National Park Service
U.S. Department of the Interior

# State of the Park Report

## Cape Hatteras National Seashore

**North Carolina**

**2016**

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**On the cover:** Cape Hatteras National Seashore, Photo By: David Krueger

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Disclaimer. This State of the Park report summarizes the current condition of park resources, visitor experience, and park infrastructure as assessed by a combination of available factual information and the expert opinion and professional judgment of park staff and subject matter experts. The internet version of this report provides the associated workshop summary report and additional details and sources of information about the findings summarized in the report, including references, accounts on the origin and quality of the data, and the methods and analytic approaches used in data collection and assessments of condition. This report provides evaluations of status and trends based on interpretation by NPS scientists and managers of both quantitative and non-quantitative assessments and observations. Future condition ratings may differ from findings in this report as new data and knowledge become available. The park superintendent approved the publication of this report.

# Executive Summary

The mission of the National Park Service is to preserve unimpaired the natural and cultural resources and values of national parks for the enjoyment, education, and inspiration of this and future generations. National Park Service Management Policies (2006) state that "The Service will also strive to ensure that park resources and values are passed on to future generations in a condition that is as good as, or better than, the conditions that exist today." As part of the stewardship of national parks for the American people, the NPS has begun to develop State of the Park reports to assess the overall status and trends of each park's resources. The NPS will use this information to improve park priority setting and to synthesize and communicate complex park condition information to the public in a clear and simple way.

The purpose of this State of the Park report is to:

- Provide to visitors and the American public a snapshot of the status and trend in the condition of a park's priority resources and values;
- Summarize and communicate complex scientific, scholarly, and park operations factual information and professional opinion using non-technical language and a visual format;
- Highlight park stewardship activities and accomplishments to maintain or improve the State of the Park;
- Identify key issues and challenges facing the park to help inform park management planning.

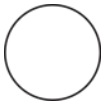
The purpose of Cape Hatteras National Seashore (CAHA) is to permanently preserve the wild and primitive character of the ever-changing barrier islands, protect the diverse plant and animal communities sustained by the coastal island processes, and provide for recreational use and enjoyment that is compatible with preserving the distinctive natural and cultural resources of the nation's first national seashore.

Significance statements express why the park unit's resources and values are important enough to warrant national park unit designation. Cape Hatteras National Seashore is significant because:

- It was the first national seashore established to preserve significant segments of remote and unspoiled barrier islands and the associated plants, wildlife and coastal processes, and to provide diverse opportunities for resource-compatible outdoor recreation.
- Located at the near-shore confluence of the Gulf Stream and Labrador currents, the seashore is continually shaped by coastal geologic, hydrologic, and weather processes, which together contribute to the evolution of these barrier islands.
- Its coastal location and dynamic conditions have inherent scientific value as a living laboratory for physiographic and ecological research, including the study of climate change and its effects on sea level and ecology. This knowledge base has local, national, and global value and provides a robust source of information for education and stewardship programs and experiential learning opportunities.
- It is representative of a mid-Atlantic barrier island system that is characterized by a diversity of aquatic and terrestrial habitat including open beach, dune, tidal marsh, wetland, shrub thicket, and maritime forest—each of which support a wide variety of wildlife.
- The seashore supports resident and seasonal populations of federally-listed and state-listed plants and animals including species such as the piping plover, American oystercatcher, gull-billed tern, green sea turtles, loggerhead sea turtles, and seabeach amaranth.
- Its artifacts, historic sites, and geographic setting provide tangible links to understanding humankind's ability to adapt in a harsh and changing coastal environment in isolation from the mainland. These links, which are of deep symbolic significance to local villagers, include lighthouses, shipwrecks, and Native American sites.
- Numerous historical events of national significance have occurred on or near its shores including four centuries of shipwrecks, the United States government's response to protect maritime commerce during the Civil War and World War II, and the experimental development and use of new technology.

The summary table, below, and the supporting information that follows, provide an overall assessment of the condition of priority resources and values at CAHA based on scientific and scholarly studies and professional opinion. The internet version of this report, available at http://www.nps.gov/stateoftheparks/caha/, provides additional detail and sources of information about the resources summarized in this report, including references, accounts on the origin and quality of the data, and the methods and analytical approaches used in the assessments. Reference conditions that represent "healthy" ecosystem parameters, and regulatory standards (such as those related to air or water quality) provide the rationale to describe current resource status. In coming years, rapidly evolving information regarding climate change and associated effects will inform our goals for managing park resources, and may alter how we measure the trend in condition of park resources. Thus, reference conditions, regulatory standards, and/or our judgment about resource status or trend may evolve as the rate of climate change accelerates and we respond to novel conditions. In this context, the status and trends documented here provide a useful point-in-time baseline to inform our understanding of emerging change, as well as a synthesis to share as we build broader climate change response strategies with partners.

The Status and Trend symbols used in the summary table below and throughout this report are summarized in the following key. The background color represents the current condition status, the direction of the arrow summarizes the trend in condition, and the thickness of the outside line represents the degree of confidence in the assessment. In some cases, the arrow is omitted because data are not sufficient for calculating a trend (e.g., data from a one-time inventory or insufficient sample size).

| Condition Status | | Trend in Condition | | Confidence in Assessment | |
|---|---|---|---|---|---|
|  | **Warrants Significant Concern** |  | **Condition is Improving** |  | **High** |
|  | **Warrants Moderate Concern** |  | **Condition is Unchanging** |  | **Medium** |
|  | **Resource is in Good Condition** |  | **Condition is Deteriorating** |  | **Low** |

# State of the Park Summary Table

| Priority Resource or Value | Condition Status/Trend | Rationale |
|---|---|---|
| **Natural Resources** | | web ▸ |
| **Air Quality** |  | Overall air quality warrants significant concern and is relatively unchanged. Scenic views are often obscured by air pollution-caused haze; however visibility is improving. Average natural visual range during 2010–2014 was reduced from about 97 nautical miles (nm) (without the effects of pollution) to about 43 nm. Ozone sometimes reaches levels that can make breathing difficult for sensitive groups and cause injury to ozone-sensitive plants. Some vegetation communities and surface water in the park may be susceptible to nutrient enrichment effects of excess nitrogen deposition. Airborne toxics, including mercury, can deposit with rain or snow and accumulate in birds, mammals, amphibians, and fish, resulting in reduced foraging efficiency, survival, and reproductive success. Air quality indicator condition status and trend (where available) are determined by using the latest 5 and 10 year data sets, respectively (NPS-ARD 2016). |
| **Geologic Features and Processes** |  | Sea level rise and other human impacts, such as the placement of hardened structures, creation of dunes, and dredging, continue to exacerbate shoreline change and interrupt barrier island dynamics. Shoreline change occurs at variable rates along both the Atlantic Ocean and back barrier shorelines, resulting in changes in island width. Of the nearly 120 miles of shoreline along the North Carolina Outer Banks, 27 percent of the mapped shoreline is classified as being at very high vulnerability due to future sea level rise. |
| **Water Quality** |  | Overall water quality at the park is good based on measurements of water chemistry, sediment chemistry, and benthic macroinvertebrates. Monthly water-quality data during 2012 reflected good to fair conditions throughout the year. |

| Priority Resource or Value | Condition Status/Trend | Rationale |
|---|---|---|
| **Plant and Wildlife Communities** |  | Park habitats support a variety of plant and animal species including 24 state-listed rare plant species and 36 state-listed rare animal species. The park has been recognized by the state Natural Heritage Program for having over 10,000 acres of significantly unique natural communities that support rare flora and fauna. Impacts from exotic plant species including *Phragmites* on these natural communities are of concern to the park. Nuisance and exotic wildlife species and their impacts to native species such as nesting shorebirds, are also of concern. |
| **Protected Species of Management Concern** |  | Protected species of management concern include sea turtles, piping plovers, American oystercatchers, colonial waterbirds, and seabeach amaranth. The park has seen a marked upturn in sea turtle nesting activity over the last five years. Piping plover breeding pairs have shown an increasing trend while fledge rate has remained relatively constant. American oystercatcher breeding pairs and fledge rate have remained relatively constant. Protected colonial water bird species (least tern, common tern, gull-billed tern, and black skimmer) annual nests have shown an increasing trend. The protected plant species, seabeach amaranth, has not been found within the park since 2005 and is believed to be possibly extirpated from the area. |
| **Acoustic Environment** |  | All sound resources, whether audible or not, are referred to as the *acoustic environment* of a park. The quality of the acoustic environment affects park resources including wildlife, cultural resources, the visitor experience, and landscapes. The condition of the acoustic environment is assessed by determining how much man-made noise sources contribute to the acoustic environment through the use of a national noise pollution model. This measure is referred to as the *mean acoustic impact level*. Impact is measured in A-weighted decibels (dBA). The mean acoustic impact level at the park is 2.8 dBA, meaning that the condition of the acoustic environment warrants moderate concern. Overall, long-term projected increases in ground-based and aircraft traffic indicate a deteriorating trend in the quality of acoustic resources at this location. |
| **Dark Night Sky** |  | A photic environment is described as the physical amount and character of light at a particular location, irrespective of human perception. The NPS Night Sky Program characterizes a park's photic environment by measuring both anthropogenic and natural light. Anthropogenic Light Ratio (ALR) is a measure of light pollution calculated as the ratio of median Anthropogenic Sky Glow to average Natural Sky Luminance. ALR for Cape Hatteras National Seashore ranges from 0.18 on Ocracoke Island to 0.32 at Boardwalk 27, which is considered a good condition. Trend is neutral based on slow five year population growth of local communities surrounding the park such as Buxton, Hatteras, Frisco, and Rodanthe. Only Avon had a significant increase in population over the same five year period at 22%. |
| **Cultural Resources** | | web ▸ |
| **Archeological Resources** |  | CAHA possesses 38 currently recognized archeological sites, 33 of which are recorded as being in good condition, 4 are in fair condition, and 1 is a partial shipwreck that has not been relocated since it was identified in 1977. The sites recorded to be in fair condition were found to be suffering from shoreline erosion as a result of rising sea levels. It has been more than 5 years since the majority of the sites have had their conditions assessed with a number of sites likely to have suffered at least some additional shoreline erosion. |

| Priority Resource or Value | Condition Status/Trend | Rationale |
|---|---|---|
| **Cultural Anthropology** |  | *An Ethnohistorical Description of the Eight Villages Adjoining Cape Hatteras National Seashore and Interpretive Themes of History and Heritage* was completed in 2005. The eight villages described are within the boundaries of the park, but are not part of the park. There has been no documented ethnographic overview and assessment, a required baseline document, conducted for CAHA. Such a study would provide a more nuanced understanding of living people and communities and their knowledge of natural landscapes and association with the park. This would include their historical and present engagement with, use of, and interpretation of tangible and intangible cultural resources. |
| **Cultural Landscapes** |  | A Cultural Landscape Report was completed for Cape Hatteras Light Station in 2003 to provide treatment recommendations after the relocation of the lighthouse in 1999. A Cultural Landscape Report has been completed for Bodie Island Light Station in conjunction with the restoration of the lighthouse and opening the tower to climbing in April 2013. A Cultural Landscape Report has been completed for Ocracoke Light Station. A Historic Grounds Study was completed for Little Kinnakeet Life Saving Station in 1988, but nothing further has been documented. Of the four component landscapes identified, only Cape Hatteras Light Station has a certified Cultural Landscape Inventory, with a condition of fair. More research is needed to identify other potential component landscapes. Cultural landscapes are not adequately documented in the existing National Register documentation. |
| **Historic Structures** |  | Thirty-eight structures in CAHA are identified and listed in the List of Classified Structures (LCS) database. A Historic Resource Study was completed in 1985. Historic Structure Reports (HSRs) have been completed for Bodie Island Light Station, Ocracoke Light Station, and the Cape Hatteras Light Station.<br>75% of the eligible structures have accurate, complete, and reliable data.<br>70% of the park's identified historic structures have adequate National Register (NR) documentation. 75% of the listed structures are in good condition. |
| **History** |  | The park's 2007 Administrative History and the 1985 Historic Resource Study should be updated to reflect current scholarship and recent events. Although all structures have some sort of documentation, only four (or 15%) of the structures associated with the Cape Hatteras National Historic Landmark nomination have adequate National Register documentation. |
| **Museum Collections** |  | The most recent Scope of Collections Statement (SOCS) was completed in 2004. It is supported by the Enabling Legislation, resource management goals and objectives, and interpretive themes. The SOCS should be reviewed and updated every 3–5 years. Based on the fiscal year 2015 Collection Management Report, only 22% of the Cape Hatteras museum collections is catalogued (total collection = 697,075). The bulk of the backlog is archives (total 685,641 items or 429 linear feet). Although it needs to be updated, the 2004 Scope of Collection statement is consistently implemented for new acquisitions to the Cape Hatteras museum collection. All of the park's museum collection storage facilities are in good condition. |
| **Visitor Experience** | | web ▸ |
| **Number of Visitors** |  | The total of 2,274,635 visitors to CAHA in 2015 was 5% higher than the 5-year average of 2,164,792 visitors for 2010–2014. |

| Priority Resource or Value | Condition Status/Trend | Rationale |
|---|---|---|
| **Visitor Satisfaction** |  | Based on the standard visitor satisfaction surveys conducted each year, the percentage of visitors satisfied in fiscal year 2015 was 99.0%, which is higher than the average for the previous five years (93.2%) and ten years (93.2%) (2015 Visitor Survey Card Data Report). |
| **Interpretive Programs – Talks, Lighthouse Climbs, and Special Events** |  | The park is actively working to achieve the goals outlined in the Long-Range Interpretive Plan. The park opened the Bodie Island Lighthouse to climbing in 2013. Staff is enhancing programmatic focus towards youth engagement and critical resource interpretation in support of resource management goals. |
| **Interpretive Media – Brochure, Exhibits, Signs, and Digital Media** |  | The park is developing and installing new wayside exhibits throughout the park and connecting with new audiences by implementing the Outer Banks Group Social Media Plan. An exhibit upgrade is needed at the Museum of the Sea. |
| **Scenic Resources** |  | The park has numerous opportunities for scenic views of beach landscapes, the Atlantic Ocean, Pamlico Sound, and coastal maritime habitats. Visitors enjoy scenic views from day use areas, along beach and soundside access points, and from atop Cape Hatters and Bodie Island Lighthouses. Structures associated with development and utility infrastructure may impact certain views. |
| **Accessibility** |  | The park provides access for visitors that meet Americans with Disabilities Act (ADA) standards. Every project the park is working on addresses ADA compliance. Films shown at the park are ADA compliant. The new mobile app provides accessibility features for park visitors. |
| **Safety** |  | Park staff dedicated to public safety activities (safety manager and park law enforcement rangers) monitor and respond to visitor safety incidents. Park staff regularly conducts visitor safety assessments. The park works closely with local emergency services agencies to manage incidents and ensure staff and visitor safety. The park's Law Enforcement staff is trained for handling Emergency Responses including law enforcement and emergency medical incidents. Regular risk management educational messages are shared with staff and volunteers. The park recently implemented a robust employee safety program with a proactive approach to providing engaging and effective training opportunities for employees and volunteers with the aim of increasing awareness and reducing risks. The park has identified additional staff training needed and is developing a program to ensure appropriate safety training for all staff. |
| **Partnerships** |  | The park has partnerships with federal, state, and local government entities, higher education institutions, and non-profit organizations. The park's cooperating association, Eastern National, provides educational retail sales in the park's visitor center. The park intends to work with stakeholders to develop a dedicated support group, often referred to as a Friends Group. The number of volunteer hours has increased over the past five years. The addition of a dedicated full-time volunteer coordinator for the Outer Banks Group in 2014 has greatly helped to professionalize this program. There is an untapped potential for increasing the number of volunteers. |

| Priority Resource or Value | Condition Status/Trend | Rationale |
|---|---|---|
| **Park Infrastructure** | | web ▸ |
| **Overall Facility Condition Index** |  | The overall Facility Condition Index (FCI) for 498 assets at CAHA for 2015 was 0.017, which is Good based on industry and NPS standards. However, the park has been impacted by significant nor'easters and five hurricanes between 2011 and 2015. The park is continually in the process of performing comprehensive condition assessments, but because those assessments are not complete for all assets and conditions are fluid, the data and FCI scores in the system may not show an accurate condition. This condition status is based on inspections performed by park staff and overall experience within the park. |

# Summary of Stewardship Activities and Key Accomplishments to Maintain or Improve Priority Resource Condition:

The list below provides a few examples of stewardship activities and accomplishments by park staff and partners to maintain or improve the condition of priority park resources and values for this and future generations:

**Natural Resources**

- Since 2011, realized protected species management successes including more than 63 pairs of piping plovers that fledged 35 chicks; 123 pairs of American oystercatchers that fledged 80 chicks; and 3,458 least tern nests, 418 common tern nests, 619 black skimmer nests, 48 Forster's terns and 61 gull-billed tern nests were documented. Also, 1,036 sea turtle nests and 877 false crawls were documented.
- Completed long-term vital signs monitoring plan and began implementation of monitoring key indicators of natural resource conditions, including implementation of protocols to monitor wintering and migratory shorebirds, water quality, amphibians, landbirds, and plant communities.
- Ongoing implementation of beach management activities to reduce impacts of recreational activities on natural resources.
- Continued the Sea Turtle Volunteer Program in 2015, which allows the local public to assist with the management and protection of sea turtles. Approximately 50 volunteers assisted CAHA staff in 2015 with sea turtle stewardship.

**Cultural Resources**

- Park partners include Chicamacomico Historical Association, North Carolina Department of Natural and Cultural Resources, North Carolina State Graveyard of the Atlantic Museum, Ocracoke Preservation Society, Outer Banks History Center, Outer Banks Lighthouse Society, and Hatteras Island Ocean Center.
- Museum Collection Hurricane Plan developed for the Outer Banks Group Hurricane Plan in 2015.
- East Carolina University (ECU) completing a sea level rise study on Cape Hatteras National Seashore historic structures (PEPC 149758).
- The park hosted a Nationally Significant Cultural Landscapes and a National Park Service Facilities Maintenance Software System (FMSS) Workshop in 2015.

**Visitor Experience**

- After a five-year renovation, the Bodie Island Lighthouse was opened to the public for climbing the first time ever in 2013. This program provides a unique visitor experience that complements the climb at Cape Hatteras Lighthouse.
- Collaboration between Resource Management and Interpretive Divisions established and created a new sea turtle nest excavation program for the park in 2013. This park-wide program reveals resource management efforts not often seen by the public and allows visitors to experience one of the park's primary natural resources.
- An Off-Road Vehicle Management Plan/ Environmental Impact Statement was implemented in 2012.
- In 2012, the partnership with the Outer Banks National Scenic Byway began. Highway 12 received National Scenic Byway recognition and runs the length of the seashore, connecting northern and southern counties in eastern North Carolina, and highlights points of interest along the way.

**Park Infrastructure**

- Resurfaced three off-road vehicle (ORV) parking areas at ramps 27, 55, and 67; installed new ORV beach access to include Ramp 25, a parking area and boardwalk; installed new ORV beach access Ramps 32, 48, and 63; and a parking area at Ramp 32; and extended Inside (Interdunal) Road.
- Replaced the Ocracoke campground waterline, lift stations and interior plumbing and fixtures; and rehabilitated the interiors of the Frisco and Oregon Inlet Campgrounds comfort stations and showers, including interior plumbing and electrical.
- Replaced decking and utility hook-ups for electric and water service at Silver Lake on Ocracoke.
- Replaced the Oregon Inlet Boat ramp to include new finger piers and an ADA-compliant floating dock.
- Reduced the park footprint with the demolition and removal of 16 park buildings to include the associated roads and parking areas.

# Key Issues and Challenges for Consideration in Management Planning

In 1937, Congress designated approximately 67 miles of the North Carolina Outer Banks along the Bodie, Hatteras, and Ocracoke Island coasts as the nation's first National Seashore. Cape Hatteras National Seashore was created for the purposes of preserving natural and cultural resources, while also providing recreational use and enjoyment compatible with preserving the unspoiled barrier island ecosystem. Outdoor activities along the park's coastal waters and inland sounds include fishing, swimming, off-road vehicle use, strolling along beaches, and water sports such as kayaking, surfing, kiteboarding, and paddle boarding. Park staff will continue to work towards preserving the park's resources while managing for high-quality visitor experiences. Park managers will focus on the following topics over the coming years:

**Partnerships and Community Relationships**
The park intends to build and strengthen community relations, recognizing the importance of community, history, and local cultures in effectively managing the park's resources and enhancing visitor experiences.

**Science Informing Management**
The park plans to improve the quality, quantity, and breadth of scientific data used for management and decision-making.

**Workforce Leadership Development**
Park management will focus on developing and improving leadership skills within the park's workforce including: building and maintaining a safety culture; building trust, transparency, and credibility throughout the organization; providing hands-on opportunities for staff to grow skills and careers; and mentoring staff on team and project management.

**National Park Experience**
The park will actively work to enhance the National Park Service experience for park visitors including: strengthening the park's identity as a unit of the National Park Service; providing more and enhanced visitor experiences; and proactively engaging youth.

# Chapter 1. Introduction

The purpose of this State of the Park report for Cape Hatteras National Seashore (CAHA) is to assess the overall condition of the park's priority resources and values, to communicate complex park condition information to visitors and the American public in a clear and simple way, and to inform visitors and other stakeholders about stewardship actions being taken by park staff to maintain or improve the condition of priority park resources for future generations. The State of the Park report uses a standardized approach to focus attention on the priority resources and values of the park based on the park's purpose and significance, as described in the park's Foundation Document or General Management Plan. The report:

- Provides to visitors and the American public a snapshot of the status and trend in the condition of a park's priority resources and values.
- Summarizes and communicates complex scientific, scholarly, and park operations factual information and professional opinion using non-technical language and a visual format.
- Highlights park stewardship activities and accomplishments to maintain or improve the state of the park.
- Identifies key issues and challenges facing the park to inform park management planning.

The process of identifying priority park resources by park staff and partners, tracking their condition, organizing and synthesizing data and information, and communicating the results will be closely coordinated with the park planning process, including natural and cultural resource condition assessments and Resource Stewardship Strategy development. The term "priority resources" is used to identify the fundamental and other important resources and values for the park, based on a park's purpose and significance within the National Park System, as documented in the park's foundation document and other planning documents. This report summarizes and communicates the overall condition of priority park resources and values based on the available scientific and scholarly information and professional opinion, irrespective of the ability of the park superintendent or the National Park Service to influence it.

