

SECN Program Summary

National Park Service
U.S. Department of the Interior

Inventory & Monitoring Program
Southeast Coast Network



Status of Freshwater Monitoring, 2011

Freshwater Monitoring Overview

The SECN has substantial freshwater resources that are located within or near many parks. As part of NPS Vital Signs monitoring, data are being collected on several facets of freshwater ecosystem health including the evaluation of stream habitat, monitoring surface and groundwater dynamics, and assessing water chemistry. In the future, the SECN plans to conduct or assist with lake water quality monitoring as well as fish community assessments (Table 1).

This document provides an overview of the current status of the Southeast Coast Network's freshwater monitoring efforts as of August 2011. It also includes information about potential future monitoring efforts and rationale for efforts that have been deferred or are no longer being considered for implementation. The objectives of SECN freshwater monitoring activities involve the documentation of changes in numerous ecosystem components that may differ across the network and have various levels of federal protection depending on the specific ecosystem being monitored.

Freshwater Resources Within Parks

Six parks within the SECN occur adjacent to or within riverine habitats including: Moores Creek National Battlefield, Congaree National Park, Chattahoochee River National Recreation Area, Kennesaw Mountain National Battlefield, Ocmulgee National Monument, and Horseshoe Bend National Military Park (Figure 1). With the exception of CONG, SECN jurisdiction within these systems consists primarily of non-wadable large rivers and the adjacent riparian corridor and floodplain. Only CONG includes significant subwatersheds and tributaries where water-related vital signs outside, and in addition to, the mainstem river systems are addressed.

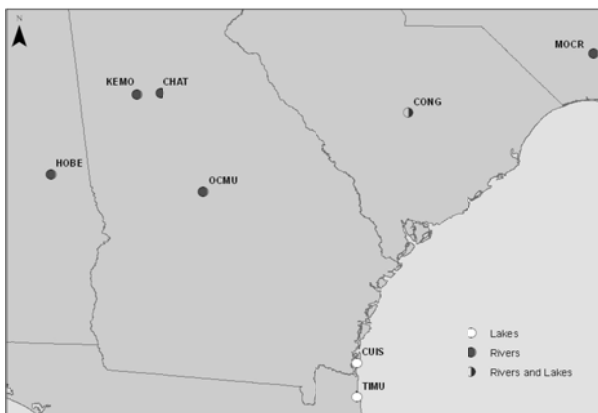


Figure 1. Locations of parks within the SECN that contain freshwater resources and currently have one or more Vital Signs monitoring protocols implemented.

The SECN's river parks span three physiographic provinces and five river basins (Figure 2). In addition to park units that contain rivers, three parks have notable lake/pond features (Figure 1), but SECN monitoring in those systems is limited. Parks with lake resources include Cumberland Island NS, Congaree NP, and Timucuan Ecological & Historic Preserve. In all three locations there is strong interest from the parks to conduct lake monitoring in the future.

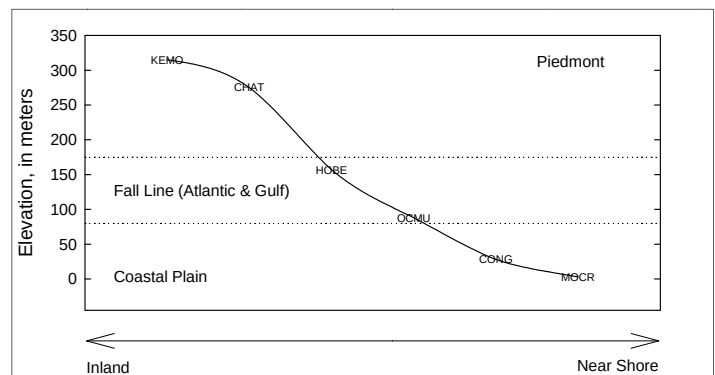


Figure 2. Location of the six river parks within the Southeast Coast Network along an elevation gradient. River systems within the Network span two physiographic provinces (Piedmont and Coastal Plain) within the region as well as the transition zone between those provinces.

