big South Fork National River and Recreation Area
- BLRI—Blue Ridge Parkway
- GRSM—Great Smoky Mountains National Park
- OBRI—Obed Wild and Scenic River

Network parks vary in size from 5,174 acres to 521,490 acres, and include two of the most-visited units in the National Park system (GRSM & BLRI). The Southern Appalachian Ecoregion is one of the most species-rich temperate areas in the world, with 2,250 species of vascular plants, including over 130 species of trees, over 200 species of birds, and thousands of species of invertebrates, including the highest number of land snail species in the U.S. Network parks protect the largest contiguous stands of old-growth forest remaining in the eastern United States, as well as many of the best remaining examples of globally imperiled species and communities. Within the network parks, there are 409 species ranked as Critically Imperiled, Imperiled, or Vulnerable by The Nature Conservancy, including 32 species federally-listed as Endangered or Threatened. Major threats to park resources include air and water quality degradation, invasive exotic species, exotic insects and diseases, and rapid development adjacent to the parks.

PROGRAM GOALS

- Determine status and trends in indicators of the condition of park ecosystems to help managers make better-informed decisions and work more effectively with other agencies and individuals to benefit park resources
- Provide early warning of abnormal conditions or impairment of selected resources to help develop effective mitigation measures and reduce costs of management

- Provide data to better understand the dynamic nature and condition of park ecosystems and to provide reference points for comparisons with more altered environments
- Provide data to meet certain legal and congressional mandates related to natural resource protection and visitor enjoyment
- Provide a means of measuring progress towards performance goals

VITAL SIGNS

Vital Signs are a subset of physical, chemical, and biological elements and processes of park ecosystems that are selected to represent the overall health or condition of park resources, known or hypothesized effects of stressors, or elements with important human values. The Vital Signs selected for the Appalachian Highlands Network are shown on the facing page. Information obtained through monitoring can help managers implement the most effective approach to managing or restoring natural systems. Long-term vegetation data, for example, can support habitat restoration, trigger invasive plant eradication, support deer management., and document the effects of insect and disease outbreaks in the parks' forests. Long-term monitoring of water quality, and aquatic organisms such as fish and mussels, reflects the overall health of the parks' riverine ecosystems, and the effects of disturbance in upstream watersheds.

Vital Signs Monitored by the Appalachian Highlands Network						
Category	Vital Sign Name	Vital Sign Measures	Possible Management Application	BISO	BLRI	OBRI
Air and Climate	Ozone*	Atmospheric ozone concentration, damage to sensitive vegetation	Minimize ozone exposure to visitors and staff; document resource damage	X	X	X
	Wet and dry deposition*	Wet and dry sulfate and nitrate deposition, concentrations of nitrates, sulfates in high-elevation streams	Inform regional assessments of air quality; conduct further research to determine extent & likely source of impacts	X	X	X
	Visibility and particulate matter*	IMPROVE station data, change in visibility deciviews	Minimize air pollution exposure to visitors and staff; prediction of good and bad visibility times for visitors	X	X	X
	Air contaminants*	Aluminum & mercury, especially in high-elevation streams	Supports regional air quality monitoring and augments local health advisories; supporting data for interpreting trends in aquatic fauna	X	X	X
	Weather*	Rainfall amount, snowfall amount, temperature, relative humidity, wind speed and direction, solar radiation, fog or cloud emersion time, UV-B radiation	Essential data for interpreting other Vital Signs trends	X	X	X
Water	Surface water dynamics	Flow, daily, seasonal, and annual water level fluctuation	Identify threats to maintaining normal stream flows; establishes benchmarks for restoration efforts; essential for interpreting other Vital Signs trends	X	X	X
	Water chemistry	Temperature, specific conductivity, pH, dissolved oxygen, ANC, turbidity, major ions	Characterize the range of chemical constituents and identify excesses or deficiencies for core water parameters	X	X	X
	Nutrient dynamics	Nitrate, ammonia, total phosphate	Identify potential pollution sources	X	X	X
	Toxics	Heavy metals, coal, aluminum	Identify potential pollution sources and levels exceeding legal standards	X	X	X
	Microorganisms	Fecal coliform, fecal strep	Identify potential pollution sources and levels exceeding legal standards; minimize health risks to visitors, staff and park wildlife	X	X	X
Biological Integrity	Aquatic macroinvertebrates	Species richness, diversity, IBI of stream macroinvertebrates, relative abundance	Identify impacts of pollution and habitat loss to benthic communities	X	X	X
	Invasive exotic plants	New invasions (early-warning emphasis); occurrence, distribution models of most damaging species	Identify target areas for treatment to control new infestations before they become a resource threat	X	X	X
	Forest vegetation	Community structure and demography; species composition, relative abundance, structure, exotic species occurrence (partly remote sensing)	Trigger for invasive or pest species management, assessment of need for deer population control, restoration	X	X	X
	Cumberlandian cobblebars	Species composition, structure, distribution, patch size; distribution & trends in rare species occurrence within the community	Control of invasive exotics, removal of encroaching woody species; identification of unnatural alterations in flood regimes	X		X
	Freshwater mussels	Mussel species composition, abundance, age structure	Potential restoration actions, captive rearing and reintroduction; identification and remediation of significant sources of habitat disruption and water quality decline	X		X
	T&E Fish - duskytail darter	Distribution, abundance, age structure	Potential restoration actions, captive rearing and reintroduction; identification and remediation of significant sources of habitat disruption	X		
Human use	T&E Fish - spotfin chub	Distribution, abundance, age structure	Potential restoration actions, captive rearing and reintroduction; identification and remediation of significant sources of habitat disruption			X
	Medicinal and ornamental plant poaching	Population trends and changes in distribution patterns of selected medicinal and ornamental plants	Identify areas most likely to be heavily poached; concentrate law enforcement efforts in most effective places and times to limit resource damage		X	
Landscapes	Vegetation impacts from recreational rock climbing	Veg community structure, species composition; extent of exposed substrate	Restrict climbing to non-sensitive areas and seasons; adjust procedures to limit damage (eg. no "topping out")		X	X
	Land cover and use	Area of dominant land cover types, patch size distribution, fragmentation; road density, housing density, other development & resource extraction adjacent to parks	Evaluate ecosystem conversion; inform regional assessments of land use; define the importance of parks in urbanizing and otherwise altered landscapes	X	X	X

* Vital Signs that are already monitored by partner agencies or other entities

(GRSM has had a long-term ecological monitoring program in place for over a decade and is operationally distinct from the rest of the Network)