In 1937, Cape Hatteras became the first national seashore. It was designated to preserve dynamic barrier islands and its unique vegetation, wildlife and coastal processes, and to provide recreation and enjoyment for the public. Located within a day's drive of several urban centers, CAHA is a popular vacation destination that receives over two million visitors each year. Visitors can access the northern entrance via roadways and can reach the southern entrance by ferry or air travel. Stretching approximately 70 miles from north to south, CAHA crosses three islands: Bodie, Hatteras, and Ocracoke. The islands are linked by North Carolina Highway 12 and by the Hatteras Inlet Ferry. Although not part of the park, the islands are also inhabited by eight villages predating the park that reflect the history of the Outer Banks region.

The area now known as Cape Hatteras National Seashore has a long and rich cultural heritage. The islands that make up the seashore have been home to Native Americans, farmers, watermen, slaves, lighthouse keepers, surfmen, and many others whose legacy continues to shape the culture of the area.

The people of the area have witnessed events that include hurricanes, the death of Blackbeard the pirate, Civil War battles, the construction of the now-famous lighthouses, the birth of the U.S. Life-Saving Service Stations, hundreds of shipwrecks, Billy Mitchell's test bombings, Reginald Fessenden's first radio broadcasts, the building of dunes by the Civilian Conservation Corps (CCC), scientific strides in weather forecasting, German U-boat attacks, and much more. Though some of the documentation of history has been lost through time, the culture found in the people, places, and stories continues to persist and evolve.

Today, popular visitor activities include beachcombing, swimming, beach driving, fishing, hiking, camping, lighthouse climbing, and learning about the history and natural features of the islands. While exploring these unique barrier islands, many park visitors take particular interest in Coquina Beach, the Cape Hatteras Lighthouse, and Ocracoke Island. Coquina Beach is home to the ruins of the Laura A. Barnes, which shipwrecked in 1921 due to high seas. The iconic Cape Hatteras Lighthouse protects one of the most hazardous sections of the Atlantic Coast, an area known as the "Graveyard of the Atlantic," because of the thousands of shipwrecks that have occurred here over the past three centuries. Because Ocracoke Island cannot be reached via a bridge, its small harbor village has retained much off its early charm and character. Each island also has its own lighthouse, unique in design and history.

Located at the ocean's edge, CAHA is shaped by ever-changing barrier island processes. Barrier islands are narrow, low-lying, dynamic landforms that run parallel to ocean coasts and are constantly shifting and reshaping as a result of wind, waves, storms, ocean currents, and sea level changes. These processes continue to influence the islands today through erosion and accretion of the shoreline, overwash across the islands, and the formation, migration, and closure of the inlets. CAHA supports a vast array of animal life in its aquatic and terrestrial habitats. In addition to native mammals, the seashore's reptiles, amphibians, and many types of marine invertebrates are significant components of the native biodiversity of the islands. Life also abounds in the air above the park; with 360 documented bird species using the seashore's habitats for nesting, resting, or feeding.

The present vegetation and ecology on the islands are a result of both natural processes and human activity. The notable ecological alterations from human activities included: (1) coastal settlement and development, including the extraction of oak maritime forests

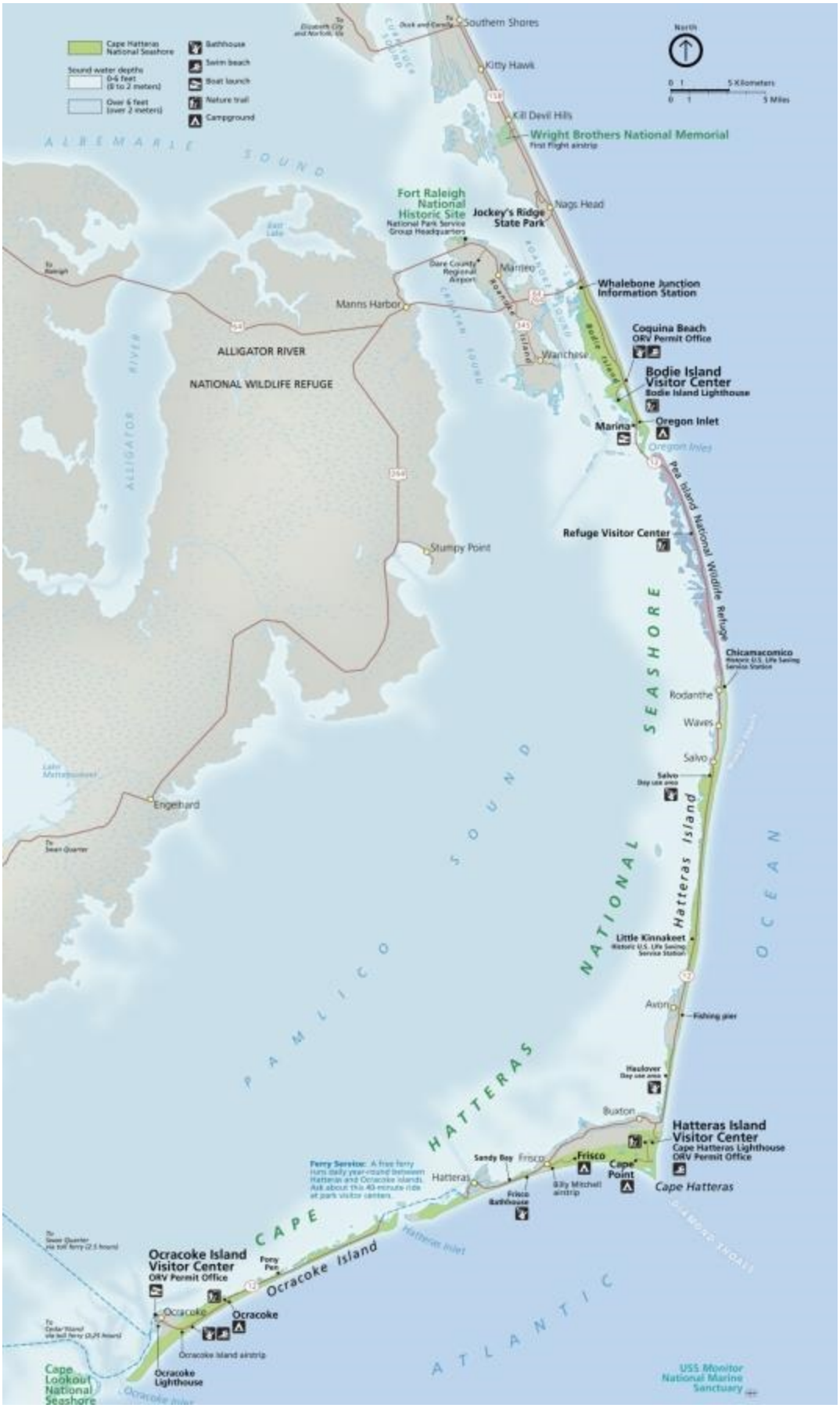
for shipbuilding; (2) early efforts at mosquito control and waterfowl management, which involved excavation of drainage ditches and construction of water control structures; and (3) construction and vegetative stabilization of primary dunes along the length of the seashore. Today, plant communities include beach and dunes vegetation, wetland vegetation, shrub thickets, and maritime forests.

CAHA provides a special opportunity to protect a widely diverse natural community and a robust collection of cultural resources, while also providing a unique, unspoiled seashore experience for visitors.

The purpose of CAHA is to permanently preserve the wild and primitive character of the ever-changing barrier islands, protect the diverse plant and animal communities sustained by the coastal island processes, and provide for recreational use and enjoyment that is compatible with preserving the distinctive natural and cultural resources of the nation's first national seashore.

Significance statements express why the park unit's resources and values are important enough to warrant national park unit designation. CAHA is significant because:

- It was the first national seashore established to preserve significant segments of remote and unspoiled barrier islands and the associated plants, wildlife and coastal processes, and to provide diverse opportunities for resource-compatible outdoor recreation.
- Located at the near-shore confluence of the Gulf Stream and Labrador currents, the seashore is continually shaped by coastal geologic, hydrologic, and weather processes, which together contribute to the evolution of these barrier islands.
- Its coastal location and dynamic conditions have inherent scientific value as a living laboratory for physiographic and ecological research, including the study of climate change and its effects on sea level and ecology. This knowledge base has local, national, and global value and provides a robust source of information for education and stewardship programs and experiential learning opportunities.
- It is representative of a mid-Atlantic barrier island system that is characterized by a diversity of aquatic and terrestrial habitat including open beach, dune, tidal marsh, wetland, shrub thicket, and maritime forest—each of which support a wide variety of wildlife.
- The seashore supports resident and seasonal populations of federally-listed and state-listed plants and animals including species such as the piping plover, American oystercatcher, gull-billed tern, green sea turtles, loggerhead sea turtles, and seabeach amaranth.
- Its artifacts, historic sites, and geographic setting provide tangible links to understanding humankind's ability to adapt in a harsh and changing coastal environment in isolation from the mainland. These links, which are of deep symbolic significance to local villagers, include lighthouses, shipwrecks, and Native American sites.
- Numerous historical events of national significance have occurred on or near its shores including four centuries of shipwrecks, the United States government's response to protect maritime commerce during the Civil War and World War II, and the experimental development and use of new technology.




**Map of the Park (high resolution version)**

# Chapter 2. State of the Park

The State of the Park is summarized below for four categories—Natural Resources, Cultural Resources, Visitor Experience, and Park Infrastructure—based on a synthesis of the park's monitoring, evaluation, management, information programs, and professional opinion. Brief resource summaries are provided below for a selection of the priority resources and values of the park. Clicking on the web ▸ symbol found in the tables and resource briefs below will take you to the internet site that contains content associated with specific topics in the report.

The scientific and scholarly reports, publications, datasets, methodologies, and other information that were used as the basis for the assessments of resource condition are referenced and linked throughout the report and through the internet version of this report that is linked to the NPS IRMA data system (Integrated Resource Management Applications). The internet version of each report, and the associated workshop summary report available from the internet site, provide additional detail and sources of information about the findings summarized in the report, including references, accounts on the origin and quality of the data, and the methods and analytical approaches used in data collection and the assessments of condition. Resource condition assessments reported in this State of the Park report involve professional opinion and the professional judgment of park staff and subject matter experts involved in developing the report. This professional opinion and professional judgment derive from the in-depth knowledge and expertise of park and regional staff gained from their being involved in the day-to-day practice of all aspects of park stewardship and from the professional experience of the participating subject matter experts. This professional opinion and professional judgment utilized available factual information for the analyses and conclusions presented in this report. This State of the Park report was developed in a park-convened workshop.

The status and trends documented in Chapter 2 provide a useful point-in-time baseline measured against reference conditions that represent "healthy" ecosystem parameters, or regulatory standards (such as those related to air or water quality). We also note that climate change adaptation requires us to continue to learn from the past, but attempting to manage for conditions based on our understanding of the historical "natural" range of variation will be increasingly futile in many locations. Thus, these reference conditions, and/or our judgment about resource condition or trend may evolve as the rate of climate change accelerates and we respond to novel conditions. Our management must be even more "forward looking," to anticipate plausible but unprecedented conditions, also recognizing there will be surprises. In this context, we will incorporate climate considerations in our decision processes and management planning as we consider adaptation options that may deviate from traditional practices.

# 2.1. Natural Resources

## Air Quality

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Visibility** | Haze Index |  | Visibility warrants significant concern. This status is based on NPS Air Resource Division benchmarks and the 2010–2014 estimated visibility on mid-range days of 15.8 deciviews (dv), compared to estimated natural conditions of 7.7 dv (greater dv values indicate decreased visibility). Under typical relative humidity conditions, average natural visual range during 2010–2014 was reduced from about 97 nm (without the effects of pollution) to about 43 nm, because of pollution at the park. The visual range was reduced to about 30 nm on the 20% haziest/high pollution days. During 2013–2015 the worst visual range was 23 nm. Visual range is reduced further under high relative humidity conditions caused by diurnal variation or meteorology.<br><br>Data from the Swanquarter, NC visibility IMPROVE (Interagency Monitoring of Protected Visual Environments) monitoring site indicate that during the 2005–2014 decade, the trend in visibility improved on both the 20% clearest days and 20% haziest days, resulting in an overall improving visibility trend. The degree of confidence in the visibility status and trend at CAHA is high because of the nearby visibility monitor (IMPROVE Site ID: SWAN1, NC; NPS-ARD 2016). |
| **Ozone** | Human Health: Annual 4th-highest 8-hour concentration |  | Human health risk from ground-level ozone warrants moderate concern. This status is based on NPS Air Resource Division benchmarks and the 2010–2014 estimated ozone concentration (4th-highest 8-hour average) of 68.0 parts per billion (ppb). Ozone is a respiratory irritant, causing coughing, sinus inflammation, chest pains, scratchy throat, lung damage, and reduced immune system functions. Children, the elderly, people with existing health problems, and active adults are most vulnerable. The degree of confidence in the status of human health risk from ground-level ozone is medium, because estimates are based on interpolated data from more distant ozone monitors (NPS-ARD 2016). |

## Air Quality (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Ozone (continued)** | Vegetation Health: 3-month maximum 12-hour W126 |  | Vegetation health risk from ground-level ozone warrants moderate concern. This status is based on NPS Air Resource Division benchmarks and the 2010–2014 estimated W126 metric of 8.4 parts per million-hours (ppm-hrs). The W126 metric relates plant response to ozone exposure during daylight hours over the growing season. A risk assessment concluded that plants in Cape Hatteras NS are at moderate risk for ozone damage (Kohut 2004, Kohut 2007). There are many ozone-sensitive plants in the park including: cottonwood (*Populus deltoides*), American sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), box elder (*Acer negundo*), loblolly pine (*Pinus virginiana*), flameleaf sumac (*Rhus copallinum*), and common milkweed (*Asclepias syriaca*) (NPSpecies 2016). The degree of confidence in the status of vegetation health risk from ground-level ozone is medium because estimates are based on interpolated data from more distant ozone monitors (NPS-ARD 2016). |
| **Deposition** | Nitrogen Wet Deposition |  | Wet nitrogen deposition warrants significant concern. This status is based on NPS Air Resources Division benchmarks and the 2010–2014 estimated wet nitrogen deposition range of 3.9 to 4.2 kilograms per hectare per year (kg/ha/yr). To maintain the highest level of protection in the park, the maximum of this range (4.2 kg/ha/yr) is used to determine the significant concern. The degree of confidence in the wet nitrogen deposition status is medium because estimates are based on interpolated data from more distant deposition monitors (NPS-ARD 2016).<br><br>Ecosystems at CAHA were rated as having very high sensitivity to nutrient-enrichment effects relative to all Inventory & Monitoring parks. Nitrogen deposition may disrupt soil nutrient cycling and affect biodiversity of some plant communities, including wetland (Sullivan et al. 2011a, Sullivan et al. 2011b). Excess nitrogen can also cause invasive exotic plant species to grow faster and out-compete native vegetation adapted to low nitrogen levels (Blett & Eckert 2013; Bobbink et al. 2010). Furthermore, the estimated total nitrogen deposition (wet plus dry) is above the minimum ecosystem critical loads for some park vegetation communities, suggesting that lichen and forest vegetation are at risk for harmful effects (NADP-TDEP 2014, Pardo et al. 2011). |

## Air Quality (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Deposition (continued)** | Sulfur Wet Deposition |  | Wet sulfur deposition warrants significant concern. This status is based on NPS Air Resources Division benchmarks and the 2010–2014 estimated wet sulfur deposition range of 2.8 to 3.1 kilograms per hectare per year (kg/ha/yr). To maintain the highest level of protection in the park, the maximum of this range (3.1 kg/ha/yr) is used to determine the significant concern. The degree of confidence in the wet sulfur deposition status is medium, because estimates are based on interpolated data from more distant deposition monitors (NPS-ARD 2016).<br><br>Although CAHA receives high levels of sulfur deposition, ecosystems in the park are not typical of sulfur-sensitive systems and were rated as having very low sensitivity to acidification effects relative to all Inventory & Monitoring parks. Acidification effects can include changes in water and soil chemistry that impact ecosystem health (Sullivan et al. 2011c, Sullivan et al. 2011d). |
| | Mercury/Toxics Deposition |  | Mercury/toxics deposition warrants significant concern. Given landscape factors influence the uptake of mercury in the ecosystem, the status is based on estimated wet mercury deposition and predicted levels of methylmercury in surface waters. The 2011–2013 wet mercury deposition was high at the park, ranging from 10.2 to 11.3 micrograms per square meter per year (NPS-ARD 2016) and the predicted methylmercury concentration in park surface waters is very high, estimated to be 0.34 nanogram per liter (USGS 2015). To maintain the greatest level of protection, the highest values for both factors were compared to NPS Air Resource Division benchmarks to determine the significant concern status. The degree of confidence in the mercury/toxics deposition status is low because wet deposition and methylmercury concentration estimates are based on interpolated or modeled data rather than in-park studies, since there are no park-specific studies examining contaminant levels in animals or plants from park ecosystems.<br><br>High mercury concentrations in birds, mammals, amphibians, and fish can result in reduced foraging efficiency, survival, and reproductive success. Elevated levels of mercury in humans can affect the brain, kidneys, and reproductive function. Wet and dry deposition can lead to mercury loadings in water bodies, where mercury may be converted to a bioavailable toxic form of mercury, methylmercury, and bioaccumulate through the food chain. Wetlands, especially those rich in organic matter, are important sites for methlymercury production. |

## Geologic Features and Processes

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Located at the ocean's edge, CAHA is shaped by ever-changing barrier island processes. Barrier islands are narrow, low-lying, dynamic landforms that run parallel to ocean coasts and are constantly shifting and reshaping as a result of wind, waves, storms, ocean currents, and sea level changes. These processes continue to influence the islands today through the processes of erosion and accretion of the shoreline, overwash across the islands, and the formation, migration, and closure of inlets.

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Barrier Island Dynamics** | Shoreline and island change |  | Sea level rise and other human impacts, such as the placement of hardened structures, creation of dunes, and dredging, continue to exacerbate shoreline change and interrupt barrier island dynamics. For example, barrier island dynamics were permanently altered in the 1930s when the CCC constructed an artificial duneline the length of the Outer Banks. Along with erosion, other activities, such as beach nourishment projects, dredging and control of sediment movement, placement of sandbags and other hardened structures, has continued to interrupt barrier island dynamics and contribute to shoreline and island change within the park.<br><br>Shoreline change occurs at variable rates along both the Atlantic Ocean and back barrier shorelines, resulting in changes in island width. Based on a 2011 long-term average annual erosion rate update report and maps (over approx. 47 to 76 years up to 2009) prepared by the North Carolina Division of Coastal Management (2011), Atlantic shoreline change ranges from -2 to -10 ft/yr. along S. Bodie Island, from -2 to -12.5 ft/yr. along Pea Island, from -2 to -12.5 ft/yr along Hatteras Island, and from -2 to -8.5 ft/yr. along Ocracoke Island. Between the villages of Avon and Buxton, the ocean shoreline has receded up to 2,500 feet over 151 yrs (an average of 17 ft./yr.), and up to 76% of the island width in 1852 has been lost (Riggs et al. 2008). |
| | Coastal Vulnerability Index |  | A Coastal Vulnerability Index (CVI) was used by the U.S. Geological Service (USGS) (Pendleton et al. 2004) to map the relative vulnerability of the coast to future sea level rise within CAHA. The CVI ranks the following in terms of their physical contribution to sea level rise-related coastal change: geomorphology, regional coastal slope, rate of relative sea level rise, historical shoreline change rates, mean tidal range, and mean significant wave height. The calculated CVI values for CAHA (Pendleton et al. 2004) range from 18.26 (low vulnerability) to 51.03 (very high vulnerability), with a mean CVI value of 37.64 (high vulnerability). Of the nearly 120 miles of shoreline along the North Carolina Outer Banks, 27 percent of the mapped shoreline classified as being at very high vulnerability due to future sea level rise. Another 27 percent were classified as high vulnerability, 30 percent as moderate vulnerability, and 16 percent as low vulnerability (Pendleton et al. 2004). |

## Resource Brief: Human Management of Barrier Islands

Natural coastal processes have been modified by human activities within and adjacent to CAHA, which has directly impacted the natural barrier island environment. Barrier islands are low-lying, dynamic landforms that are constantly evolving in response to storms, ocean currents, sea level changes, waves, and wind. The artificial dunes constructed in the 1930s and 1950s (see Resource Brief on Dune Construction) have impeded the overwash and inlet formation processes during storms that contribute to landward barrier migration and are essential to maintain island width and elevation. Erosion of the estuarine shoreline has increased due to a reduction of sediment supply, and a net result has been a narrowing of the island. Dune stabilization has altered beach, dune, and marsh geomorphology and led to changes in backshore ecosystems. After dune stabilization, the islands became thickly vegetated as shrubs and other vegetation colonized locations where historically they would have been absent due to flooding and burial by overwash. Other impacts from the stabilized dunes include narrowing of the ocean beach width, steepening of the beach profile (which can potentially limit turtle and shorebird nesting sites), and increased erosion.

Oregon Inlet, at the south end of Bodie Island, has been altered by a system of coastal modifications in order to maintain a navigation channel. Modifications include dredging of nearly 12 million cubic yards of sediment from the inlet system between 1960 and 2012, and construction of a 2,979-foot-long terminal groin and a 1,350-foot-long revetment on the southern inlet shoreline (Pea Island) between 1989 and 1991. The terminal groin has prevented Oregon Inlet from migrating southward, and along with the southward growth of Bodie Island, has caused the inlet to narrow and deepen. Sediment dredged from the inlet is placed on the southward (downdrift) beaches on Pea Island to counteract the increased shoreline erosion rates experienced after the groin construction. Shoreline retreat rates along Pea Island remain highly variable, and the beach nourishment along Pea Island has been reported to negatively impact the benthic infauna habitat along the beach and surf zone due to changes in beach mineralogy and grain size.

Dune construction and inlet stabilization has resulted in relative stability for transportation routes in the region such as NC Highway 12, which allows access to the region and supports today's largely tourism-based economy. Severe storms, including hurricanes, often destroy various elements of infrastructure. Hurricanes in 2003 and 2011 resulted in breaches in different locations on Hatteras Island, which were filled or bridged in order to rebuild Highway 12. Beach nourishment projects have been conducted in the past for the towns/villages within or adjacent to the park. The Town of Nags Head completed two beach nourishment projects in 2001 and 2011. Although outside of the park, sediment placed along the Nags Head shoreline may affect park beaches as it moves down coast through littoral transport. An emergency beach nourishment project occurred on the northern end of the Rodanthe village in 2014. In 2016, the NPS issued a special use permit for Dare County to conduct a beach nourishment project in Buxton village.