Table 1. Summary of the status of freshwater monitoring at six SECN parks as of May 2011.

Vital Sign	Objectives	Status
Stream Habitat	• Status and trends of macro- and micro-habitat features. • Evaluate divergence from climate change forecasts.	Field Trials 2011; Draft protocol
Groundwater Dynamics	• Status and trends of freshwater and saltwater tables in existing wells.	Operational Published
Surface Water Discharge	• Evaluate divergence from CC Forecasts.	Operational Published
Fixed-Station Water Quality	• Diel, monthly, and annual variability of pH, nutrients, chlorophyll, temperature, and salinity/conductivity. • Monthly and annual variability of nitrogen, phosphorus, clarity.	Operational In Review
Water Chemistry	• Location, responsible party, parameters, and period of record of historical and ongoing water quality monitoring data.	Operational
Lake Water Quality	• Status and trends of core parameters and nutrients. • Status and trends of aquatic vegetation.	Pre-development
Fish Communities	• Not developed.	Deferred
Invertebrates	• Not developed.	Dropped



Figure 3. Example 360° panoramic photo of stream habitat features in Porters Creek near SECN Headquarters in Athens, GA.

Vital Signs

Stream Habitat

Stream habitat monitoring will be conducted at all six riverine parks in the SECN. The current 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.

The database and reporting function for this is near completion; though, reporting functions will not be fully tested until the summer 2011 data has been collected.

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) (Figure 3). 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.

Currently, a full stream habitat/fish suitability map is not planned. An acoustic doppler current profiler (ADCP) was considered; however, after evaluating the effort and computing time required compared with video surveillance, it was decided that ADCP would not be the most efficient method of data collection. It is still considered an optional module to add to the protocol and database.

Groundwater Dynamics

Groundwater dynamics are monitored primarily through data harvesting and has been completed for all parks. An inventory of existing wells that are within or in proximity to network parks has been conducted and applications to retrieve and analyze existing long-term periods of record have been developed. Data gaps in well coverage have been identified and funds from the Enhanced Climate Monitoring program will be used to either install new wells or equip existing wells with data loggers beginning in FY 2011.

The data storage and reporting system is complete for this protocol and the FY2010 data report is currently in preparation (see below). This vital sign is scheduled to be integrated with the FWS Refuge System I&M program beginning in FY2011; FWS has identified wells within or near refuges in the South Atlantic LCC where data are being collected and data from those wells will be retrieved and integrated into the NPS monitoring system. Reporting functions will then be available to both NPS and FWS personnel for data exploration and reporting.

Table 2. Summary of reported groundwater concerns at SECN park units (from Rasmussen et al. 2009).

Park	Inactive Wells	Groundwater Contamination	Saltwater Intrusion	Flooding	Increased Demand
CAHA					
(FORA/WRBR)	X	X	X	X	
CALO		X		X	
CANA		X			
CHAT	X	X		X	
CONG	X	X		X	X
CUIS	X	X	X		X
FOFR	X	X			
FOMA (CASA)		X	X		
FOPU	X	X	X		
FOSU (CHPI)	X	X			
HOBE	X	X			
KEMO		X			
MOCR		X		X	
OCMU	X	X			
TIMU (FOCA)	X	X	X		X

Surface Water Discharge

Similar to the groundwater dynamics monitoring, surface water discharge is being monitored through existing gaging stations that are located within and around NPS units. An inventory of existing gaging stations, their period of record, and data analysis tools has been published (Jones et al. 2010), the database is operational, software for retrieving and analyzing data has been developed (Figure 4), and the first report should be published this summer. Data are being analyzed within the context of the Indicators of Hydrologic Alteration methods (TNC 2007).

Much like the groundwater dynamics tools, the SECN plans to acquire data from stations relevant to FWS Refuges within the South Atlantic LCC.