## Resource Brief: History of Dune Construction

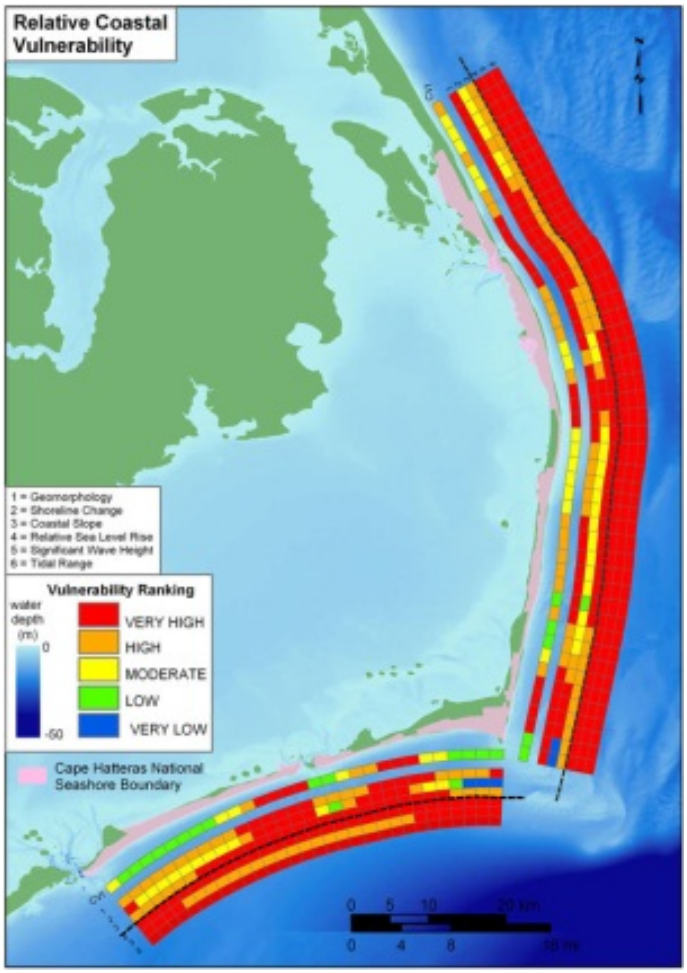
In response to rapid erosion, the CCC and Works Project Administration in collaboration with NPS began an island stabilization program in 1937 (Dallas et al. 2013). Sand fences were erected along 108 miles of the North Carolina coast from the Virginia State Line to southern Hatteras Island, trapping windblown sand and forming barrier dunes. The dunes were then stabilized with vegetation. By 1941, the project had installed 780 miles of sand fencing, planted 6,510 acres of grass and over 3 million trees and shrubs, and built 75 miles of dikes and jetties. Dune height ranged from 10–26 ft and dune widths were 82–328 ft (Dallas et al. 2013).

In October 1956, the NPS resumed dune construction, extending the artificial dunes to the southern tip of Ocracoke Island and rebuilding the 1930s dune system. A storm known as "the Ash Wednesday storm" destroyed portions of the dune on March 7, 1962; however, the dune line was completely restored along the entire length of the National Seashore (Dallas et al. 2013).

In the 1970s, NPS stopped actively maintaining the constructed dunes, allowing natural coastal processes to reshape and modify them. However, following storms the North Carolina Department of Transportation (NCDOT) has removed sand from Highway 12 and rebuilt the dunes to protect the highway. All of the reconstruction activities occur within the NCDOT highway right-of-way and are not regulated by CAHA. CAHA also permits private landowners in the villages to rebuild small dunes along their oceanfront property lines using sand washed onto their property during storms.

# Resource Brief: Coastal Vulnerability

A Coastal Vulnerability Index (CVI) was used by the USGS (Pendleton et al. 2004) to map the relative vulnerability of the coast to future sea level rise within CAHA. The CVI ranks the following in terms of their physical contribution to sea level rise-related coastal change: geomorphology, regional coastal slope, rate of relative sea level rise, historical shoreline change rates, mean tidal range, and mean significant wave height. The vulnerability ranking system allows the six variables to be incorporated into an equation that produces a CVI. This approach combines the coastal system's susceptibility to change with its natural ability to adapt to changing environmental conditions, yielding a quantitative, although relative, measure of the park's natural vulnerability to the effects of sea level rise. The areas within CAHA that are likely to be most vulnerable to sea level rise are those with the highest occurrence of overwash and the highest rates of shoreline change. The calculated CVI values for the park range from 18.26 (low vulnerability) to 51.03 (very high vulnerability), with a mean CVI value of 37.64 (high vulnerability). Of the nearly 120 miles of shoreline along the North Carolina Outer Banks, 27 percent of the mapped shoreline is classified as being at very high vulnerability due to future sea level rise. Another 27 percent was classified as high vulnerability, 30 percent as moderate vulnerability, and 16 percent as low vulnerability.




**A map of the CVI (vulnerability ranges) for Cape Hatteras National Seashore.**

## Water Quality

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| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Water Chemistry** | Water Quality Index |  | Ten of 17 sites sampled in 2010 had overall site conditions rated as "fair" based on National Coastal Assessment water quality criteria (Gregory and Smith 2011). |
| | Water Clarity |  | Water clarity is important for submerged aquatic vegetation growth. Increased turbidity can affect sea grass beds, which are an important food source and nursery habitat for aquatic organisms.<br><br>5/5 sites sampled in 2010 rated as "good" based on Environmental Protection Agency (EPA) National Coastal Assessment criteria (Water Clarity index scores < 2.3) (Gregory and Smith 2011). However, 12/17 sites had missing data. No significant trends in turbidity based on continuous data collected 2010–2013 (Rinehart et al. 2013, Wright et al. 2012a, 2012b). |
| | Chlorophyll *a* |  | Chlorophyll *a* measures the amount of productivity of single celled plants (algae) in the water, which serve as a food source for marine organisms. Algae blooms can create problems by blocking sunlight from reaching submerged aquatic vegetation and can indicate high nutrient levels in the water.<br><br>15/17 sites sampled in 2010 were rated as "good" based on EPA National Coastal Assessment criteria (chlorophyll *a* concentrations < 5 µg/L) (Gregory and Smith 2011). No trends observed based on monthly sampling from 2010–2013 (Rinehart et al. 2013, Wright et al. 2012a, 2012b). |
| | Total Dissolved Nitrogen |  | Total dissolved nitrogen is a measure of the amount of nutrients present in the aquatic environment. Excessive dissolved nitrogen act as a fertilizer and can create harmful algae blooms.<br><br>6/17 sites rated as "poor" (concentrations > 0.5 mg/L; Gregory and Smith 2011). However, no trends observed based on monthly sampling from 2010–2013, and all monthly samples collected were rated as fair (Rinehart et al. 2013, Wright et al. 2012a, 2012b). |
| | Total Dissolved Phosphorus |  | Total dissolved phosphorus is a measure of the amount of nutrients present in the aquatic environment. Excessive dissolved phosphorus acts as a fertilizer and can create harmful algae blooms.<br><br>15/17 sites sampled in 2010 rated as "fair" based on EPA National Coastal Assessment criteria (TDP concentrations between 0.01 and 0.05 mg/L) (Gregory and Smith 2011). No trends observed based on monthly sampling from 2010–2013 (Rinehart et al. 2013, Wright et al. 2012a, 2012b). |

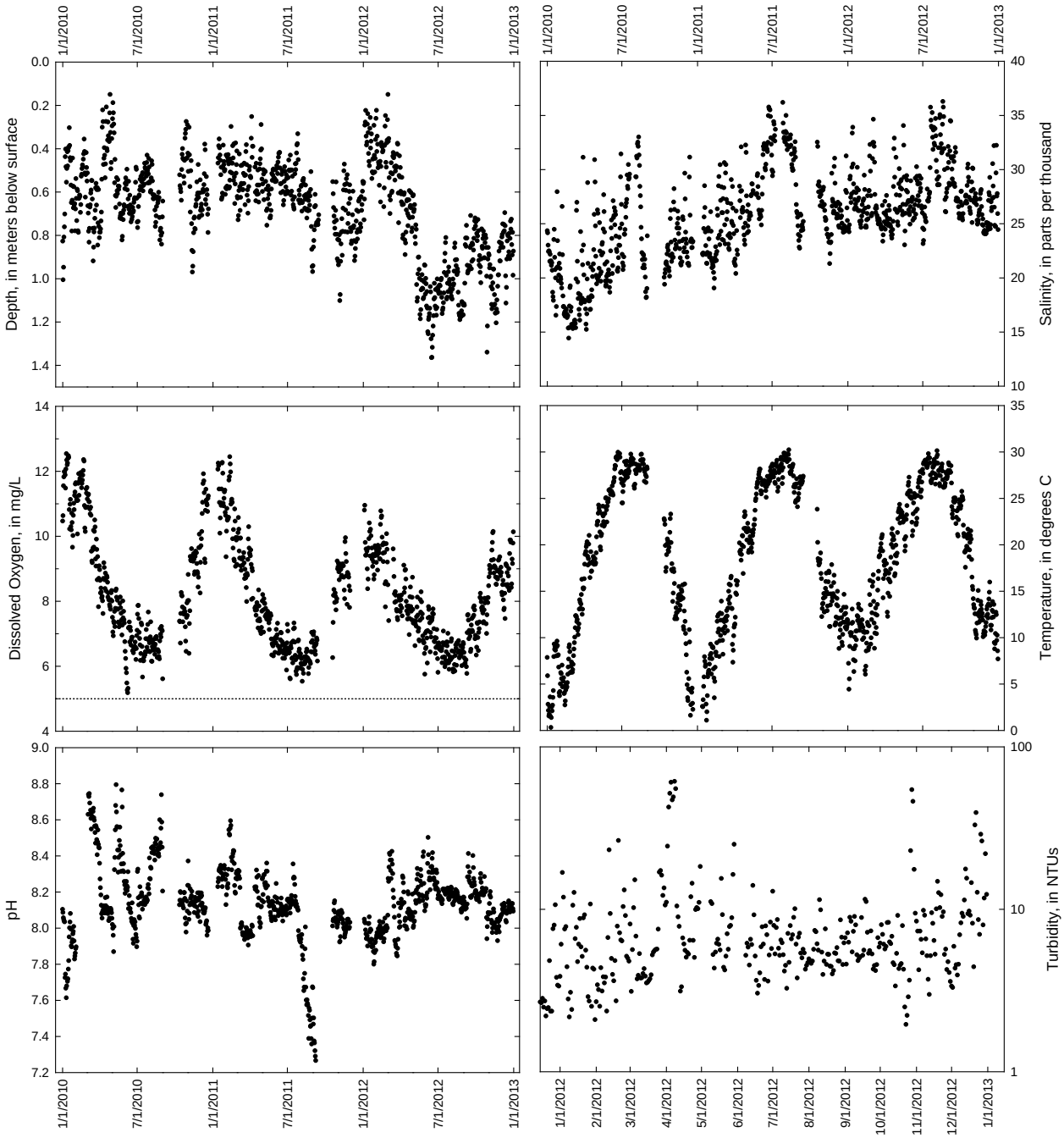
## Water Quality (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Water Chemistry (continued)** | Dissolved Oxygen |  | Dissolved oxygen (DO) is necessary for aquatic organisms to survive. Variations in DO can affect the health and distribution of aquatic organisms.<br><br>17/17 sites sampled in 2010 rated as "good" based on EPA National Coastal Assessment criteria (DO Concentrations >5 mg/L) (Gregory and Smith 2011). No significant trends based on continuous data collected 2010–2013 (Rinehart et al. 2013, Wright et al. 2012a, 2012b). |
| **Sediment Chemistry** | Sediment Quality Index |  | Sediment Quality index rated as "good" for all 17 sites sampled in 2010 (Gregory and Smith 2011). |
| | Sediment Contaminant Rating |  | Sediment Contaminant Rating scored as "good" for all 17 sites sampled in 2010 (Gregory and Smith 2011). |
| | Total Organic Carbon |  | 17/17 sites sampled in 2010 had Total Organic Carbon (TOC) levels rated as "good" based on EPA National Coastal Assessment criteria (TOC < 2%) (Gregory and Smith 2011). |
| **Benthic Macroinvertebrates** | Southeast Coast Benthic Index |  | Benthic macroinvertebrates (mole crabs, marine worms, etc.) are a primary food source for fish and other aquatic and terrestrial organisms.<br><br>Hymel (2009) conducted a review of existing benthic macroinvertebrate (BMI) records found within or adjacent to Southeast Coast Network (SECN) coastal parks. A list of 90 BMI taxa was compiled for CAHA. 9 of 11 sites sampled in 2010 had Southeast Coast Benthic Index scores that rated as "good" (DeVivo and Gregory 2011). |

## Resource Brief: Continuous Water Quality Monitoring

In November 2005, the SECN Inventory and Monitoring Program began monitoring water-quality in estuarine waters near CAHA. One continuous monitoring station was operational during 2012 in Pamlico Bay at the Ocracoke Boat Ramp dock. During this time, continuous data loggers collected pH, dissolved oxygen, water temperature, salinity, turbidity, and water-level data at 30-minute intervals. Additional water-quality measurements are collected monthly such as water-clarity conditions, nutrients, and chlorophyll *a* levels. This monitoring effort was designed to collect data so that managers are able to make better-informed decisions by understanding trends and variability of water-quality conditions in park waters. Mean monthly dissolved oxygen levels were good throughout the entire year (2012), ranging from a high of 9.6 mg/L in February to a low of 6.4 mg/L in July and August. No daily average dissolved oxygen levels dipped below 5 mg/L. Monthly water-quality data collected at the SECN site near CAHA during 2012 reflect good-to-fair conditions throughout the year, with water-clarity rating good in the spring and early summer and fair in the late summer. Dissolved inorganic nitrogen (DIN) and phosphorus (DIP) indicated good conditions when available.




**Mean daily values for water quality parameters collected in Pamlico Bay at the Ocracoke Boat Ramp dock at CAHA 2010–2012. Breaks in data record indicate missing and/or flagged data. Dotted line (Dissolved Oxygen) indicates minimum value for a rating of good (USEPA 2012).**

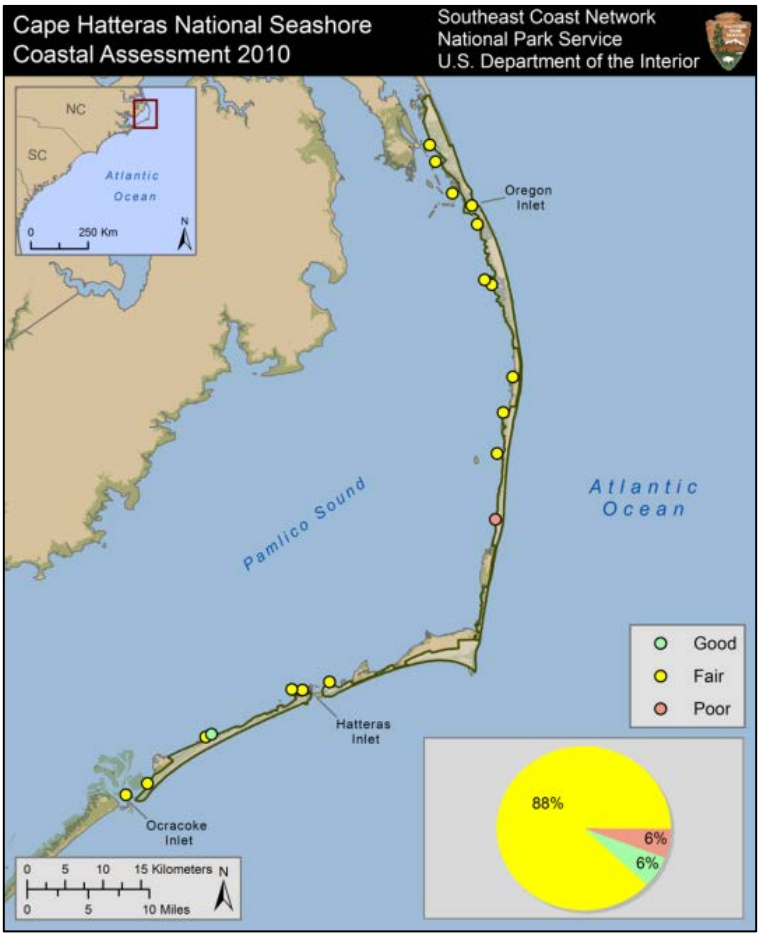
# Resource Brief: Coastal Water Quality Assessment

In July 2010, the SECN, in cooperation with the University of Georgia Marine Extension Service, conducted a water quality assessment at 30 sites at CAHA and Cape Lookout National Seashores as a part of the NPS Vital Signs Monitoring Program (Gregory and Smith 2011). Monitoring was conducted following methods developed by the EPA as a part of the National Coastal Assessment Program and included laboratory analysis for chlorophyll *a*, total dissolved nitrogen and phosphorous concentrations, and field measurements of water temperature, pH, dissolved oxygen, and salinity. Estimates of water clarity were made using a secchi disk to estimate turbidity.

The water quality at CAHA was rated good for 7 out of 10 metrics. The Water Quality Index was rated fair, and dissolved nitrogen levels were at concentrations considered poor at just over a third of sites. Dissolved phosphorus concentrations were fair at most sites, and only a single site located just north of the Cape Hatteras Lighthouse rated poor due to elevated phosphorus levels. Chlorophyll *a* and dissolved oxygen levels were good throughout most of the sampling locations. Only 13% of sites rated in the fair range for chlorophyll *a* and only 3% rated as fair for dissolved oxygen.

Overall sediment conditions were considered good at all sites sampled, showing only trace amounts of metals and little or no organic contamination. Higher levels of nutrients, especially total dissolved nitrogen, were more common in the park's northern waters potentially due to higher population densities in this area. Continued monitoring of nutrient levels in the park's waters, especially in high use areas, should be considered.

When comparing water quality inside and outside park boundaries, overall water quality was better within park waters than surrounding areas as indicated by a higher percentage of sites that ranked "good" for DO, DIN, DIP, water clarity, and chlorophyll *a* (Parman et al. 2012). Of the sites inside the park, 94% of DIP samples were rated "good" during 2010 versus only 66% sites that rated "good" in the 20 miles surrounding the park. Water clarity was "good" at all sites inside the park, while 22% of sites surrounding the park were "good" and 78% were "fair." Long-term trends in the median concentration of DIP were "poor" between 2000−2009. These findings suggest that runoff from nearby development has not had a large influence on water quality inside the park (Parman et al. 2012).




**Summary assessment of water-quality conditions at Cape Hatteras National Seashore in July 2010. Assessment based on numbers of categorical ratings at each site for using the water-clarity index (WCI), Chlorophyll a, total dissolved nitrogen, total dissolved phosphorus and dissolved oxygen measurements. Graph shows percentage of sites in each condition category (modified from Gregory et al. 2011).**

## Plant and Wildlife Communities

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Plant Diversity** | Species Richness |  | CAHA has 1,134 known vascular-plant species, subspecies, and varieties (NPS Species database). Yaupon holly and wax myrtle were the most frequently-occurring species in the shrub stratum; and saltmeadow cordgrass, greenbrier, poison ivy, and climbing hempvine were the most frequently-occurring species in the groundcover stratum (Byrne et al. 2012). The park has documented 24 state-listed rare plants since 2010. |
| **Amphibians and Reptiles** | Species Richness<br>Disease Incidence |  | Twelve species of amphibians have been documented at CAHA (NPSpecies database) including 9 species of frogs and toads. Green tree frog and squirrel tree frog were the most widely-distributed amphibians during sampling events in 2010 (Byrne et al. 2011b). Chytrid fungus (a pathogen linked to amphibian population declines around the world) was not found in any species during a 2010 study (Byrne and Moore 2011). Fifty-one species of reptiles are known to occur in or within close proximity of CAHA (Tuberville et al 2005). |
| **Birds** | Species Richness<br>Relative Abundance |  | More than 1,100 birds representing 88 species were detected at CAHA during surveys in 2010 (Byrne et al. 2011a). Boat-tailed grackle, Carolina wren, red-winged blackbird, and laughing gull were the most widely-distributed species in the park, detected at 37–40% of sampling locations. European starling was the only non-native species detected. Several sensitive species, such as piping plover and American oystercatcher, nest within the park. The park is also an important stopover for shorebirds, such as the red knot. |
| **Invasive and Exotic Species** | Exotic/Invasive Animals |  | Invasive animals in the park can include coyotes, nutria, red fox, feral hogs, feral cats, and mink. Sporadic, infrequent occurrences of feral hogs occurred within the park. There has been periodic/ intermittent evidence of low numbers of feral hog presence since 2000 with a known source population to the north of the park. Human influence has likely led to an imbalance in numbers of certain animal species, such as coyotes, raccoons, and opossums. The increased abundance of these animals can lead to increased predation of sensitive and other naturally-occurring species in the park. The park implemented a regimented trapping program to help reduce unnatural levels of some of these predators over the last several years. |

## Resource Brief: Updating the Natural Resource Inventories

NPS policy requires park managers know the nature and condition of the natural resources under their stewardship and have the means to detect and document changes in order to fulfill the NPS mission of conserving parks unimpaired. Resource inventories can be used as a tool to achieve this understanding. Two primary purposes of resource inventories are to: (1) document the occurrence, location, and current condition of physical habitat and major associated biota; and (2) identify locally rare or threatened and endangered species, locating fragile (or rare) ecosystems and potential "indicator species." The NPSpecies database includes working and certified species lists for each National Park.

**Large tolype moth found during butterfly and moth inventories conducted at Cape Hatteras National Seashore. Photo by Britta Muiznieks.**

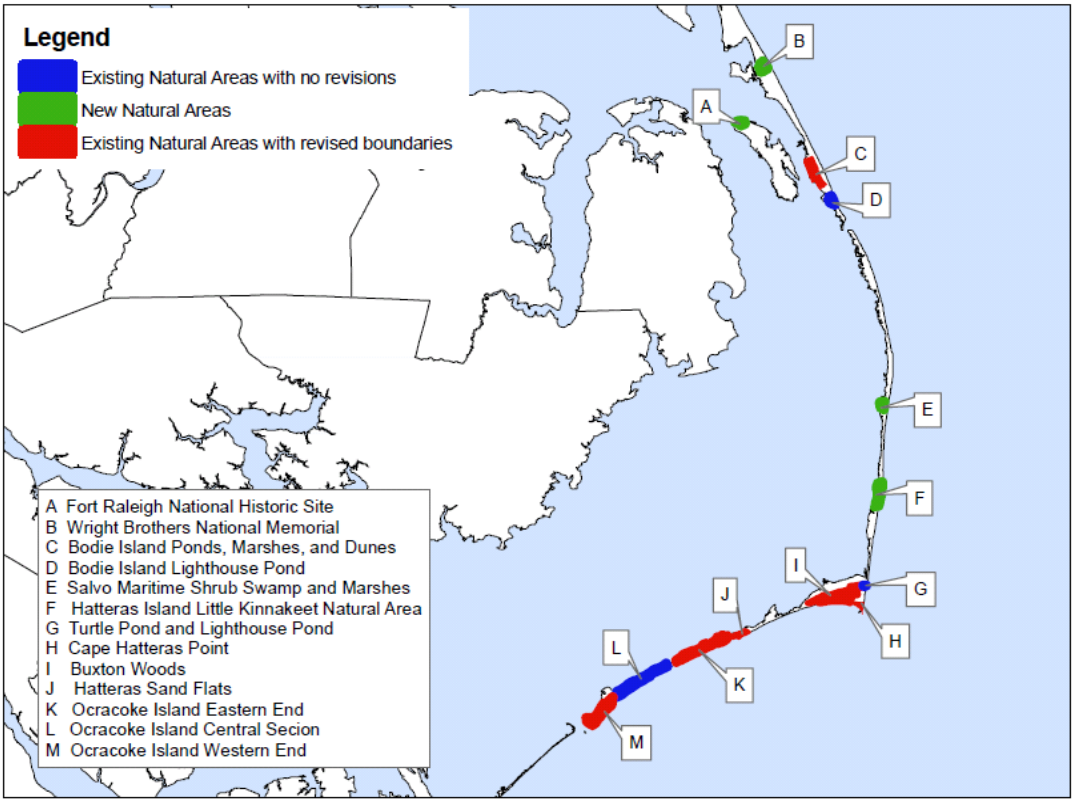
## Resource Brief: Natural Heritage Areas

Significant Natural Heritage Areas (SNHAs) are defined by the North Carolina Natural Heritage Program (NCNHP) as areas that "possess natural values, and biological, botanical, zoological, and ecological resources justifying recognition by the State as an outstanding part of the natural heritage of North Carolina" (NCNHP 2013). In 1987, the NPS entered into a Registry Agreement designating 7,491 acres of the Seashore as registered SNHA. After field inventories were conducted by the North Carolina Natural Heritage Program ecologists in recent years, proposals were made to update/expand the existing registries and create two additional SNHAs in 2014. The updated Cape Hatteras National Seashore Natural Areas consist of a total of 10,976 acres of registered SNHA. The natural areas specific to this agreement include: (1) Bodie Island Ponds, Marshes, and Dunes, (2) Bodie Island Lighthouse Pond, (3) Salvo Maritime Shrub Swamp and Marshes (new), (4) Hatteras Island Little Kinnakeet Natural Area (new), (5) Turtle Pond and Cape Hatteras Lighthouse Pond, (6) Buxton Woods, (7) Cape Hatteras Point, (8) Hatteras Sand Flats, (9) Ocracoke Island – Eastern End, (10) Ocracoke Island – Central Section, and (11) Ocracoke Island – Western End (Sand Flats).

The areas designated as SNHAs at CAHA contain "a representative variety of barrier island community types, in excellent and relatively undisturbed condition" (NCNHP 2012). The two Bodie Island SNHAs support the southern limit and some of the best examples of the Stable Beach Heather Dune Barren natural community in the state, several rare marsh plant species (i.e., maritime pinweed, salt marsh spikerush, beaked spikerush), and important foraging and nesting areas for bird species of concern (i.e., black-necked stilt, black rail) created by artificial impoundments. Hatteras Island SNHAs support a wide array of unique natural communities, including freshwater and Interdune Ponds, Maritime Shrub Swamp (including the extremely globally rare Red Bay Subtype), Maritime Evergreen Forest, Maritime Wet Grassland, and Dune Grass (Schafale 2012). Buxton Woods is particularly unique as it is considered "one of the largest and most diverse complexes of maritime natural communities in North Carolina and beyond" (NCNHP 2013). The Hatteras SNHAs support a wide array of rare flora, including the only two existing populations of state Significantly Rare Illinois pondweed in North Carolina, the northernmost limit and largest existing populations of the Federal Species of Concern dune bluecurl, and numerous other state species of concern (i.e., moundlily yucca, nerved witch grass, four-angled flatsedge) (Gadd 2012).

Rare wildlife is also abundant in the park's SNHAs, with areas supporting foraging and nesting habitat for colonial waterbirds, the Federally Threatened piping plover and loggerhead turtle, and numerous state species of concern (i.e., American oystercatcher, common and least tern, black skimmer, Buxton white-footed mouse). The three Significant Natural Heritage Areas on Ocracoke cover over 80 percent of NPS land on the island. In addition to supporting many of the same flora and fauna species of concern and rare natural communities as found on Hatteras Island, Ocracoke is home to several unique state-listed wildlife species, including the marsh killifish, Outer Banks king snake, Eastern diamondback terrapin, and the Carolina water snake (LeGrand 2012).

The Registry Agreements that establish Significant Natural Heritage Areas are a mutual understanding between the NPS and the North Carolina Department of Environment and Natural Resources to "protect outstanding examples of the natural diversity occurring in North Carolina and preserve unique and unusual natural features." These agreements involve no loss of ownership rights, but simply express the sincere intentions of a landowner to refrain from making or permitting changes that alter the natural values for which the areas were registered. NPS staff works closely with the NCNHP to facilitate and maintain SNHA registries and is dedicated to protecting these areas from artificial alterations and allowing natural processes to operate unhindered.




**Significant Natural Heritage Areas within Cape Hatteras National Seashore, Fort Raleigh National Historic Site and Wright Brothers National Memorial**

## Resource Brief: Fire Management

The barrier island ecosystem has undergone significant changes to the natural plant communities since the 1930s when an artificial dune line was established to prevent ocean overwash. The natural process of overwash maintained the park in sand flat and grassland ecosystems with minimal woody vegetation. Prior to the 1930s, only Buxton Woods and areas around the villages of Hatteras and Ocracoke supported forested areas and expanses of woody vegetation. Since the 1930s, there has been a significant increase in woody vegetation, which has altered plant communities and put human-created structures at risk. One method of woody vegetation removal and habitat restoration is through the use of prescribed fire.

In February 2012, the park conducted the first prescribed fire in 20 years, which burned 1,300 acres on Bodie Island. The intent of the burn was to reduce woody vegetation accumulation and to reduce fuel loading and the threat of wildfires to historic structures and human development in and around the park. Additionally, a resource benefit of these prescribed fire projects will be realized through a reduction of the amount of woody vegetation encroachment, and fire may be used in conjunction with other treatment methods to help reduce the coverage of the invasive common reed (*Phragmites australis*). The park established vegetation monitoring points to help assess the effectiveness of fire at achieving the stated goals.

## Resource Brief: Amphibians

Amphibian communities in the southeastern United States are widely considered to be among the most diverse in the world (Byrne et al. 2011b). According to information gathered in 2004, the park contains 12 known amphibian species including nine species in Anura (frogs and toads) and three species in Caudata (e.g., salamanders, newts, amphibians, sirens) (Tuberville et al. 2005). 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.

Amphibian communities were monitored using automated recording devices at 30 locations in the summer of 2010. During these sampling events, six native anuran species were detected and no non-native species were detected (Byrne et al. 2011b). Green tree frog and squirrel tree frog were the most widely-distributed amphibians. In 2010, the NPS SECN 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). These data will serve as a baseline for future monitoring efforts of vocal anurans at the park.

***Hyla cinerea* (green treefrog), observed during vital signs monitoring efforts at Cape Hatteras National Seashore in 2010. Photograph by SECN staff.**

**Naïve occupancy estimates (proportion of sites where the species was detected) for amphibians at CAHA, 2010.**

| Scientific Name | Common Name | Proportion of Sites Where Seen |
|---|---|---|
| *Hyla cinerea* | Green treefrog | 0.50 |
| *Hyla squirella* | Squirrel treefrog | 0.50 |
| *Rana sphenocephala* | Southern leopard frog | 0.30 |
| *Bufo fowleri* | Fowler's toad | 0.27 |
| *Gastrophryne carolinensis* | Eastern narrow-mouthed toad | 0.07 |
| *Rana catesbeiana* | Bullfrog | 0.03 |

## Resource Brief: Exotic Plant Management

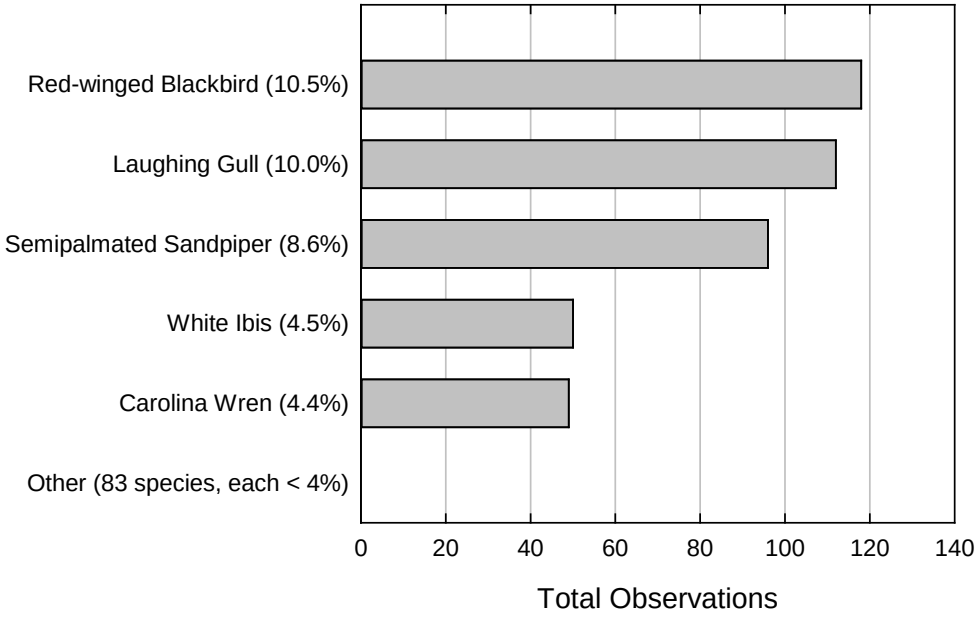
The common reed (*Phragmites australis*) is an invasive exotic plant species that is encroaching wetland areas within the park. *Phragmites* is a tall perennial grass that can attain heights of up to 10 feet, which is significantly taller than that of native marsh species, such as *Spartina*, black needlerush, and cattails. Although it is a prolific seed producer, *Phragmites* most often spreads locally through vigorous growth of rhizomes and stolons, which can grow up to 2 meters per year (Batterson and Hall 1984). *Phragmites* can eventually sustain stem densities of up to 300 culms per square meter through development of a dense root mat (Hara *et al*. 1993). In addition to vigorous biomass growth, *Phragmites* is also reported to release the allelopathic chemical gallic acid into the soil, which inhibits the establishment and growth of other marsh species (Rudrappa et al. 2007). As a result of these physiological characteristics, *Phragmites*, once established, frequently develops dense, monospecific colonies over extensive areas and can exclude shorter native marsh species.

As of 2012, approximately 800 acres of brackish water marsh in the park was being severely impacted by *Phragmites* (NPS, unpublished data). Isolated patches of *Phragmites* can double in coverage every 5 years (NPS, unpublished data). In 2012 and 2013, the park in cooperation with the Southeastern Exotic Plant Management Team began treating isolated patches of *Phragmites* to prevent monoculture conditions and continued spread into unique natural communities that contain state listed plant species. Herbicide treatments are labor intensive, with staff using backpack sprayers to foliar treat *Phragmites* monocultures with an aquatic-safe version of the chemical glyphosate (Rodeo). Treatments are conducted during summer and early fall months when the plants are actively growing, and multiple applications are required.

# Resource Brief: Birds

Birds are an important component of park ecosystems. Their high body temperature, rapid metabolism, and high ecological position in most food webs make them a good indicator of the effects of local and regional changes in ecosystems. 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 of these attributes in relation to changes in the structural diversity of vegetation resulting from fire and other management practices will improve our understanding of the effects of various management actions. More than 366 species of birds have been reported in the park (NPSpecies database).

The SECN conducted a survey of landbirds in 2010 finding a high diversity of birds in the park. A total of 1,122 birds representing 88 species were detected. Boat-tailed grackle, Carolina wren, red-winged blackbird, laughing gull, and Eastern towhee occupied 70–80% of sampling locations in the park. European starling was the only non-native species detected; occurring at 13% (4/30) of the sampling locations.




**Relative abundance of bird species observed at Cape Hatteras National Seashore, 2010. Numbers in parentheses indicate the proportion of all observations represented by each species. Modified from Byrne et al. 2011a.**

**Semipalmated sandpiper (*Calidris pusilla*) observed during monitoring at Cape Hatteras National Seashore in 2010. Photo by Tim Bowman.**

## Protected Species of Management Concern

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Sea Turtles** | Number of sea turtle nests and emergence success |  | The park has been monitoring sea turtle activity since 1987. In 2015, 289 nests were documented, with an approximate emergence success of 49%. Over the previous five years, the total number of nests has shown a 27% average annual increase while emergence success has remained relatively constant (NPS CAHA 2015). Condition status was based on the park's short-term desired future conditions of 94 nests per year with a 2% average annual increase (as defined in the Off-Road Vehicle Final Environmental Impact Statement). |
| **Shorebirds** | Piping Plovers breeding pairs and fledging rate |  | In 2015, 12 Piping Plover (PIPL) pairs were identified, and 2 PIPL chicks successfully fledged (0.17 fledged / pair). Since 2003, annual number of nesting PIPL pairs has ranged from 2 to 15 with an increasing trend, while fledge rate has remained relatively constant (NPS CAHA 2015). As fledging rates naturally fluctuate, the average fledging rate since 2000 has remained just under 1 chick fledged per pair (0.7). Condition status was based on the park's short-term desired future conditions of 15 nesting pairs per year and an average fledge rate of 1.0 per pair as reflected in the recovery plan for the species (as defined in the Off-Road Vehicle Final Environmental Impact Statement). |
| | American Oystercatcher – breeding pairs and fledging rates |  | In 2015, 25 pairs of American oystercatcher (AMOY) nested at the Seashore, with 13 AMOY chicks fledged (0.52 fledged / pair). Since 2003, annual number of nesting pairs has ranged from 23 to 27 with an average fledge rate of 0.76 fledges / pair (NPS CAHA 2015). Condition status was based on the park's short-term desired future conditions of 30 nesting pairs per year and an average fledge rate of 0.4 fledges / pair (as defined in the Off-Road Vehicle Final Environmental Impact Statement). Recent scientific data indicates increases in populations might be a challenge (Schulte and Simons 2015). |
| | Number of Colonial Waterbird (CWB) nests per species |  | Preliminary results of 2015 annual colony surveys showed that 291 Least terns (LETE), 16 common tern (COTE), 3 gull-billed tern (GBTE), 2 Forster's terns (FOTE), and 85 black skimmer (BLSK) nests were observed. Condition status was based on the park's short-term desired future conditions of 462 LETE, 292 COTE, 21 GBTE, and 132 BLSK annual nests (as defined in the Off-Road Vehicle Final Environmental Impact Statement). Over the last five years, all species have shown an increasing trend in annual nests (NPS CAHA 2015). Confidence is rated moderate due to lack of fledgling data. |

## Protected Species of Management Concern (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Seabeach Amaranth** | Number of plants |  | Seabeach amaranth is a federally-protected species and populations have fluctuated greatly since surveys began in the park in 1985. In the last 15 years, numbers were the highest in 2002 with 93 plants. More recently numbers have declined with only one plant found in 2004 and two plants found in 2005. No plants have been observed since that time and the plant is currently thought to be extirpated from the park. Many areas where amaranth was historically found have been continuously protected through summer and winter resource management closures. At Hatteras Inlet, large portions of the historic range are no longer present due to continued erosion. While it is thought that the plant may possibly be extirpated from the park, it should be noted that plants are not evident most years, but may survive in the seed bank; populations of seabeach amaranth may still be present even though plants are not visible for several years (NPS CAHA 2015). |

## Resource Brief: Sea Turtle Genetic Project

**Nesting green sea turtle at Cape Point.**

CAHA lies near the northern range of nesting for four sea turtle species, including the loggerhead, green, Kemp's ridley, and leatherback. Each nesting season, beginning in May and continuing through September, sea turtles crawl onto the beaches of Cape Hatteras to deposit their eggs in the sand. While the park monitors and records the total number of nests laid each year, the number of unique nesting females cannot be inferred as each female can lay multiple nests in a single season.

In 2010, CAHA, along with other North Carolina, South Carolina, and Georgia beaches, began participating in a genetic mark-recapture study of Northern Recovery Unit nesting female loggerheads using DNA derived from eggs. The study, coordinated by the Georgia Department of Natural Resources, the University of Georgia, and North Carolina Wildlife Resource Commission (NCWRC), identifies a specific nesting female to each nest sampled. One egg from each nest located is taken and the maternal DNA is sampled. This research will ultimately answer questions about the total number of nesting females in the population, the number of nests each female lays per season, distance between nests laid by individual females, and other information that is important to understanding the population dynamics of sea turtles. While analysis of all DNA samples is incomplete, it has been determined that Cape Hatteras had a minimum of 81 unique nesting females in 2010, 75 in 2011, and 105 in 2012. In 2015, the study recognized that two nests on Cape Hatteras belonged to hawksbill sea turtles, which is this species' northern-most record for nesting. Currently, the results of this study are preliminary and ongoing. Recently, the project was awarded a grant from the National Oceanic and Atmospheric Administration to continue collecting DNA samples hopefully through 2016 (Kazmierczak 2013).

## Resource Brief: Protected Bird Management

The park plays an important role in the survival of many wildlife species by providing a variety of important habitats. Located on a major avian migratory route known as the Atlantic Flyway, the park was designated as a globally important bird area in 1999 by the American Bird Conservancy in recognition of the value the seashore provides to bird migration, breeding, and wintering (American Bird Conservancy 2005).

In 1986, the Atlantic coast population of the piping plover (*Charadrus meolodus*) was listed as threatened under the Endangered Species Act. Various factors contributed to the decline of the species including; the loss of habitat due to development; loss of habitat due to erosion; predation; intentional or unintentional disturbance by dogs, people, and vehicles; and weather (i.e., tropical storms or late nor'easters that cause extreme high tides). Piping plover monitoring in the park began in 1985. Monitoring has focused on identifying nesting habitat, locating and protecting piping plover breeding territories and nests, and determining nesting and fledging success.

**Piping Plover brooding chicks at Cape Point**

The American oystercatcher (*Haematopus palliates*) is a ground-nesting shorebird native to North Carolina. As with many shorebirds, oystercatcher numbers have been in sharp decline over the past 20 years. With only an estimated 10,000 individuals (or 3,500 breeding pairs), the American oystercatcher is designated Significantly Rare by the U.S. Fish and Wildlife Service (USFWS), and is a Species of Special Concern in North Carolina. American oystercatcher monitoring began at the park in 1999, with the focus on monitoring of number of breeding pairs, nest success, and fledging rates.

Other protected bird species include colonial waterbirds that nest in large groups or colonies and obtain their food from the water. The park provides nesting habitat for several species of special concern and state-listed colonial-nesting waterbirds, including the common tern (*Sterna hirundo*), least tern (*Sterna antillarum*), gull-billed tern (*Gelochelidon nilotica aranea*), and black skimmer (*Rhynchops niger*). Monitoring of colonial waterbirds focuses on identifying nesting habitat, protecting nesting areas and chicks, and monitoring colony activity. Monitoring data have been collected at the park since 1977.

## Acoustic Environment

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Acoustic Impact Level** | A modeled measure of the noise (in dBA) contributed to the acoustic environment by man-made sources |  | The condition of the acoustic environment is assessed by determining how much noise man-made sources contribute to the environment through the use of a national noise pollution model. The mean acoustic impact level at the park is 2.8 dBA, meaning that the condition of the acoustic environment warrants moderate concern. Overall, long-term projected increases in ground-based (U.S. Federal Highway Administration 2013) and aircraft traffic (Federal Aviation Administration 2010) indicate a deteriorating trend in the quality of acoustic resources at this location. Confidence in condition is considered high due to the availability of 2008 and 2011 acoustic monitoring results (Rapoza 2014). |

# Resource Brief: Acoustic Environment at Cape Hatteras National Seashore

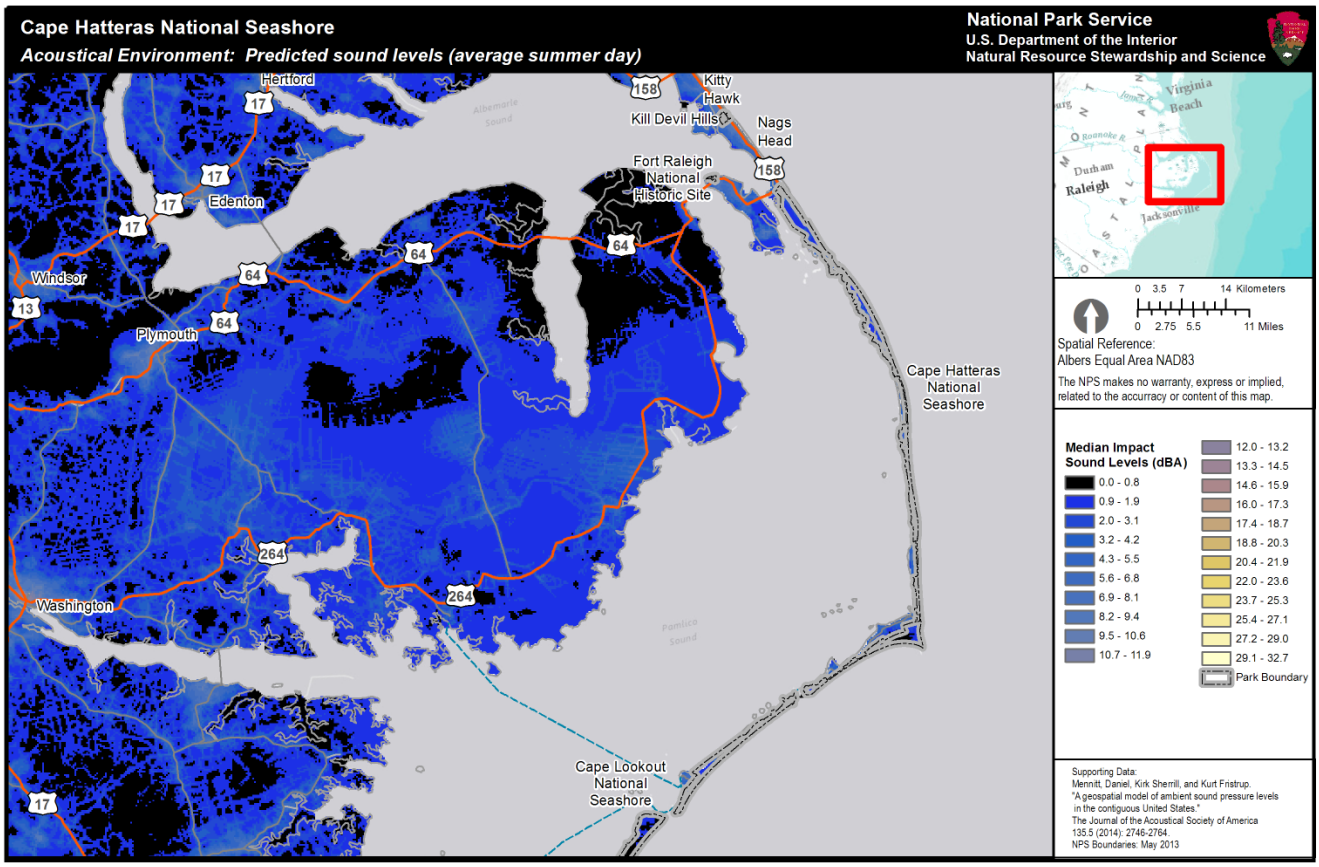
To characterize the acoustic environment, NPS has developed a national model of noise pollution (Mennitt et al. 2014). This model predicts the increase in sound level due to human activity on an average summer day. The model is based on measured sound levels from hundreds of national park sites and approximately 100 additional variables such as location, climate, vegetation, hydrology, wind speed, and proximity to noise sources such as roads, railroads, and airports. The model reveals how much quieter parks would be in the absence of human activities. The quality of the acoustic environment affects visitor experience and ecological health. Acoustic resource condition, both natural and cultural, should be evaluated in relation to visitor enjoyment, wilderness character, ecosystem health, and wildlife interactions. Learn more in the document Recommended indicators and thresholds of acoustic resources quality, the figures below, and the NPS Natural Sounds and Night Skies Division website. In 2008 and 2011, long-term acoustical measurements were gathered at three sites in the park. These measurements are summarized in the report Cape Hatteras National Seashore: Acoustical monitoring 2008 and 2011.