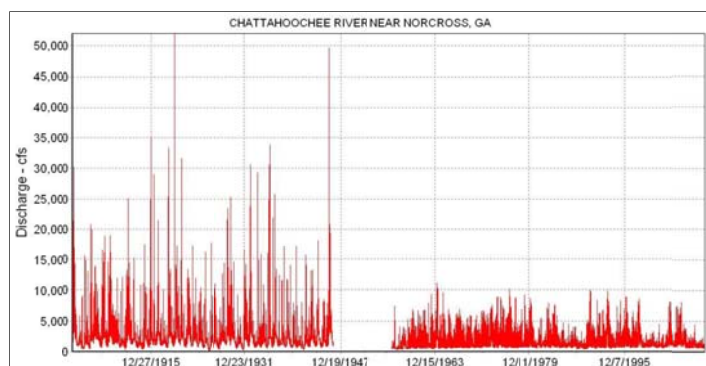


Figure 4. Example of output from data retrieval and analysis for daily flow of the Chattahoochee River pre- and post-construction of Buford Dam (from Jones et al. 2010).

Water Chemistry

The combination of different state-by-state freshwater monitoring protocols and the large number of private, public, and citizen scientists collecting data, make reporting freshwater monitoring data a challenge. The SECN strategically deferred decisions related to freshwater monitoring because the amount of monitoring underway is staggering (particularly within the Chattahoochee River near CHAT). The strategy of the SECN was to first identify existing programs that were already collecting data prior to implementing a park-specific protocol. A series of watershed condition assessments for SECN river parks has been completed (Burkholder et al. 2010a–d, Mallin and McIver 2010, 2009; see Table 3) and the network is currently undergoing a metadata-level analysis of ongoing monitoring efforts throughout the entire SECN (Sheldon et al. 2009).

Table 3. Current and potential stressors that have affected or may affect Moores Creek National Battlefield habitats (from Mallin and McIver 2009). [EP – Existing problem, OK – Low or no problem, PP – Potential problem, ND – No data to make judgment].

Stressor	Drinking Well			
	Moore's Creek	Water	Groundwater	Savanna
Algal blooms	ND	OK	OK	ND
Toxic algae	ND	OK	OK	ND
Nutrient loading	PP	OK	PP	ND
Excessive nitrate	OK	OK	PP	OK
Airborne ammonium	PP	OK	OK	ND
Hypoxia	EP	OK	OK	ND
Sedimentation	PP	OK	OK	OK
Erosion	EP	OK	OK	OK
Fecal bacteria	EP	OK	ND	ND
Metals contamination	EP(Hg) ¹	OK	ND	ND
Toxic compounds	ND	OK	ND	ND
Invasive species	OK	OK	OK	EP
Habitat disruption	EP	OK	OK	OK

¹Fish tissue consumption advisory.

A metadata summary of existing water quality monitoring data has been completed for the coastal zone and ~216,000 records have been compiled along the south Atlantic coast cataloging past and current monitoring efforts and protocols in the region (<http://www.gcrc.uga.edu/wqmeta/>). A fully searchable online database has been created and can be queried by keyword, parameter, and geographic bounding box. In FY2010 this project was expanded to cover the entire South Atlantic LCC. A funding request has been submitted to NOAA (submitted by the South Atlantic Governor's Alliance on behalf of UGA, the Georgia Coastal Research Council, and

NPS) to further expand the project to improve the portal, move it to a permanent server, conduct a gap analysis, and link the data records to NRInfo (which will serve all DOI agencies).

Fixed Station Water Quality

This protocol is similar to the protocol used in NPS estuarine systems and is based on methods used by the NOAA NERR program. The protocol consists of a series of stations with permanently deployed data sondes used to collect pH, turbidity (at some parks), dissolved oxygen, temperature, depth, and salinity/conductivity every 30 minutes. Monthly nutrient sampling at or around sites is also conducted where nutrient data are not being collected by other agencies in the vicinity of the park (DiDonato et al., *in review*).