**Criteria for Condition Status/Trend**

For State of the Park Reports, NPS has established acoustic standards (green, amber, red) and two sets of impact criteria for urban parks and non-urban parks. A park's status (urban or non-urban) is based on data from the U.S. Census Bureau (U.S. Census 2010). Parks outside designated urban areas typically possess lower sound levels, and exhibit less divergence between existing sound levels and predicted natural sound levels. These quiet areas are highly susceptible to subtle noise intrusions. Park units inside designated urban areas typically experience more interference from noise sources. The majority of the park is located in non-urban areas, so condition thresholds for non-urban parks are listed in the table below. Just as smog limits one's ability to survey a landscape, noise reduces the area in which important sound cues can be heard. Therefore, thresholds in the table are also explained in terms of listening area.

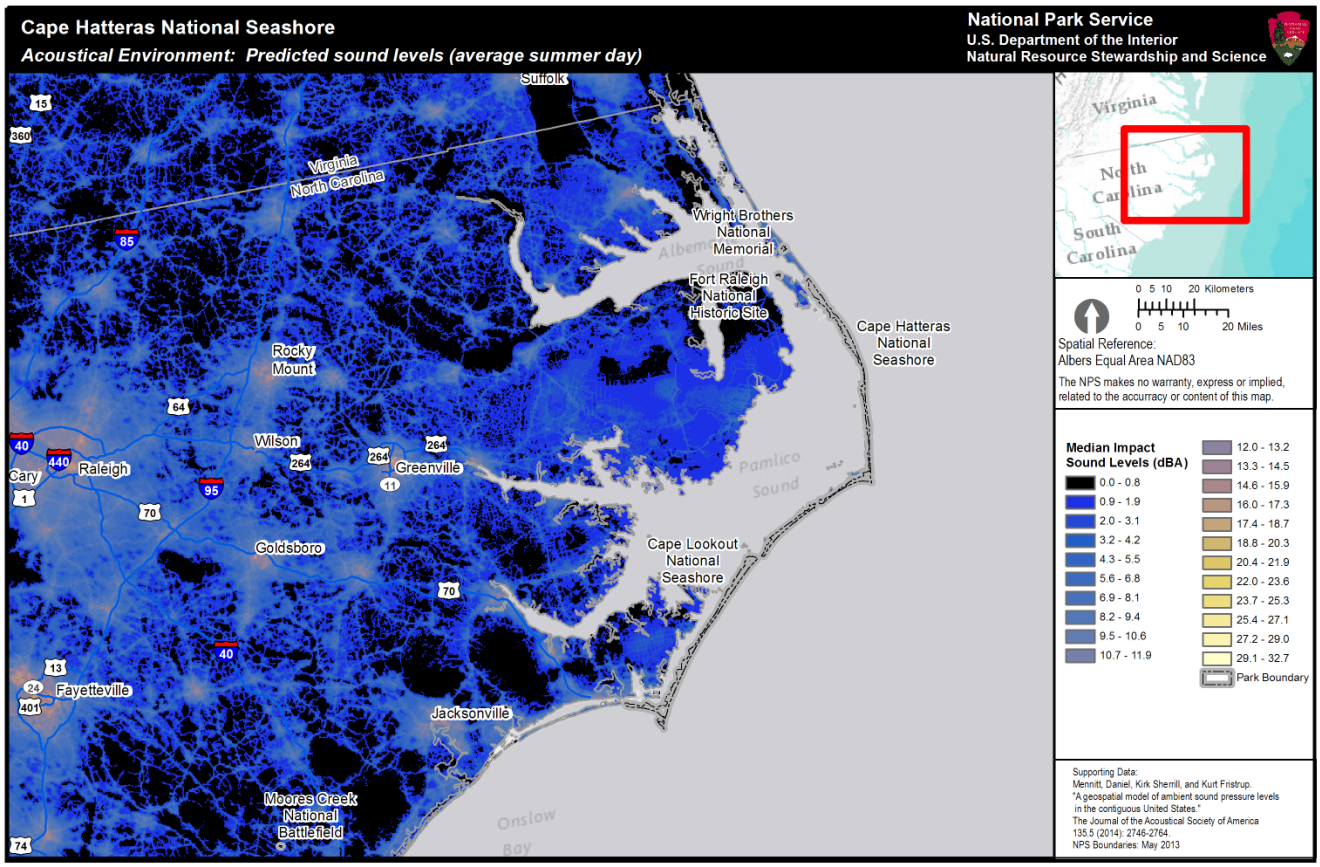
### Condition thresholds for the acoustic environment in non-urban parks

| Indicator | Threshold (dBA) |
|---|---|
| Acoustic Impact Level<br><br>A modeled measure of the noise (in dBA) contributed to the acoustic environment by man-made sources. | Threshold ≤ 1.5<br>*Listening area reduced by ≤ 30%* |
| | 1.5 < Threshold ≤ 3.0<br>*Listening area reduced by 30–50%* |
| | 3.0 < Threshold<br>*Listening area reduced by > 50%* |




NPS Natural Sounds & Night Skies Division and NPS Inventory and Monitoring Program MAS Group 20160303

**Map of predicted acoustic impact levels in the park for an average summer day. The color scale indicates how much man-made noise increases the sound level (in A-weighted decibels, or dBA), with 270 meter resolution. Black or dark blue colors indicate low impacts while yellow or white colors indicate greater impacts. Note that this graphic may not reflect recent localized changes such as new access roads or development.**




NPS Natural Sounds & Night Skies Division and NPS Inventory and Monitoring Program MAS Group 20160303

**Map of predicted acoustic impact levels in the park and the surrounding area for an average summer day. The color scale indicates how much man-made noise increases the sound level (in A-weighted decibels, or dBA), with 270 meter resolution. Black or dark blue colors indicate low impacts while yellow or white colors indicate greater impacts. Note that this graphic may not reflect recent localized changes such as new access roads or development.**

## Dark Night Sky

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Anthropogenic Light** | Anthropogenic Light Ratio (ALR) — Average Anthropogenic Sky Glow: Average Natural Sky Luminance |  | A photic environment is described as the physical amount and character of light at a particular location, irrespective of human perception. The NPS Night Sky Program characterizes a park's photic environment by measuring both anthropogenic and natural light. ALR is a measure of light pollution calculated as the ratio of median Anthropogenic Sky Glow to average Natural Sky Luminance. ALR for CAHA ranges from 0.18 on Ocracoke Island to 0.32 on Hatteras Island, which is considered a good rating. Trend is neutral based on slow five-year population growth of local communities surrounding the park such as Buxton, Hatteras, Frisco, and Rodanthe. Only Avon had a significant increase in population over the same five-year period at 22%. |

# Resource Brief: Night Sky Resources at Cape Hatteras National Seashore

The night sky has been a source of wonder, inspiration, and knowledge for thousands of years. Unfettered night skies with naturally occurring cycles of light and dark are integral to ecosystem function as evidenced by the fact that nearly half the species on earth are nocturnal. The quality of the nighttime environment is relevant to nearly every unit of the NPS system as the nighttime photic environment and its perception of it by humans (the lightscape) are both a natural and a cultural resource and are critical aspects of scenery, visitor enjoyment, and wilderness character.

**Condition and Functional Consequences**
Night sky quality at Cape Hatteras National Seashore is good with an ALR range of 0.18 to 0.32. This is considered a good condition for non-urban parks. At the light levels observed from Ocracoke Island, most observers feel they are in a natural environment. The Milky Way is visible from horizon to horizon and may show great detail, with fine details such as the Prancing Horse. Zodiacal light (or "false dawn" which is faint glow at the horizon just before dawn or just after dusk) can be seen under favorable conditions, and there is negligible impact to dark adaptation looking in any direction. From Boardwalk 27 and other sites closer to populated areas the Milky Way is visible but has typically lost some of its detail and is not visible as a complete band. Zodiacal light is rarely seen. Anthropogenic light likely dominates light from natural celestial features and shadows from distant lights may be seen.

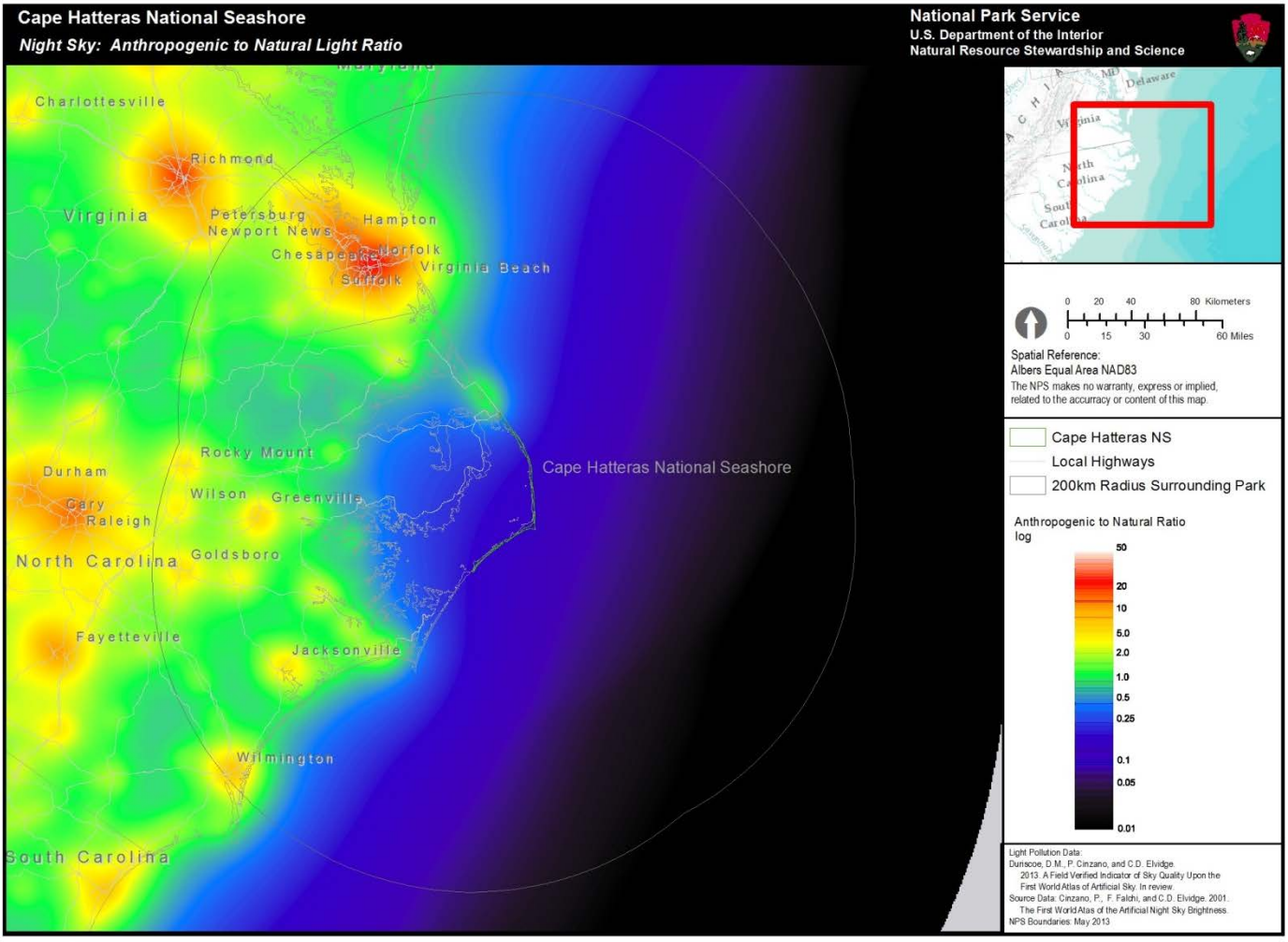
**Assessment**
One way the Natural Sounds & Night Sky Division (NSNSD) scientists measure the quality of the photic environment is by measuring the median sky brightness levels across a park and comparing that value to average natural night sky luminance. This measure, called the ALR, can be directly measured with ground based measurements, or when these data are unavailable are modeled. The geographic information system model, calibrated to ground based measurements in parks, is derived from the 2001 World Atlas of Night Sky Brightness, which depicts zenith sky brightness (the brightness directly above the observer). Anthropogenic light up to 200 kilometers from parks may degrade a park's night sky quality, and is considered in the neighborhood analysis. This impact is illustrated in the corresponding ALR map with a 200km ring around the park center.

The ALR thresholds are applied spatially to the park. For both urban and non-urban parks, the designated condition (green, amber, red) corresponds to the ALR level that exists in *at least half of* (median condition) the park's landscape (see table below). Thus it is probable that a visitor will be able to experience the specified night sky quality. It is also probable that the majority of wildlife and habitats found within the park will exist under the specified night sky quality. For parks with lands managed as wilderness, the designated condition is based on the ALR level that exists in more than 90% of the wilderness area.

**Criteria for Impact**
Two impact criteria were established to address the issue of urban and non-urban park night sky resources. Parks within urban areas, as designated by the U.S. census bureau, are considered less sensitive to the impact of anthropogenic light and are assessed using higher thresholds of impact. Parks outside of designated urban areas are considered more sensitive to the impact of anthropogenic light and are assessed using lower thresholds of impact. According to the U.S. Census Bureau, Cape Hatteras National Seashore is categorized as non-urban, or more sensitive (U.S. Census Bureau 2010). Learn more in the document Recommended Indicators of Night Sky Quality, and the NPS Natural Sounds & Night Skies Division website.

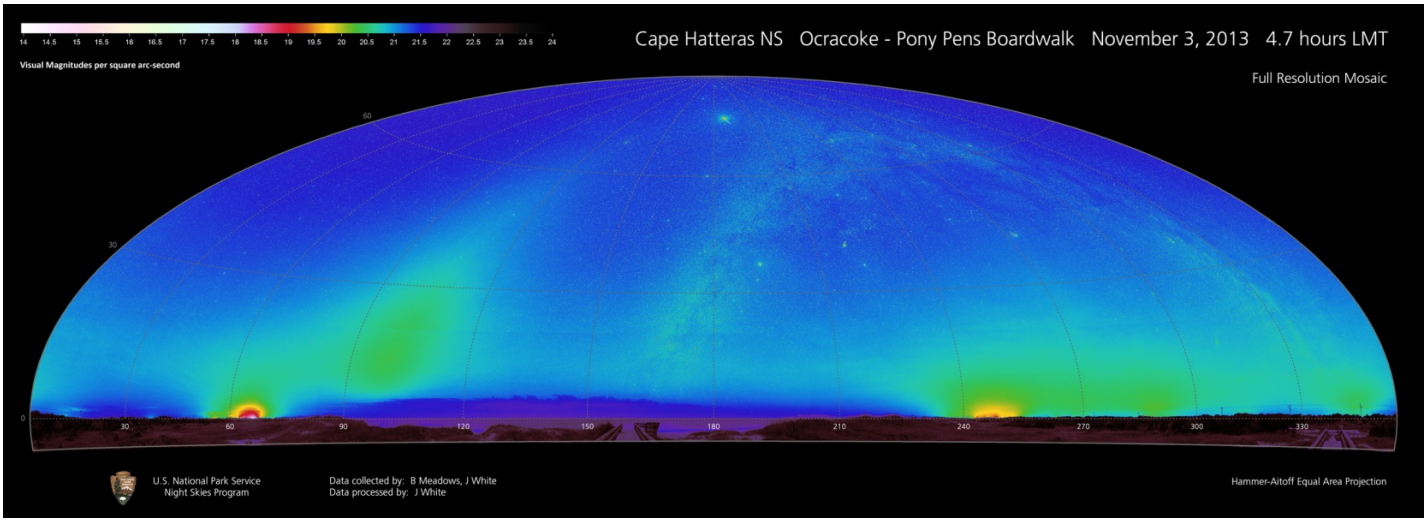
**Thresholds for Level 1 and 2 Parks**

| Indicator | Threshold for Level 1 Parks – Non-Urban | Additional Threshold for Areas Managed as Wilderness | Threshold for Level 2 Parks – Urban |
|---|---|---|---|
| Anthropogenic Light Ratio (ALR)— Average Anthropogenic All-Sky Luminance : Average Natural All-Sky Luminance<br><br>Light flux is totaled above the horizon (the terrain is omitted) and the anthropogenic and natural components are expressed as a unit less ratio<br><br>The average natural sky luminance is 78 nL | ALR < 0.33 (<26 nL average anthropogenic light in sky) *At least half of park area should meet this criteria* | ALR < 0.33 (<26 nL average anthropogenic light in sky) *At least 90% of wilderness area should meet this criteria* | ALR < 2.00 (<156 nL average anthropogenic light in sky) *At least half of park area should meet this criteria* |
| | ALR 0.33–2.00 (26–156 nL average anthropogenic light in sky) *At least half of park area should meet this criteria* | ALR 0.33–2.00 (26–156 nL average anthropogenic light in sky) *At least 90% of wilderness area should meet this criteria* | ALR 2.00–18.00 (156–1404 nL average anthropogenic light in sky) *At least half of park area should meet this criteria* |
| | ALR > 2.00 (>156 nL average anthropogenic light in sky) *At least half of park area should meet this criteria* | ALR > 2.00 (>156 nL average anthropogenic light in sky) *At least 90% of wilderness area should meet this criteria* | ALR > 18.00 (>1404 nL average anthropogenic light in sky) *At least half of park area should meet this criteria* |




Created by NPS Natural Sounds & Night Skies Division and NPS Inventory and Monitoring Program MAS Group on 20160328

**Regional view of anthropogenic light near Cape Hatteras National Seashore. White and red represents more environmental influence from artificial lights while blues and black represent less artificial light. This scale shows regional context and how far reaching the impacts of artificial lighting can be. While Cape Hatteras National Seashore may be influenced by artificial light it still maintains more naturalness than surrounding areas and serves as a harbor of dark skies.**




**Panoramic image of all (natural and anthropogenic) sources of light as observed from Ocracoke Pony Pens at Cape Hatteras National Seashore in 2013. This image was captured with highly sensitive photographic equipment in order to demonstrate the extent of sky glow from human light sources. White and red represents more environmental influence from artificial lights while blues and black represent less influence. Images with less anthropogenic light may display celestial objects like stars or the span of the Milky Way.**

## Resource Brief: Historical and Projected Changes in Climate at Cape Hatteras National Seashore

Climate change impacts many aspects of park management from natural and cultural resources to park operations and visitor experience. Effective planning and management must be grounded in our understanding of past dynamics and the realization that future conditions may shift beyond the historical range of variability. Climate change is predicted to manifest itself not only as shifts in mean conditions (e.g., increasing mean annual temperature and sea level), but also as changes in climate variability (e.g., more intense storms and flooding).