The equipment and protocol functions equally well in freshwater and marine environments, and the SECN currently has fixed stations deployed at Congaree NP in Wise Lake, and Chattahoochee NRA is using data sondes for periodic monitoring of locations to address short-term management questions. However, this approach is likely not optimal for monitoring within the SECN. In freshwater systems, monthly/seasonal sampling coupled with storm sampling to catch watershed-level impacts is likely more efficient and yields data that are more meaningful.

Our data system is fully developed and we have begun publishing data reports (see Gregory et al. 2010 for example data functions; Figure 5).

Lake Water Quality

The SECN is currently in the process of evaluating methods to monitor lake water quality at CUIS and it is potentially a great opportunity to standardize methods across refuges and parks with lake resources. Lake monitoring will not be conducted by SECN staff, but if implemented at one or more units, the data management system could be expanded to accommodate a lake monitoring module (the data model underlying the SECN information management system includes this capacity).

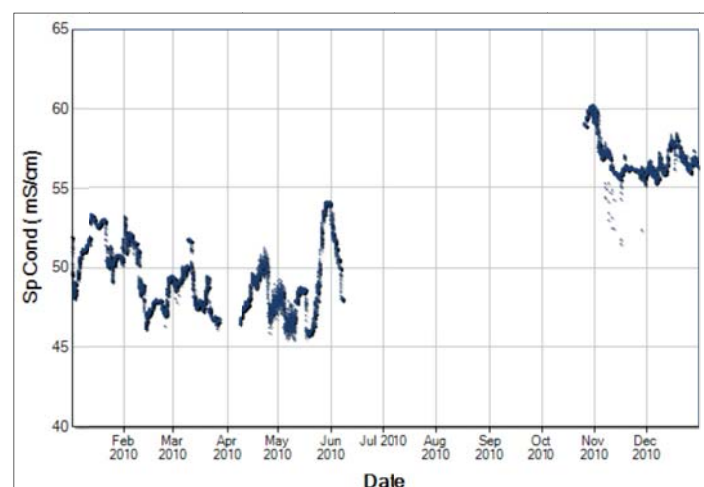


Figure 5. Specific conductivity (mS/cm) at Canaveral National Seashore visitor center dock January 1 – December 31, 2010. Breaks in data record indicate missing and/or flagged data (from Gregory et al. 2010).

Fish Communities & Invertebrates

Although there is strong interest in conducting monitoring for fish communities and invertebrates, the variation of protocols that would need to be implemented at each park has prevented the SECN from implementing any monitoring at these taxonomic levels. For invertebrates, when subject matter experts were consulted, EPA and SCDNR both indicated there was a move to standardize invertebrate methods across the states. A longstanding issue has been that data are not comparable across state boundaries and EPA has been actively trying to persuade states to adjust protocols.

Six years later, inter-state standardization still has not occurred. The only two viable alternatives are a family-level monitoring method similar to those used by adopt-a-stream programs, which lacks fine-grain monitoring information, and the USGS-NAWQA protocols. Although applicable everywhere, the lab costs associated with the NAWQA protocols are prohibitively expensive. As an additional complication, Florida invertebrate diversity is largely driven by chironomid diversity, which requires additional taxonomic expertise and associated lab costs.

Implementation of a fish community monitoring protocol has been problematic because of the types of river systems found in the SECN. Big rivers are extremely difficult to control sampling effort when conducting repeated sampling, and while repeat inventories could be conducted, developing or adjusting Indices of Biotic Integrity where they do not currently exist (IBIs) would be time consuming and expensive. Many published protocols exist for Wadeable Streams; unfortunately, most of the monitoring needs within SECN parks do not involve Wadeable Streams.

A final consideration for fish and invertebrate sampling is the potential for both to generate a large number of specimens that would need to be accessioned. Although it is possible to conduct field identifications (or partial identifications), it can consume a lot of field time that could be better spent collecting additional samples. Specimens have multiple uses once curated, but they also take space and have to be maintained.