**Historical climate trends (1894–2012)**

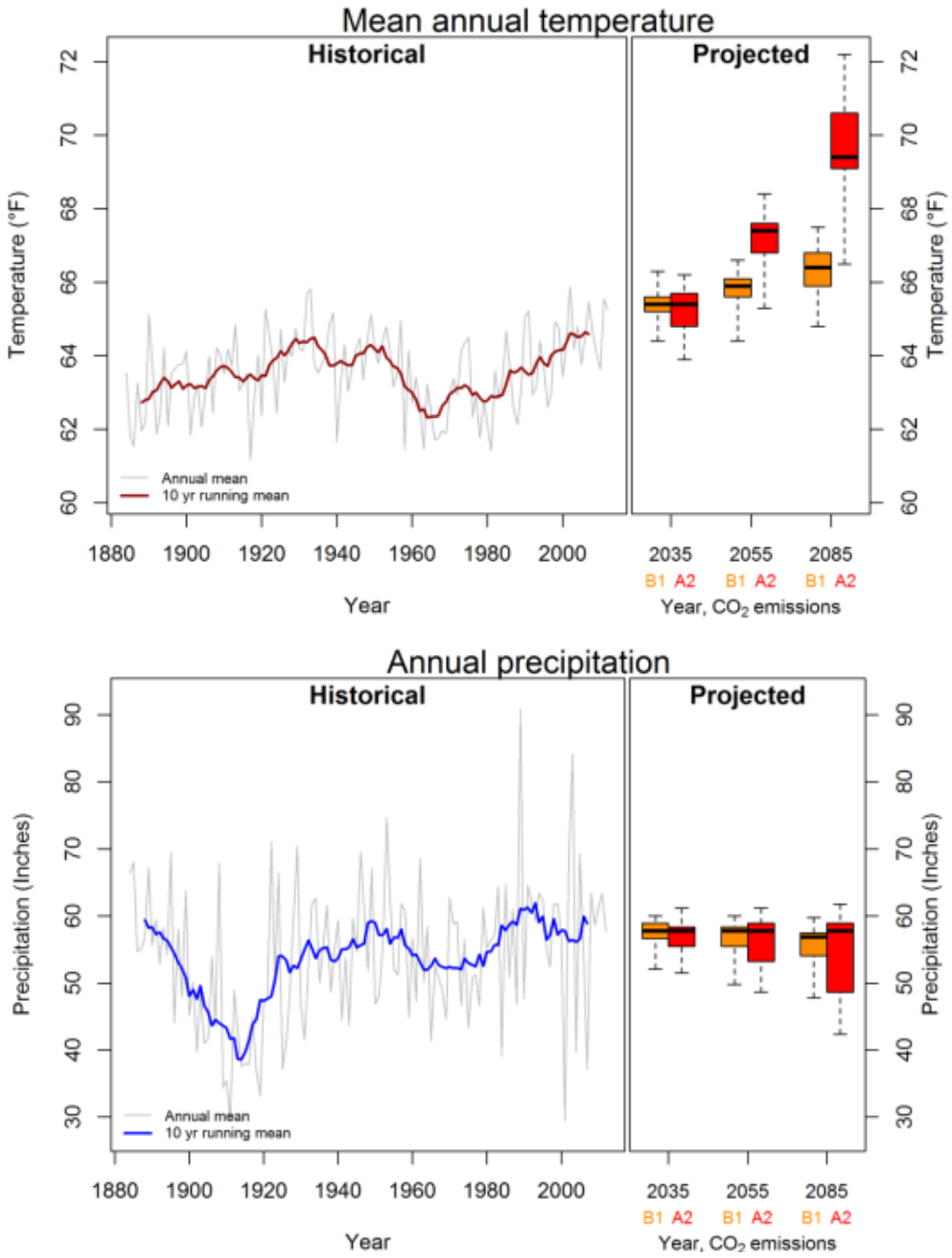
Historical climate trends for the park (Fisichelli 2013) are based on data from a long-term weather station on Hatteras Island (cdiac.ornl.gov). Over the entire 119 year record (1894–2012), mean annual temperature varied between 61.2 °F and 65.9 °F. Since 1960 temperatures have increased at a rate of +0.5 °F per decade (see figure below). Annual precipitation showed strong interannual variability and also a slight increasing trend of +0.6 inches per decade across the entire record. Data from NOAA (2013) show that sea level rose around Beaufort, NC at the rate of 0.11 in/yr over the last 60 years (Caffrey 2013). In addition, a large number of tropical storms have passed through the region.

**Future climate projections**

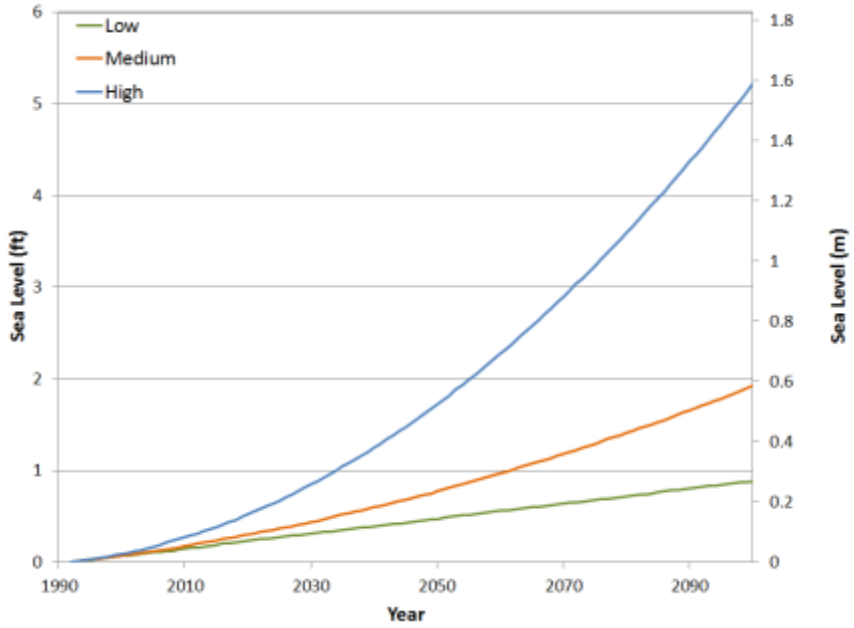
Future climate projections for the area including the park are from multi-model averaged data (Kunkel et al. 2013). Mean annual temperature, compared with the 1971–1999 average, is projected to increase 2–4 °F by mid-century and 3–6 °F by the end of the century, depending on the greenhouse gas emissions scenario (see figure below). Current greenhouse gas emissions are on a trajectory similar to the highest emissions scenarios (see references in Fisichelli 2013). Warming by mid-century is projected for all seasons, with the greatest increases likely in summer (Kunkel et al. 2013). There is wide agreement among individual climate models in the direction and magnitude of warming over the coming decades. Total annual precipitation may increase slightly by mid-century; however, precipitation variability is likely to remain large over the coming decades, and there is greater uncertainty in precipitation than temperature projections (Kunkel et al. 2013). Sea level will continue to rise, 0.8–1.7 feet by 2065 and 2–5 feet by 2100 (see figure below and Caffrey 2013).

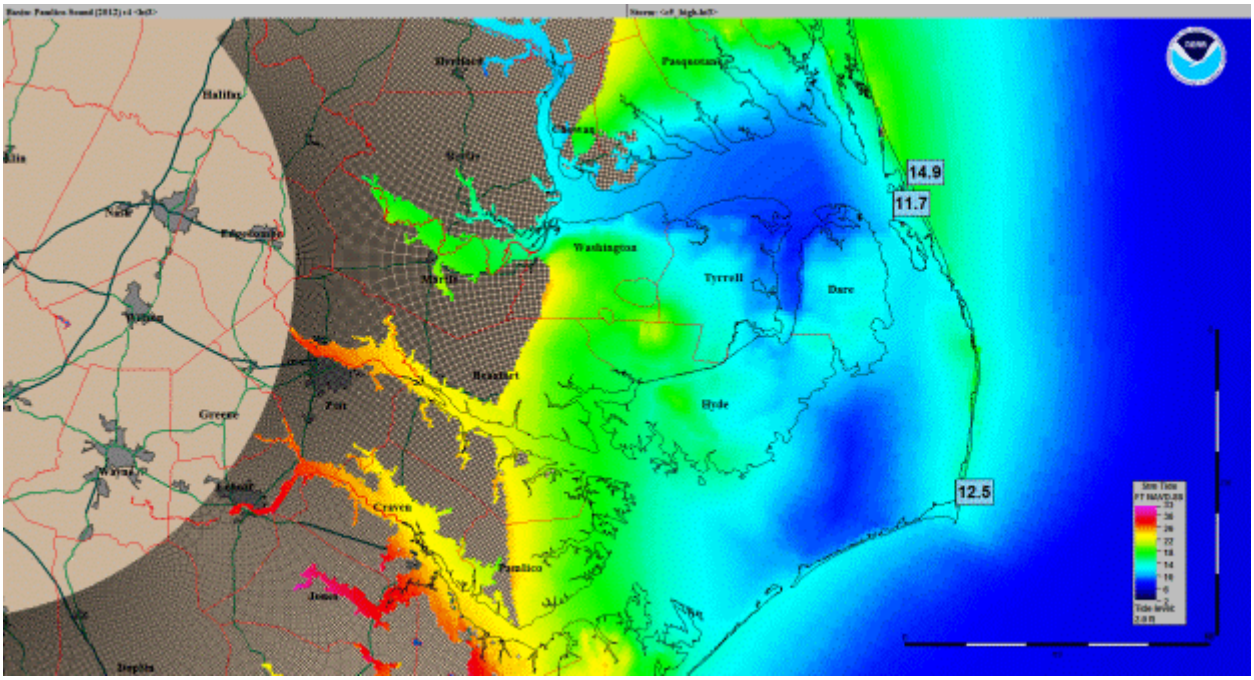
In addition to warmer mean temperatures and changes in annual and seasonal precipitation, climate change will exhibit itself in many other ways in the park. These include more frequent heat waves, droughts, floods, and an extended frost-free season. The number of days with maximum temperatures > 95 °F is projected to increase 15–20 days/year by mid-century while the number of days with minimum temperatures below freezing is projected to decrease by approximately 10–15 days (high (A2) emissions scenario 2041–2070 compared with 1980–2000) (Kunkel et al. 2013). Small changes in total precipitation may mask large shifts in the precipitation regime and associated impacts to ecosystems. The annual number of days with heavy rainfall (> 1 inch) is projected to increase by 10–15%, while the maximum number of days between rain events is likely to increase by a few days (high (A2) emissions scenario, 2041–2070 compared with 1980–2000) (Kunkel et al. 2013). Significantly warmer temperatures and a more variable precipitation

regime may lead to both more frequent droughts and more severe flooding and erosion. It can be expected that storm surges will increase as storm intensity increases; however, the number of storms and their paths may not change.




**Historical and projected mean annual temperature and annual precipitation for CAHA. Historical data (1894–2012) are from the Cape Hatteras, NC weather station (cdiac.ornl.gov). Projected climate change (30 year means) for the region including the park (data from Kunkel et al. 2013, see Tables 4, 6 and Figures 26, 37) are for three future periods centered on 2035 (2021–2050), 2055 (2041–2070), and 2085 (2070–2099). Two greenhouse gas emissions scenarios are presented, the low (B1) and high (A2) scenarios (IPCC 2007). Projected climate boxplots indicate the variability in future projections among 14–15 CMIP3 climate models. Values for the area including CAHA are based on the mean model output for that location and the range of climate model projections for the southeast region: the bold horizontal black line represents the mean among all models, the upper and lower bounds of the boxes indicate the 25th and 75th percentile model output values and the whiskers show the minimum and maximum change.**




***Top*: Projected rate of sea level rise for Beaufort, NC (USACE 2013); *Bottom*: storm surge (ft.) for a category 5 storm at high tide (prepared by M. Caffrey using NOAA SLOSH).**

# 2.2. Cultural Resources

## Archeological Resources

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| Knowledge | Sufficient research is conducted to understand the relationship of the park's archeological resources to the historic contexts for the park. |  | The 38 known archeological sites fall into six main categories: maritime culture sites, such as lighthouses, life-saving stations, and shipwrecks (13 sites), Civil War (1 site), World War II (3 sites), 20th-century coastal communities including residences, cemeteries, and hunting/fishing camps (14 sites), 1930s CCC Camps (2 sites), and prehistoric middens (5 sites); however, most of the sites have been identified solely on the basis of surface evidence and not archeological excavations. |
| | Scope of archeological resources in the park is understood and a determination has been made whether or not they are a fundamental or other important resource. |  | Most sites are only known on the basis of surface remains observed during pedestrian surveys, especially 20th-century residences. However, half of the park's 38 sites are linked to relatively well-known historic resources such as Bodie Island Light Station, Old Cape Hatteras Lighthouse, Ocracoke Lighthouse, Loop Shack, Ramp 55 Wreck, or marked cemeteries, but their archeological components have not been evaluated to any appreciable degree except for a few rare exceptions such as Fort Clark, Old Cape Hatteras Lighthouse, Gooseville Gun Club Clubhouse, and the Ramp 55 Wreck. |
| Inventory | Percentage of park intensively surveyed. |  | Only 0.8% of the park has been surveyed to current NPS standards. |
| | Percentage of archeological resources with complete, accurate, and reliable documentation (a completed State site form). |  | Formal site documentation has been completed for 13 (34%) of the park's known archeological sites. Three of the sites without formal documentation are listed on the National Register. |
| Documentation | Percentage of known sites with adequate National Register documentation. |  | Twenty-one percent (8 of 38) of the park's currently recognized sites have sufficient documentation to evaluate their potential for listing on the National Register. Ten percent (4 of 38) of the park's sites are listed on the National Register. |
| | Research results are disseminated to park managers, planners, interpreters, and other NPS specialists and incorporated into appropriate park planning documents. |  | There is no Archeological Overview and Assessment for Cape Hatteras National Seashore. Sites are overdue for assessments. |

## Archeological Resources (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Certified Condition** | Percentage of archeological resources certified as complete, accurate, and reliable in the Archeological Sites Management Information System (ASMIS) in good condition. | | Eighty-seven percent (33 of 38) of the park's currently recognized sites are in Good condition; however, 10% (4 of 38) are being impacted by shoreline erosion due to sea level rise. |

## Resource Brief: Shipwrecks at Cape Hatteras (Submerged Cultural Resources)

It is estimated that more than 1,000 vessels have been lost in the treacherous waters of the "Graveyard of the Atlantic" off of North Carolina's Outer Banks. Sixty-three of these shipwrecks remain as submerged cultural resources within the boundaries of CAHA. One of these is the *Laura A. Barnes*, a four-masted schooner christened in 1918 in Camden, Maine. The *Laura A. Barnes* wrecked on June 1, 1921 off of Bodie Island after she became stranded in the breakers due to dense fog and high winds. The eight crewmen aboard were rescued using a breeches buoy by the crew of the Bodie Island Coast Guard Station No. 175. The vessel was valued at $80,000. The remains of the *Laura A. Barnes* have been relocated one mile south to Coquina Beach across from the Bodie Island Lighthouse.

***Right*: The remains of shipwreck *Laura A. Barnes* on February 15, 1960. NPS Photo.**

## Cultural Anthropology

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Knowledge** | Sufficient research is conducted to understand the relationship of the park's ethnographic resources to the historic context(s) for the park. |  | There is no documented ethnographic overview and assessment (EOA) conducted at the park, a required baseline document. An *Ethnohistorical Description of the Eight Villages Adjoining Cape Hatteras National Seashore and Interpretive Themes of History and Heritage* was completed in 2005. These villages are within the boundaries of the park but are not part of the park. An *Ethnographic Study of Cape Hatteras National Seashore* was completed in 2010. This study evaluated 4 properties (Bodie Island Spit, Cape Point, Hatteras Island Spit, and South Point Ocracoke) to determine if they were Traditional Cultural Properties (TCP) for potential listing in the National Register. Ethnographic study could document connections between the park and Native Americans, African Americans/Pea Island Lifesavers, European Americans, World War II/German submariners, British sailors on the San Delfino/ HMS Bedfordshire at Hatteras/Ocracoke, two British cemeteries at Hatteras and Ocracoke, pirates/Blackbeard, Hotel D'Afrique on Hatteras, and the small African American community on Ocracoke. |
| **Inventory** | Appropriate studies and consultations document resources and uses, traditionally associated people, and other affected groups, and cultural affiliations. |  | There is no documented ethnographic overview and assessment (EOA) conducted at the park, a required baseline document. An *Ethnohistorical Description of the Eight Villages Adjoining Cape Hatteras National Seashore and Interpretive Themes of History and Heritage* was completed in 2005. These villages are within the boundaries of the park but are not part of the park. An *Ethnographic Study of Cape Hatteras National Seashore* was completed in 2010. This study evaluated 4 properties (Bodie Island Spit, Cape Point, Hatteras Island Spit, and South Point Ocracoke) to determine if they were Traditional Cultural Properties (TCP) for potential listing in the National Register. Further ethnographic study could document connections between the park and Native Americans, African Americans/Pea Island Lifesavers, European Americans, World War II/German submariners, British sailors on the San Delfino/ HMS Bedfordshire at Hatteras/Ocracoke, two British cemeteries at Hatteras and Ocracoke, pirates/Blackbeard, Hotel D'Afrique on Hatteras, and the small African American community on Ocracoke. |
| **Documentation** | Resources eligible for the National Register of Historic Places as traditional cultural properties are identified. |  | An *Ethnographic Study of Cape Hatteras National Seashore* was completed in 2010. This study evaluated 4 properties (Bodie Island Spit, Cape Point, Hatteras Island Spit, and South Point Ocracoke) to determine if they were Traditional Cultural Properties (TCP) for potential listing in the National Register. These properties were determined ineligible. The park is seeking to determine other potential properties for eligibility determination. |

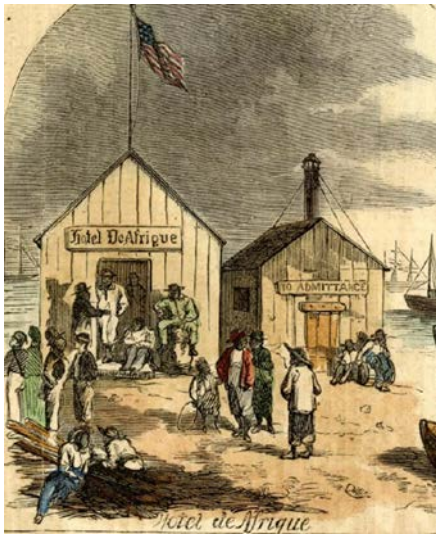
## Cultural Anthropology (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Documentation (continued)** | Research results are disseminated to park managers, planners, interpreters, and other NPS specialists and incorporated into appropriate park planning documents. | | An *Ethnohistorical Description of the Eight Villages Adjoining Cape Hatteras National Seashore and Interpretive Themes of History and Heritage* was conducted in 2005.<br><br>https://www.nps.gov/ethnography/research/docs/caha_ethno_v1.pdf<br><br>https://www.nps.gov/ethnography/research/docs/caha_ethno_v2.pdf |

## Resource Brief: Hotel de Afrique on Hatteras Island

In August of 1861, Union forces defeated Confederate troops at Hatteras Inlet and at Forts Clark and Hatteras. Word of this victory spread quickly and hundreds of former enslaved people escaped from mainland regions of North Carolina and Roanoke Island to freedom on Hatteras Island. At Hatteras, slaves received food and housing in exchange for unloading supply vessels. The Hotel de Afrique operated from 1861–1865 and was the first safe haven for African Americans in North Carolina during the Civil War. The site of the Hotel de Afrique is marked with a black stone monument near the entrance to the Graveyard of the Atlantic Museum in Hatteras, North Carolina. The Hotel de Afrique site has been selected for inclusion in the National Underground Railroad Network to Freedom.




***Right*: Harper's Weekly Magazine, February 15, 1862 "Hotel de Afrique"**

## Resource Brief: Pea Island Life Saving Station

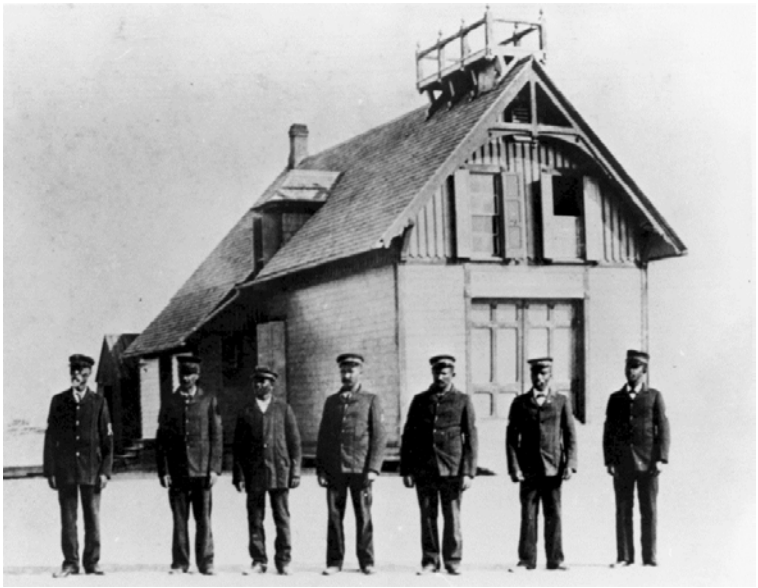


**Photo of Pea Island Lifesavers provided by NPS**

The Pea Island Life Saving Station No. 177 was the only station in the Life Saving Service and Coast Guard manned by an all African American crew. Captain Richard Etheridge became the first African American to command a lifesaving station when he was appointed keeper in 1880. His station earned the reputation of *"one of the tautest on the Carolina Coast,"* with its keeper well known as one of the most courageous and ingenious lifesavers in the Service. On October 11, 1896, Keeper Richard Etheridge and Pea Island Surfmen Benjamin Bowser, Lewis Wescott, Dorman Pugh, Theodore Meekins, Stanley Wise, and William Irving rescued nine people off of the three-masted schooner *E.S. Newman*. En route from Providence, Rhode Island to Norfolk, Virginia, the vessel was blown 100 miles south off course in a storm and came ashore on the beach two miles south of the Pea Island station. The Pea Island crew members entered the perilous waters ten times and rescued the entire crew of the *E.S. Newman*. In 1996, on the one hundredth anniversary of this brave rescue, the Pea Island station was posthumously awarded a Gold Lifesaving Medal.

## Cultural Landscapes

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Knowledge** | Sufficient research exists to understand the relationship of the park's cultural landscapes to the historic context(s) for the park. |  | Lighthouses, light stations, and lifesaving stations are an integral part of the history of humankind's ability to adapt in a harsh and changing coastal environment in isolation from the mainland. All three light stations at CAHA have Cultural Landscape Reports. Little Kinnakeet Life Saving and Coast Guard Station have a Historic Grounds Study. Cultural landscape reports are needed for Little Kinnakeet and the Hatteras Weather Bureau Station. |
| | Scope of cultural landscapes in the park is understood and a determination has been made whether or not they are a fundamental or other important resource. |  | The cultural landscapes of Cape Hatteras National Seashore are listed as Fundamental Resources that must be preserved and maintained. All three light stations at CAHA have Cultural Landscape Reports with treatment recommendations. Cape Hatteras Light Station also has a Cultural Landscape Inventory. Little Kinnakeet Life Saving and Coast Guard Station has a Historic Grounds Study but no further documentation. Cultural landscape reports are needed for Little Kinnakeet and the Hatteras Weather Bureau Station. |
| | Adequate research exists to document and preserve the cultural landscape's physical attributes, biotic systems and uses when those uses contribute to historical significance. |  | All three light stations at CAHA have Cultural Landscape Reports. Little Kinnakeet Life Saving and Coast Guard Station has a Historic Grounds Study, but no further documentation. The remainder of the park has not been surveyed or evaluated for cultural landscapes. |
| **Inventory** | Percentage of landscapes eligible for the National Register in the Cultural Landscapes Inventory (CLI) with certified complete, accurate, and reliable data. |  | Three of four component landscapes to not have CLIs. A Cultural Landscape Inventory was completed for Cape Hatteras Light Station in 1998. Cultural Landscape Inventories have not been completed for Bodie Island Light Station, Ocracoke Light Station, and Little Kinnakeet Life Saving Station. |
| **Documentation** | Percentage of cultural landscapes with adequate National Register documentation. |  | Bodie Island Light Station has a recent National Register nomination and includes good information about the cultural landscape, but the nomination should still be updated to include additional documentation of the entrance road and parking lot and a revision of the period of significance. One of the four (25 percent) Cultural Landscapes has adequate National Register documentation. |

## Cultural Landscapes (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| Certified Condition | Percentage of cultural landscapes certified as complete, accurate, and reliable in the Cultural Landscapes Inventory (CLI) in good condition. |  | Only one CLI has been completed of the four properties (25 percent). The Cape Hatteras Light Station CLI has a certified condition of fair. No other CLIs have been completed for the other three identified component landscapes. |
| | Percentage of Maintained Landscapes (historic) in FMSS with a Facility Condition Index (FCI) indicating good condition. |  | The maintained landscape FCI indicates good condition. |

## Resource Brief: Bodie Island Coastal Survey Markers

The United States Survey of the Coast founded February 10, 1807, has a direct connection to Cape Hatteras National Seashore. The primary mission of the Survey of the Coast was to provide nautical charts to the American maritime communities for safe passage into American ports and along our extensive coastline. The agency initiated a plan to build a geodetic triangulation network as a framework for both topographic surveys of the shoreline and hydrographic survey of harbors and offshore waters. As part of our nation's first coastal survey, the Survey of the Coast established accurate baselines using the geodetic triangulation method in six spots from Maine to Georgia, including grounds now in Cape Hatteras National Seashore. In 1848, two base markers and six associated posts were placed by the Survey of the Coast near the Bodie Island Lighthouse. These now historic markers are the only remaining complete sets of coastal survey baseline markers left in the United States.