Although the SECN is not conducting fish and invertebrate monitoring, both taxonomic groups are built into the overall data model and the database could accommodate those protocols.

Algae

Some parks outside of the SECN are currently collecting algal taxonomic data, particularly in the Great Lakes region, where Ruth Patrick did much of her bioassessment work in the early 1940s. The Great Lakes Network has an algal biologist on staff and frequently contracts work out as well. These are great data with a long-term record, but very costly and this Vital Sign was not considered for SECN parks.

Lab Costs and Data Analysis

Lab contracts for the SECN are currently under review, especially for Florida parks. Originally, the SECN used EPA contract specifications and EPA-certified labs. In 2010, however, FL was unable to use SECN data for bioassessment criteria development because it did not meet State certification

standards. Although EPA-certified labs are sufficient for most of the work required for park/refuge management, National Environmental Laboratory Accreditation (NELAC) certification is mandatory (at least by Florida for certain uses of data) for anything to be included in FL-STORET. Analyses at NELAC-certified labs typically cost three times more than labs without this certification. The SECN is currently evaluating needs for new lab contracts, particularly for samples collected in FL parks.

Data management resources related to water resources are higher than any others implemented by the SECN. Of all of SECN protocols, 2–3 times more effort has been expended on developing water quality vital signs modules as compared to the others, and the QA/QC process is the largest bottleneck in terms of data analysis and reporting. Fixed-station data are particularly time consuming, and because much of the data are being collected and managed by third parties, transferring it into one data management system for analysis will continue to be a challenge in the future. One problem is that each lab reports their data somewhat differently. Ultimately, this adds to the complexity of data reporting since lab codes need to be included in the metadata as well as being considered when rolling data up for trend analysis.

During the next year the SECN would like to explore developing an Indefinite Delivery/ Indefinite Quantity (ID/IQ) contract that can be used by both the SECN and FWS I&M Programs for lab analyses to try to streamline monitoring efforts across refuges and parks.

NPS Standards and Overall Strategy

The Water Resources Division of the NPS has published extensive guidelines, standards, and best practices including site selection, planning, QA/QC, required measures, lab selection, and reporting. These documents are routinely updated and are available publicly through the NPS website (http://www.nature.nps.gov/water/VitalSigns_index/VitalSignsdocuments.cfm). Irwin (2008) contains some of the most relevant information for SECN freshwater monitoring and includes many of the best practices from the NPS networks nationwide.

During the planning stages of the freshwater vital signs monitoring, it was frequently suggested that the SECN use existing protocols so that pre-existing data could be leveraged and protocol development costs would be kept to a minimum. The SECN has accomplished this in all cases by either using data that other agencies are collecting, or adding to/subtracting from existing peer-review field and lab methods, including those published by USGS, USDA, NOAA, EPA, and state agencies.

Summary

- Riverine freshwater monitoring is occurring at six parks within the SECN (CONG, CHAT, HOBE, MOCR, and OCMU).
- Options for lake water quality monitoring are currently being evaluated for implementation at three parks (CONG, CUIS, TIMU).

- Groundwater dynamics, surface water discharge, fixed-station water quality, and water chemistry vital signs are all currently being monitored and are operational.
- Stream habitat vital signs are in the draft protocol stage and undergoing field trials in September 2011.
- Fish community and invertebrate monitoring has been deferred or dropped due to lack of standardized methodology, presence of non-wadeable streams, and prohibitive costs associated with analyzing and housing specimens.
- Although algae taxonomy data are being collected at some parks outside of the SECN, it is not currently being considered for monitoring.