***Right*: The northern historic base marker located a few miles north of the Bodie Island Lighthouse. NPS Photo.**

# Resource Brief: Cultural Landscapes

**Cape Hatteras Light Station**

**Cape Hatteras Lighthouse**

Cape Hatteras Light Station is located on Hatteras Island and is a component cultural landscape within the Cape Hatteras National Seashore. The light station landscape includes the lighthouse, oil house, double keeper's quarters, and principal keeper's quarters, as well as the cisterns, move corridor, and historic views. The light station was transferred from the Commerce Department to the NPS in 1936. The light station complex is a cluster of associated buildings adjacent to the lighthouse that contribute to the history of Cape Hatteras lighthouse as a navigational beacon. The circulation routes and spatial organization of the light station complex also contribute to the historic period of significance (1870–1936). The lighthouse was built in 1870 to warn ships of the dangerous shoals along the Outer Banks, while the remaining buildings were added to house the keeper's family and the operating functions of the light. The lighthouse was moved in 1999 to prevent structural damage from the eroding shoreline. The associated outbuildings were also moved and the light station landscape recreated around the new lighthouse site. The National Register historic district boundary corresponds with the cultural landscape boundary and encloses ten acres. The Cape Hatteras Light Station is a National Historic Landmark.

**Bodie Island Light Station, 2013**

**Bodie Island Light Station**

Bodie Island Light Station is located on Bodie Island and is a component cultural landscape within the Cape Hatteras National Seashore. The transfer of the 15-acre Bodie Island Light Station from the U.S. Coast Guard to the NPS occurred in 1953. The lighthouse was constructed in 1872 to warn ships of the dangerous shoals along the Outer Banks. The layout of the site was consistent with other light stations of the day, where support buildings were clustered for easy access. A rectilinear arrangement resulted in a primary northeast-southwest axis linking the light tower and integral oil house and the double keepers' quarters. Support buildings were placed along the northwest-southeast axis flanking the double keepers' quarters. A wooden fence enclosed the station, and walkways connected the various buildings on site. Although the site lacks its original outbuildings (other than the three cisterns) and fencing, it retains remnants of the original circulation system, which linked major features of the station. Plantings at the site historically have been limited to native vegetation, with no trees or shrubs noted in regular inspections made at the station during the administration by the Light-house Board and the Coast Guard. Garden plots located at the rear (east) of the station were noted as being unprofitable in early reports. The NPS planted pines along the entrance road and parking area in the 1960s.


**Bodie Island Light Station, 1893**

The centerpiece of the Bodie Island Light Station today is the lighthouse with its first-order Fresnel lens. The 15-acre station is dominated by the 164-foot brick lighthouse with its bands of black and white and its attached brick oil house. An original brick walkway links the tower and attached oil house and the keepers' quarters, now the NPS bookstore and visitor center. The axial layout of the site is preserved by the surviving walkways, now paved in concrete. On the north side of the keepers' quarters, one historic outbuilding dating to around 1920 and two cisterns survive; on the south side a cistern and the foundation of a 1930 woodshed remain. No original outbuildings survive.

Modern visitor amenities include a wooden boardwalk installed in 2010 at the north end of the parking lot that leads to a 1992 restroom building and beyond to an overlook with views out over the marsh and pond to the east. South of the bookstore and visitor center is a louvered enclosure for the HVAC system. An accessible wooden ramp constructed in 1990–92 replaced the front steps and apron of the brick walk that originally led out to a board fence and gate. On the porch, a beveled wood board serves as a reducer to provide a wheelchair-negotiable change in grade from porch deck to building interior.

The Bodie Island Light Station Historic District National Register boundary forms a large square demarcated by four stones that correspond to the original fifteen-acre site acquired from John and Fanny Etheridge on June 13, 1871. In addition to the surviving buildings and structures, the circulation routes, spatial organization, topography, and historic views of the light station complex contribute to the historic period of significance for the cultural landscape (1872–1956). Although its design integrity remained intact, the preservation of the Bodie Island Lighthouse was threatened until funding was secured for its restoration in the 2009–2010 Omnibus Budget Bill. The deteriorative effects of time, the harsh marine environment, and the corrosion of original cast-iron elements resulted in significant damage to historic fabric. The park received additional funding in January 2012 and completed the project in December 2012. Except for one weekend in 1988, the lighthouse opened to the public for climbing for the first time in its history in 2013.

**Ocracoke Light Station**

Ocracoke Light Station is located on the southwest tip of Ocracoke Island north of Ocracoke Inlet and facing Pamlico Sound to the west in Hyde County, North Carolina. NC Highway 12 connects Ocracoke Island and Hatteras Island to the north via a daily ferry service. Ocracoke Light Station is a component cultural landscape within the Cape Hatteras National Seashore. Ocracoke Lighthouse was built in 1823 to assist mariners through Ocracoke Inlet. Additional buildings were added to house the keeper's family and the operating functions of the light. The spatial organization at the Ocracoke Light Station reflected a landscape pattern of support buildings clustered along a northeast axis to the keeper's quarters. The lighthouse and oil house occupied a northwest cross axis. Garden plots were located in the northwest and northeast corners of the property, and live oaks and cedars were planted near the keeper's quarters. A wooden fence enclosed the station and walkways connected the various buildings on site.


**Ocracoke Light Station, 1893**

**Ocracoke Light Station, 2009**

The transfer of the 2-acre Ocracoke Light Station from the U.S. Coast Guard to the NPS occurred in 1999. The centerpiece of the Ocracoke Light Station today is the lighthouse with its fourth-order Fresnel lens. The light station complex is a cluster of associated buildings adjacent to the lighthouse that contribute to the history of Ocracoke Lighthouse as a navigational beacon. The axial layout of the site is preserved by the surviving walkways, now paved in concrete. Associated buildings include double keepers' quarters, two storage buildings, two cisterns, a privy, a concrete oil house, and a generator building. A historic wooden picket fence encloses the station. Several historic live oaks and cedars survive in the landscape near the dwelling. Modern visitor amenities include a wooden boardwalk that links the parking area with the lighthouse, which is currently not open for climbing. The double keepers' quarters and outbuildings are currently being used for park housing and are not open to the public.

## Historic Structures

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| Knowledge | Historic Structures are identified and evaluated using historical contexts. |  | 38 structures on the seashore are identified and listed in the List of Classified Structures (LCS) database. A Historic Resource Study was completed in 1985. Historic Structure Reports (HSRs) have been completed for Bodie Island Light Station, Ocracoke Light Station, and the Cape Hatteras Lighthouse. Cape Hatteras Light Station Phase II HSR is in progress. Little Kinnakeet Life Saving Station HSR was completed in 1987. CCC Cabin# 321, 322, 323, 324, Hatteras Coast Guard Station, and the Hatteras Weather Bureau Station HSRs are needed. |
| | Adequate research exists to document and preserve the historic structure's physical attributes that contribute to historical significance. |  | 50% of the seashore structures are documented with HSRs. The evaluation and documentation of the structures should take place in light of sea level rise and climate change. A Sea Level Rise study is in progress. HSRs have been completed for Bodie Island Light Station, Ocracoke Light Station, and the Cape Hatteras Lighthouse. Cape Hatteras Light Station Phase II HSR is in progress. Little Kinnakeet Life Saving Station HSR was completed in 1987. CCC Cabin# 321, 322, 323, 324, Hatteras Coast Guard Station, and the Hatteras Weather Bureau Station HSRs are needed. |
| Inventory | Percentage of historic structures eligible for the National Register in the List of Classified Structures (LCS) with accurate, complete, and reliable data. |  | 75% of the eligible structures have accurate, complete, and reliable data. Periodic updates should be made to the LCS database to reflect funded projects and work in progress. |
| Documentation | Percentage of historic structures with adequate National Register documentation. |  | 70% of the park's identified historic structures have adequate National Register (NR) documentation. The remaining 30% are determined eligible by the State Historic Preservation Office (SHPO) but the NR nomination needs to be completed. |
| | Research results are disseminated to park managers, planners, interpreters, and other NPS specialists and incorporated into appropriate park planning documents. |  | Completed copies of Historic Structure Reports are provided to management and field libraries. |

## Historic Structures (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| Certified Condition | Percentage of historic structures certified as complete, accurate, and reliable in the List of Classified Structures (LCS) in good condition. |  | 75% of the listed structures are in good condition. |
| | Percentage of historic structures in FMSS with a FCI indicating good condition. |  | 75% of structures in FMSS are in good condition. |

## Resource Brief: Cape Hatteras Lighthouse Move

In 1803, the first Cape Hatteras lighthouse was built to aid navigation around the infamous Diamond Shoals. It was replaced in 1870 by a taller structure that contained the latest first order lens. Associated with the lighthouse were several buildings and dwellings to accommodate the light keepers and their families. The Light Station became part of the Cape Hatteras National Seashore in 1937. At that time, encroaching shorelines compelled NPS to take protective measures to save the lighthouse. For the next sixty years a variety of methods including steel groins, beach nourishment, and artificial dunes were installed.

**Moving the Cape Hatteras Lighthouse, June 25, 1999. NPS Photo.**

Despite all these attempts, storms and constant scouring eventually destroyed the dunes, and NPS began anew in 1980 to determine a strategy to protect this valuable resource. As a result of this effort, in 1999 the International Chimney Corporation of Buffalo, New York moved the entire light station 2,500 feet southwest to a new site approximately 1,600 feet from the shoreline. Original pieces of the granite foundation that were not moved, were inscribed with the names of the original lighthouse keepers, and now form the Keepers of the Light Amphitheater. One of the rollers from the rail system used to move the lighthouse was saved and placed in the museum collection. The Cape Hatteras Lighthouse, at 193 feet from the base to the top of the lantern roof, is the tallest lighthouse in the United States, and the second tallest in the world. It is a National Historic Landmark (NHL) and is recognized by millions of Americans. It stands as a regional symbol of North Carolina's Outer Banks, and a national symbol of America's maritime history.

## History

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Knowledge** | Sufficient research is conducted to understand the national significance and historical contexts for the park. |  | The park has a 2007 Administrative History that addresses the period from the establishment of the park until Mission 66 (1966). The Cape Hatteras National Seashore Historic Resource Study (HRS) was written in 1985, but should be updated to reflect current scholarship. The Hatteras Weather Bureau HRS was completed in 2007 and the Pea Island Lifesaving Station HRS was completed in 2008. |
| | Research at the appropriate level of investigation (exhaustive, thorough, or limited) precedes planning decisions involving cultural resources. |  | An appropriate level of research is conducted preceding planning decisions. Projects are reviewed using Planning, Environment, and Public Comment system (PEPC), and assets are documented in FMSS. |
| | Research is conducted by qualified scholars. |  | The park ensures that research is conducted by qualified scholars at universities or other qualified organizations. |
| **Inventory** | Cultural resources are inventoried and evaluated in consultation with State Historic Preservation Officers (SHPOs). |  | National Register nomination documents including study applications are submitted to North Carolina SHPO for review. Park projects are reviewed by North Carolina SHPO using PEPC. |
| **Documentation** | Percentage of historic properties with adequate National Register documentation. |  | Of the 38 structures in the LCS, 26 are on the National Register. All structures have some form of documentation; however, only the four structures (15%) associated with the Cape Hatteras Light Station National Historic Landmark (NHL) nomination have adequate National Register documentation. |

## Resource Brief: First National Seashore

Cape Hatteras National Seashore was authorized by Congress as our nation's first national seashore in 1937 and since that time nine additional National Seashores have been established on Assateague Island (MD, VA), Canaveral (FL), Cape Cod (MA), Cape Lookout (NC), Cumberland Island (GA), Fire Island (NY), Gulf Islands (FL, MS), Padre Island (TX), and Point Reyes (CA). Cape Hatteras was established for the purposes of 1) preserving and protecting significant segments of dynamic barrier islands that are shaped by ongoing natural processes; 2) preserving, protecting, and interpreting the park's natural and cultural resources; and 3) providing for recreational use and enjoyment in a manner compatible with the preservation and protection of the park's resources.

## Resource Brief: World War II U-Boats and British Cemeteries

In early 1942 Germany launched a U-Boat offensive against merchant shipping along the eastern seaboard of the United States called "Operation Drumbeat." The goal of the offensive was to prevent supplies, especially fuel, from reaching the island nation of Great Britain. The United States was caught unprepared. As a result, between January and June 1942, German U-Boats sunk 397 ships off the east coast. So many ships were sunk off the North Carolina coast that this area became known as "Torpedo Junction." However, on the night of April 14, 1942, fourteen miles off the coast of Bodie Island and within sight of the Bodie Island light, the U.S.S. *Roper* sunk the German U-85. The U-85 was the first German U-boat sunk by the United States during World War II and the sinking was a moral victory for the allies in the Battle of the Atlantic. The twenty-nine German sailors recovered from the U-85 were taken to Norfolk, Virginia and buried in Hampton National Cemetery.


***Left:*** **Gyroscope recovered from the U-85. NPS Photo.;** ***Right:*** **German cup recovered from the U-85. NPS Photo.**

To assist the United States with anti-submarine patrol, Great Britain sent 24 Royal Navy vessels with their British crews to patrol sensitive areas along the East Coast, including the Outer Banks. One of those British ships, the H.M.S. *Bedfordshire*, was a trawling vessel that had been converted to anti-submarine duty, and was stationed at Morehead City, North Carolina. On May 12, 1942, while the *Bedfordshire* was on patrol, a German torpedo stuck the ship and sank it, resulting in the loss of its entire 34-man British crew. Over the next few days four bodies from the *Bedfordshire* were discovered on Ocracoke beaches and in the surrounding waters. Citizens of Ocracoke buried the sailors near the village cemetery. A fifth body, an unknown sailor from the *Bedfordshire*, washed up on Hatteras Island, and was buried next to a British sailor from the merchant vessel *San Delfino*, torpedoed a year earlier. British cemeteries on Ocracoke and Hatteras islands preserve a moment in history when American shores were vulnerable to attack and honor the sacrifice of sailors, buried on foreign soil, who stood with their allies against the German threat during World War II.

**Burial of Royal Navy Sailors from H.M.S. Bedfordshire, Ocracoke Island, May 1943**

# Resource Brief: WWII Structures on Ocracoke Island, Loop Shack Hill

Between December 1943 and January 1946, Ocracoke Island hosted an Advanced Amphibious Training Base (AATB) where tactical cover and deception units, precursors to the Navy Seals, were trained for the U.S. Navy. This undercover military project was known as the Beach Jumpers. These units were trained in both classroom and live exercises of seaborne deception to simulate full force invasions along the beach while on board air-sea rescue boats (ARBs). The boats were capable of high speeds and carried time-delayed explosives, amplifiers, recorders (sound effects), smoke pots, radar, radios, rocket launchers, and two sets of twin 50 caliber machine guns. They also used radio and radar counter measures to deceive the enemy by making them believe an invasion was taking place along the beach.

**Loop Shack Hill with Blimp, 1944, Ocracoke Island, NC**

These tactical cover and deception units also monitored hidden German submarine activity off the eastern coast of the United States during World War II. As part of the project, a facility was also built on Loop Shack Hill that monitored underwater vessel passage between Ocracoke and Buxton. The "Loop Shack" was the control base for a magnetic cable loop that ran approximately 16 miles off shore. The underwater cable detected signature signals that enabled patrol boats to safely locate and identify a vessel as friend or enemy. The facility also utilized radar, radio, and radio direction-finding equipment. A concrete bunker, concrete building foundations, and footings for steel towers remain on Loop Shack Hill to serve as reminders of a small island's intriguing role in World War II.

***Left*: Footing for communications tower, Loop Shack Hill, Ocracoke Island, NC. *Right*: Building Foundation, Loop Shack Hill, Ocracoke Island, NC. NPS Photos.**

# Resource Brief: General Billy Mitchell's Aerial Bombing Tests

General Billy Mitchell was a World War I pilot who advocated the development of air power as an instrument to win future wars. Mitchell promoted the advancement of aircraft bombing techniques that could sink battleships, a strategy that would give the allied forces an edge from the sky in any major battle. He put his theory to the test off the coasts of Virginia and North Carolina. In 1921, Mitchell's Martin MB-2 bombers sank three ex-German warships, including the supposedly unsinkable *Ostfriesland* seventy-five miles from the mouth of the Chesapeake Bay. The exercise was repeated off the coast of Hatteras Island in 1923 when two obsolete American battleships, U.S.S. *Virginia* and U.S.S. *New Jersey*, met a similar fate.


**Portrait of General Billy Mitchell by Robert B. Williams, First Flight Society's First Flight Shrine. NPS Photo.**

On September 5, 1923 the *Virginia* and *New Jersey* were anchored three miles off the Diamond Shoals Lightship near Cape Hatteras, North Carolina. Seven Martin MB-2 bombers flying at 3,000 feet each dropped two 1,100 lb. bombs on the *Virginia*. According to an observer, a single bomb that struck the vessel *"completely demolished the ship as such… Both masts, the bridge, all three smokestacks, and the upperworks disappeared with the explosion and there remained, after the smoke cleared away, nothing but the bare hull, decks blown off, and covered with a mass of tangled debris from stem to stern consisting of stacks, ventilators, cage masts, and bridges."* Within 30 minutes, the battered hulk sank beneath the waves. The *New Jersey* joined the *Virginia* shortly thereafter. The dramatic sinking of the *Virginia* and *New Jersey* proved the vulnerability of warships to air attack.

Many experts agreed there was a lesson to be learned from these aerial bombing demonstrations, but Mitchell was not satisfied with the pace of change. He remained a vocal critic, and in 1925 issued a blistering statement accusing the War and Navy Departments of *"incompetency, criminal negligence, and almost treasonable administration"* of aviation affairs. Consequently, Mitchell was court-martialed and convicted on charges of *"insubordination and conduct unbecoming an officer."* Mitchell resigned from the Army, his prophecies largely disregarded by the government. On December 7, 1941 the truth of Mitchell's arguments was driven home. The Japanese, using air power alone, devastated the United States forces at Pearl Harbor and became the dominant force in the Pacific. On July 25, 1946, ten years after his death, Congress posthumously awarded Brigadier-General Mitchell the Medal of Honor.

## Museum Collections

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Knowledge** | Sufficient research and analysis exists to understand the relationship of the park's museum collection to the historic context(s) for the park. |  | Research and analysis has been conducted, but could be improved with additional cultural resource staff. |
| | Scope of museum collection in the park is understood and a determination has been made whether or not they are a fundamental or other important resource. |  | The most recent Scope of Collections Statement (SOCS) was completed in 2004. It is supported by the Enabling Legislation, resource management goals and objectives, and interpretive themes. The SOCS should be reviewed and updated every 3–5 years. The museum collection is identified as a fundamental resource and value for Cape Hatteras National Seashore in the 2011 Foundation Document. |
| **Inventory** | Percentage of existing collection that is accessioned and cataloged. |  | Based on the fiscal year 2015 Collection Management Report, only 22% of the Cape Hatteras museum collections is catalogued (total collection = 697,075). The bulk of the backlog is archives (total 685,641 items or 429 linear feet). An Archives survey was completed by an outside contractor in fiscal year 2012 for unprocessed archives already in museum storage. A survey needs to be completed on all files throughout the park. |
| | Scope of Collection is consistently implemented; items or objects are researched to determine their appropriateness for inclusion in the museum/archive collection. |  | Although it needs to be updated, the 2004 Scope of Collection statement is consistently implemented for new acquisitions to the Cape Hatteras museum collection. |
| **Documentation** | Accession and deaccession files are complete with all appropriate signatures. |  | Accession and deaccession files are consistently maintained with hard copy files and in the NPS Interior Collection Management System (ICMS). |
| **Certified Condition** | Percentage of museum collection storage facilities in the FMSS with a FCI indicating good condition. |  | All of the park's museum collection storage facilities are in good condition. |

# Resource Brief: Hatteras Weather Bureau Station and the Sinking of the *Titanic*

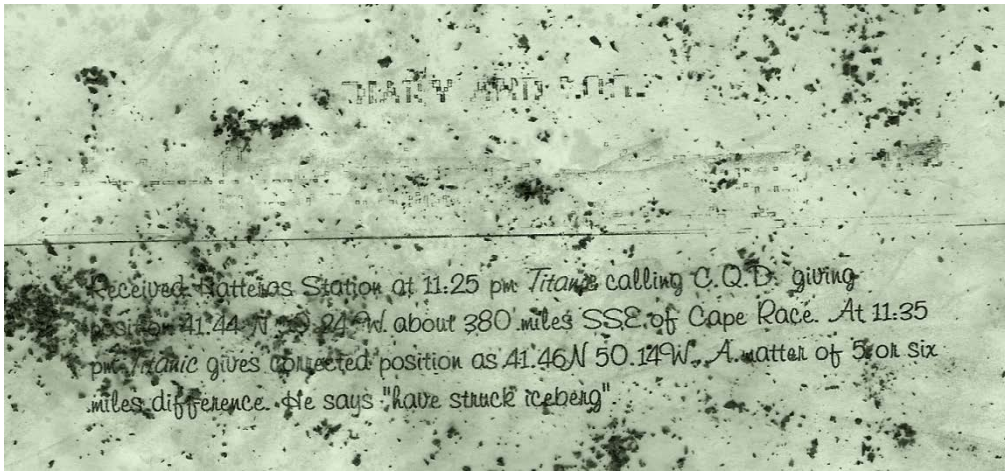
Cape Hatteras, where the Gulf Stream and Labrador Current meet, was an important location for weather forecasting. In the past, residents who lived on the Outer Banks received their news by boat or through word of mouth. Cape Hatteras, a major shipping route, was also a common place for shipwrecks. The United States Weather Bureau felt that the need to have a main weather bureau station on the North Carolina coast was important enough to build one in Hatteras Village. On July 11, 1901, Secretary James Wilson, U.S. Department of Agriculture, requested proposals for the erection of a two-story cellar frame and brick building for the Weather Bureau at Hatteras, North Carolina. The official Hatteras Weather Bureau Station was commissioned and occupied on January 1, 1902. The station was one of eleven stations built around the country. It is one of only three remaining stations nationwide, and the only one in the nation restored to its 1901 condition.