Literature Cited

- Burkholder, J. M.. 2010a. Assessment of water resources and watershed conditions in Kennesaw Mountain National Battlefield Park, Georgia. Natural Resource Report NPS/SECN/NRR—2010/273. National Park Service, Fort Collins, Colorado. (Full Report)
- Burkholder, J. M., E. H. Allen, C. A. Kinder, and E. B. Morris. 2010b. Assessment of water resources and watershed conditions in the Chattahoochee River National Recreation Area, Georgia. Natural Resource Report NPS/SECN/NRR—2010/274. National Park Service, Fort Collins, Colorado. (Full Report)
- Burkholder, J. M. and M. B. Rothenberger. 2010c. Assessment of water resources and watershed conditions in Horseshoe Bend National Military Park, Alabama. Natural Resource Report NPS/SECN/NRR—2010/268. National Park Service, Fort Collins, Colorado. (Full Report)
- Burkholder, J. M., E. H. Allen, and C. A. Kinder. 2010d. Assessment of water resources and watershed conditions in Ocmulgee National Monument, Georgia. Natural Resource Report NPS/SECN/NRR—2010/276. National Park Service, Fort Collins, Colorado. (Full Report)
- DiDonato, E. M., C. Wright, E. Thompson, J. C. DeVivo, and B. Huston. *In Review*. Methods for Fixed-Station Water Quality Monitoring in SECN Parks. Natural Resource Report NPS/SECN/NRR—20xx/xxx. National Park Service, Fort Collins Colorado. (Draft Protocol)
- Gregory, M. B., C. Wright, J. Dingle, and E. Thompson. 2010. Fixed station water quality monitoring at Canaveral National Seashore: 2010 Data Summary. Natural Resource Data Series NPS/SECN/NRDS—2011/162. National Park Service, Fort Collins, Colorado. (Resource Brief, Full Report)
- Irwin, R.J. 2008. Part B Lite QA/QC Review Checklist for Aquatic Vital Signs Monitoring Protocols and SOPs, National Park Service, Water Resources Division, Fort Collins, Colorado.
- Jones, C. D., A. M. Couch, R. D. Sherrell, T. C. Rasmussen, and J. F. Dowd. 2010. Southeast Coast Network surface water discharge monitoring: Analysis of existing data and data acquisition applications. Natural Resource Report NPS/SECN/NRR—2010/264. National Park Service, Fort Collins, Colorado. (Full Report)
- Mallin, M. A., and M. R. McIver. 2009. Assessment of water resources and watershed conditions in Moores Creek National Battlefield, North Carolina. Natural Resource Report NPS/SECN/NRR—2009/132. National Park Service, Fort Collins, Colorado. (Full Report)
- Mallin, M. A., and M. R. McIver. 2010. Assessment of water resources and watershed conditions in Congaree National Park, South Carolina. Natural Resource Report NPS/SECN/NRR—2010/267. National Park Service, Fort Collins, Colorado. (Full Report)
- Rasmussen, T. C., J. F. Dowd, R. J. McKinnon, B. M. Price, and R. D. Sherrell. 2009. Southeast Coast Network groundwater monitoring: Protocol development and analysis of existing data. Natural Resource Report NPS/SECN/NRR—2009/126. National Park Service, Fort Collins, Colorado. (Full Report)
- Sheldon, W. M., C. Laporte, J. Carpenter, and M. Alber. 2009. Southeast coastal water quality monitoring metadata tools: Database and web applications. Natural Resource Report NPS/SECN/NRR—2009/159. National Park Service, Fort Collins, Colorado. (Full Report)
- The Nature Conservancy (TNC). 2007. Indicator's of Hydrologic Alteration User's Version 7 user's Manual.

For More Information

Southeast Coast Network –

<http://science.nature.nps.gov/im/units/secn/>

Inventory & Monitoring Home –

<http://science.nature.nps.gov/im/>

Inventory Home –

<http://science.nature.nps.gov/im/inventory/>

Search Inventory Information –

<http://science.nature.nps.gov/im/tracking/InventorySearch.aspx>.

National Park Service. 2011. Status of freshwater monitoring, 2011. Southeast Coast Network Program Summary, National Park Service, Athens, GA.