**Hatteras Weather Bureau Station after restoration, Hatteras, NC. NPS Photo.**

Ten years after it was commissioned, the Hatteras Weather Bureau station would play a role in history. On the night of April 14, 1912, the station received a telegraph from the British passenger liner R.M.S. *Titanic*. The log page from the station reads:

*Received Hatteras Station at 11:25 p.m. TITANIC calling C.Q.D. giving reading 41.44 about 380 miles SSE of Cape Race. At 11:35 p.m. TITANIC gives corrected position as 41.46 N 50.14W. A matter of five or six miles difference. He says "have struck iceberg"*

This was not only one of the first distress signals received from *Titanic*, but also one of the last times "Come Quickly Distressed" (C.Q.D) was sent, as the use of "S.O.S" became more popular. Like many unneeded papers in the early 20th century, the log pages from the weather station were rolled and stuffed into plaster walls to provide insulation. It wasn't until 2005, when the weather station was being restored, that the log page was discovered.




**Hand-written log entry from the Hatteras Weather Bureau Station recording the position of the ill-fated Titanic. NPS Photo.**

# 2.3. Visitor Experience

## Visitor Numbers and Visitor Satisfaction

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Number of Visitors** | Number of visitors per year |  | The total of 2,274,635 visitors to Cape Hatteras National Seashore in 2015 was 5% higher than the 5-year average of 2,164,792 visitors for 2010–2014. |
| **Visitor Satisfaction** | Percent of visitors who were satisfied with their visit |  | Based on the standard visitor satisfaction surveys conducted each year, the percentage of visitors satisfied in 2015 was 99.0%, which is higher than the average for the previous five years (93.2%) and ten years (93.2%) (2015 Visitor Survey Card Data Report). |

## Interpretive Programs – Talks, Lighthouse Climbs, and Special Events

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Interpretive Programs** | Number and variety of programs and attendance |  | Extensive training, coaching, and mentoring are provided to all interpretive staff to ensure a high quality experience for park visitors. Overall, the variety and number of interpretive programs has remained consistent over the past five years with 1,600 programs and 32,000+ visitors attending. The park's ranger-led youth programs are being redefined from ranger-choice topic talks to activity programs focusing on critical resource themes, which is improving the visitor experience the park. |
| **Lighthouse Climbs** | Number of climbers |  | The number of visitors climbing the Cape Hatteras Lighthouse has remained consistent over the past five years. In 2013, the Bodie Island Lighthouse opened for climbing, greatly increasing the average of park lighthouse climbers. Over 150,000 visitors climbed park lighthouses in 2015. |
| **Junior Ranger Program** | Number of Junior Rangers and program quality |  | Junior Ranger Program participation has slightly increased over the past five years, averaging 3,000+ per year. A revision of the booklet in 2012 greatly upgraded youth engagement with critical resource topics. Specific youth-based ranger-led programs enhance the Junior Ranger Program. |
| **Special Events and Outreach** | Variety and longevity of events, community involvement |  | The park has had a modest increase in local school outreach and participation in community events (i.e., Ocrafest, Day at the Docks, Wildfest, KidsFest, etc.) since 2010. The park is working towards introducing curricula-based education programs in the Hatteras and Ocracoke schools in 2016. |

## Resource Brief: Community Event Participation

Park staff participates in multiple community events including: Day at the Docks, Ocrafest, Dare County KidsFest, Currituck County Wildlife Festival, Earth Day, Wings Over Water, Cape Hatteras and First Flight High School career days, etc. The Park provides special programming for commemorative days throughout the year, including National Park Week, National Junior Ranger Day, and NPS Founders Day.

**Law Enforcement Ranger participating in a career fair at First Flight Middle School**

## Resource Brief: Sea Turtle Excavation Program

Starting in 2013, the interpretation and resource divisions have collaborated to create and implement a formal interpretive visitor program during sea turtle nest excavations. A phone hotline was established that visitors can call to receive logistical information about where and when these programs are offered. Once visitors arrive at the site, while the biological technician is excavating the nest and gathering data, the interpreter gives a program that shares information about endangered sea turtles, the excavation process, and what the public could do to help these creatures. The program's continued success resulted in 20 nest excavation programs, with over 1,884 visitor contacts in 2015.

**Beach Access Information Ranger at a sea turtle excavation program**

## Interpretive Media – Brochures, Exhibits, Signs, and Digital Media

web

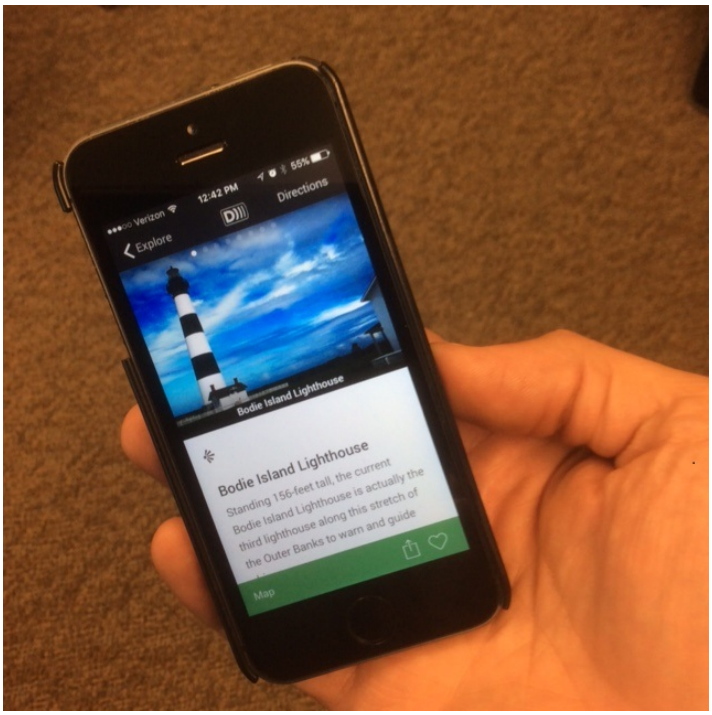
| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Wayside Exhibits** | Condition and currency of exhibits |  | Twenty-five new orientation, resource, and safety wayside exhibits were installed at ORV access ramps, swim beaches, and park entrance facilities in 2015 and 2016. Most of the old deteriorated bulletin boards have been removed. There is a need to complete resource wayside exhibits for park feature locations. Wayside exhibits for the Ocracoke Pony Pens, old Cape Hatteras Lighthouse site, and the Bodie Island Lighthouse are in design phase. |
| **Park Informational Signs (off-site)** | Usefulness, quantity, and placement |  | Off-site directional signs exist from all major highway approaches to the park. |
| **Park Informational Signs (on-site)** | Usefulness, quantity, and placement |  | In general, existing park informational signs are in fair condition with environmental conditions accelerating maintenance cycles. In recent years the park installed regulatory and safety signs at all beach access ramps, which are in good condition. The park has identified areas of opportunity to add new signs and improve existing signs and is working on a comprehensive sign plan to address needs. |
| **Exhibits** | Bodie Island Visitor Center |  | With the 2013 addition of the Bodie Island Lighthouse climbing operation and the 2016 addition of the off-road vehicle permit sales operation in the visitor center, the number of exhibits has decreased to accommodate these new operations and the park is looking at alternate ways to tell these stories. |
| | Hatteras Island Museum of the Sea |  | The Museum of the Sea is the seashore's main visitor center and main exhibit space. The exhibits here are over 30 years old and are deteriorating. The majority of exhibit space is dedicated to cultural resource stories that are outdated and not relevant to current audiences. There is a lack of exhibits related to the park's natural resources. The park recognizes the need to improve these exhibits. |
| | Ocracoke Island Visitor Center |  | With the 2016 addition of the off-road vehicle permit sales operation in the visitor center, the number of exhibits has decreased to accommodate this new operation and the park is looking at alternate ways to tell these stories. |
| **Print Media** | Accuracy and availability of primary park publications |  | The current park brochure is serviceable and updated annually, but is in need of an upgrade with an improved map and increased focus on the park's natural resources. The park's summer newspaper, *In The Park*, is available at all park visitor centers, the Wright Brothers National Memorial visitor center, the Fort Raleigh National Historic Site visitor center all Outer Banks Visitor's Bureau welcome centers, and on the park website. The newspaper has undergone considerable revision over the past five years to upgrade and streamline the publication. |

## Interpretive Media – Brochures, Exhibits, Signs, and Digital Media (continued)

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Audio-Visual Media** | Films and AV materials |  | Although the park does not have an orientation film, there are several films shown at the Museum of the Sea on the topics of rip currents, sea turtles, and climbing the Cape Hatteras Lighthouse. These films were upgraded for ADA compliance in 2012 (assistive listening, audio description, captioning). The films are serviceable; however, they are each over a decade old. The park recognizes the need for a new orientation film. The off-road vehicle (ORV) permit film, which provides regulatory and safety information, is available at permit stations and on-line. |
| **Digital Media** | Accuracy and scope of website; number of website visitors |  | Views of the park website have steadily grown over the past five years. The website provides good basic orientation trip-planning information; however the resource-based information needs to be updated to provide critical messages. The park is currently working to build this content. |
| | Social media platforms, updates, posts, likes, and overall activity |  | The park created a Twitter account in 2012 and a Facebook page, Flicker site, and Instagram site in 2013. The addition of an Interpretive Media Specialist position in 2013 has greatly enhanced the park's social media capacity and produced steady growth of all social media platforms and other interpretive media. |
| | Mobile App development |  | A mobile app for the park was completed in 2016. The app is currently available in IOS format and should be available in Android format in late 2016. |

## Resource Brief: Mobile App




In 2016, the park launched a mobile app for CAHA. The app will provide orientation, wayfinding, and interpretive content for multiple locations across the seashore. At each location, the app shows all services available at the location, information about that location, as well as any relevant interpretive context. The app also provides audio-guided tours for various sites, i.e., lighthouses. The app includes a list of scheduled events, park alerts, lighthouse climb information, campground and permit information as well as links to Recreation.gov for reserving campground sites and purchasing ORV permits. The app provides quick access to the resource management hotline. Accessibility to the park will be enhanced with audio description of each location for the visually impaired. Users can use the app on site and at home to tour the park. This free app is available on the Apple app store, and will be available on the Google Play store in late 2016. The park will have the capability to update the content of the app at any time, allowing this media to adapt and stay up-to-date with accurate information.

**Cape Hatteras National Seashore mobile app**

## Scenic Resources

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Scenic Views** | Scenic Views Quality & Protection |  | The park has numerous opportunities for scenic views of beach landscapes, the Atlantic Ocean, Pamlico Sound, and coastal maritime habitats. Visitors enjoy scenic views from day use areas, along beach and soundside access points, and from atop Cape Hatters and Bodie Island Lighthouses. Structures associated with development and utility infrastructure may impact certain views. |

## Accessibility

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Mobility** | ADA compliance |  | Many park facilities provide ADA compliant access to visitors. Recent projects to comply with ADA include new decking and ramps at the Cape Hatteras Visitor Center and an ADA accessible beach access on Ocracoke Island. A comprehensive ADA accessibility assessment is needed to identify areas for improvement in order to meet standards as fully as possible. |
| **Visual Accommodation** | ADA compliance |  | Audio descriptions were added to the films shown at the Museum of the Sea in 2012. Audio descriptions for wayside exhibits, park access points, and park features is provided through the 2016 mobile app. Braille versions of the park brochure were made available in 2015. There is a need to provide audio description for the Museum of the Sea exhibits, which may be accomplished through the mobile app. |
| **Auditory Accommodation** | ADA compliance |  | Assisted listening and captioning was added to the films shown at the Museum of the Sea in 2012, making them fully ADA compliant. Printed scripts for safety information are provided for lighthouse climbs. There is a need for provision of assistive listening devices for ranger-led programs and availability of sign language interpreters. |
| **Multi-lingual Resources** | Audio and print materials in multiple languages |  | Translations of the park brochure are available in French, German, Spanish, and Japanese; updated in 2014. The website visit planning information was made available in Spanish in 2012. Visitor center exhibits, wayside exhibits, films, and the park newspaper are not currently translated into different languages; however there is opportunity to provide some of this access through the new mobile app. |

## Safety

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Visitor Safety** | Visitor safety program |  | Park law enforcement staff monitors and responds visitor safety incidents and other members of staff regularly conduct visitor safety assessments. The park works closely with local law enforcement agencies to manage incidents and ensure staff and visitor safety. Crime is uncommon. The park's Law Enforcement staff is specially-trained for handling Emergency Response, Law Enforcement, and Emergency Medical Services. The majority of the permanent law enforcement staff is trained in Operational Leadership and many in cardiopulmonary resuscitation (CPR), First Aid, Emergency Medical Responder, and Emergency Medical Technician. |
| **Staff Safety and Training** | Staff training program |  | The majority of the permanent park staff is trained in Operational Leadership and many in CPR, Automated External Defibrillator, and First Aid. Emergency Medical Responder, Emergency Medical Technician, and Occupational Safety and Health Administration-required trainings are offered and required for emergency response staff. Risk assessments are conducted prior to task and project engagement. Regular risk management educational messages are shared with staff and volunteers. The park recently implemented a robust employee safety program with a proactive approach to providing engaging and effective training opportunities for employees and volunteers with the aim of increasing awareness and reducing risks. The park has identified additional staff training needed and is developing a program to ensure appropriate safety training for all staff. |

## Partnerships

web

| Indicators of Condition | Specific Measures | Condition Status/Trend | Rationale |
|---|---|---|---|
| **Volunteers** | Number and hours contributed |  | The number of volunteer hours has increased over the past five years. The addition of a dedicated full-time volunteer coordinator for the Outer Banks Group in 2014 has greatly helped to professionalize this program. There is an untapped potential for increasing the number of volunteers. |
| **Partnerships, Cooperating Associations, and Agreements** | Strength of official and unofficial partnerships |  | The park has partnerships with federal, state, and local government entities, higher education institutions, and non-profit organizations. The park's cooperating association, Eastern National, provides educational retail sales in the park's visitor center. The park intends to work with stakeholders to develop a dedicated support group, often referred to as a Friends Group. |

## Resource Brief: Volunteers

The Outer Banks Group Volunteer Program provides opportunities for individuals and groups to serve their community by assisting NPS in the preservation and protection of unique cultural and natural resources, and by providing visitor services at iconic sites along the Outer Banks. The mainstay of volunteers at Cape Hatteras is within the Interpretive Division (10,358 hours in fiscal year 2015). These volunteers help staff park information desks, lighthouses, and help in providing public programs. The campground host program (1,782.5 hours in fiscal year 2015) is also strong with a summer-long volunteer effort to assist serving the public at seashore campgrounds. The Ocracoke pony volunteer program (1,654 hours in fiscal year 2015) is continuing to grow, as is the sea turtle nest program (3,218.5 hours in fiscal year 2015). Volunteers also assist the Facility Management Division (1,842 hours in fiscal year 2015), the Law Enforcement Division (516 hours in fiscal year 2015), and the Administration Division (174.5 hours in fiscal year 2015). With the development of the park's first ever community-based volunteer projects program, the park hosted multiple beach cleanup events for World Oceans Month in June 2015. Cape Hatteras National Seashore also hosted two fellowships in 2015, which were held by young men from the island countries of Mauritius and Seychelles. The fellows volunteered in the park for six weeks as part of the Mandela Washington Fellowship for African Leaders Program. The volunteers assisted the natural resource division and the expanding sea turtle volunteer program. In 2014, The Outer Banks Group welcomed a new volunteer coordinator, who is working to improve and expand the volunteer program.

***Left:*** **Two Mandela Washington fellows volunteered with the sea turtle program at Cape Hatteras National Seashore.;** ***Right:*** **Students from the University of North Carolina Wilmington participate in a beach cleanup at Cape Hatteras National Seashore.**

## Resource Brief: Partnerships

The park has many partnerships that contribute to park operations, stewardship efforts and visitor experiences. Partnerships are an essential and effective means for the National Park Service to fulfill parts of its mission and foster a shared sense of stewardship. The park has several partnerships with local community organizations and stakeholder groups. For example, the park has partnered with the Outer Banks National Scenic Byway Advisory Committee. Programs, services, and projects offered by the Byway benefit local communities and promote the Seashore's mission to preserve and protect significant segments of barrier island coastline for the benefit and enjoyment of the people, and to provide for recreational visitor use consistent with that purpose. The park also partners with stakeholder groups such as the North Carolina Beach Buggy Association and the National Parks Conservation Association on education efforts and community events such as beach cleanups. The park intends to work with stakeholders to develop a dedicated support group, often referred to as a Friends Group.

# 2.4. Park Infrastructure

## Overall Facility Condition Index

web

The National Park Service uses a FCI to indicate the condition of its facilities and infrastructure. FCI is the cost of repairing an asset, such as a building, road, trail, or water system, divided by the cost of replacing it. The lower the FCI number, the better the condition of the asset. The condition of the buildings and other infrastructure assets at each park is determined by regular facility inspections, or "condition assessments," including daily informal inspections and formal yearly inspections. Deficiencies identified from these assessments are documented in the NPS FMSS and the cost for each repair determined. Repairs that cannot be completed within the year count against the condition of a structure. The total cost of these deferred repairs divided by the total cost to replace the structure results in the FCI, with values between 0 and 1 (the lower the decimal number, the better the condition). The FCI is assigned a condition category of Good, Fair, Poor, or Serious based on industry and NPS standards. Deferred maintenance projects that require additional funding are identified based on FCI. Planned preventive maintenance on critical components occurs during the year, using a park's base budget. For additional information about how park managers use information about the condition of facilities and infrastructure to make decisions about the efficient use of funding for maintenance and restoration activities at the park, Click Here.

For many of CAHA assets, the FCI data in the FMSS data system do not reflect the current condition of the structures. With the resources available, CAHA completes 20% of the comprehensive condition assessments annually. This equates to a five-year cycle in which every asset completes a full condition assessment once during the cycle. The park has endured 5 hurricanes and several major storms during the past five years, and while initial assessments are complete, a full assessment is not. The result is incomplete and dated data, which may produce an inaccurate FCI score. Even though a full assessment has not been completed on every asset, park staff does perform regular inspections of the assets. The Condition Status Trend table below reflects a more accurate condition of the assets based on the result of those inspections and the experience and current knowledge of park staff.

| Asset Category | Number of Assets 2015 | FCI 2010 / 2015 | Condition Status/Trend | Rationale |
|---|---|---|---|---|
| **Buildings** | 145 | 0.087 / 0.111 |  | The collective FCI score of the park's buildings is somewhat misleading. The park has completed significant projects in recent years that raise this score. There are high priority assets that remain in poor to fair condition. An example is the Cape Hatteras Lighthouse that has been occasionally repaired, but is in poor condition. Other examples include the park's housing units and comfort stations. Data reviews and updates have captured the 16 building demolitions and the reclassification of structures such as sheds and Pony Pen buildings. |
| **Campgrounds** | 6 | 0.004 / 0.060 |  | All of the campgrounds in the park have buildings with deteriorated exterior fabric (e.g., siding, roofs). Walkways and decking are nearing the end of their life cycle. In 2015, plumbing was updated at Oregon Inlet, Frisco, and Ocracoke Campgrounds. This work included the interiors of the comfort stations and showers. |

## Overall Facility Condition Index (continued)

web

| Asset Category | Number of Assets 2015 | FCI 2010 / 2015 | Condition Status/Trend | Rationale |
|---|---|---|---|---|
| **Waste Water Systems** | 51 | 0.042 / 0.151 |  | All systems are operational but require recurring maintenance. Sea level rise and weather-related events continue to have a significant impact on these systems. As the park consolidates buildings, the number of wastewater systems in the park will reduce. Projects have been identified and developed to upgrade the waste water systems at the Ocracoke Double Keepers Quarters, Ocracoke housing area and the Buxton housing area. |
| **Water Systems** | 4 | 0.094 / 0.024 |  | Frisco has a water plant and distribution system in operation. The water plant in the Cape Point Campground was decommissioned when the park tied into the Dare County water system; the distribution system is still in operation. |
| **Unpaved Roads and Parking Areas** | 50 | 0.018 / 0.145 |  | Generally, the park's unpaved roads and parking areas are in good condition. However, these assets require regular maintenance. The unpaved roads and parking areas are vulnerable to even minor storm events and the park has recently constructed off-road vehicle ramps and parking areas. The high 2015 FCI score reflects the investments necessary to construct and maintain these assets. |
| **Paved Roads, Parking Areas, Bridges** | 101 | 0.034 / 0.049 |  | Most of these assets are in good condition; however, parking areas require regular maintenance. The reduction in the number of assets is due to data updates as assessments are performed and structures are removed/demolished eliminating the need for access roads and parking. |
| **All Others** | 88 | 0.001 / 0.003 |  | This category includes assets such as fuel, telephone, radio systems, waysides, landscapes, cemeteries, and boat ramps. Most of these assets are in good condition. |

# Chapter 3. Summary of Key Stewardship Activities and Accomplishments

## Activities and Accomplishments

The list below provides examples of stewardship activities and accomplishments by park staff and partners to maintain or improve the condition of priority park resources and values for this and future generations:

**Natural Resources**

- Since 2011, realized protected species management successes including more than 63 pairs of piping plovers that fledged 35 chicks; 123 pairs of American oystercatchers that fledged 80 chicks; and 3,458 least tern nests, 418 common tern nests, 619 black skimmer nests, 48 Forster's terns and 61 gull-billed tern nests were documented. Also, 1,036 sea turtle nests and 877 false crawls were documented.
- Completed long-term vital signs monitoring plan and began implementation of monitoring key indicators of natural resource conditions, including implementation of protocols to monitor wintering and migratory shorebirds, water quality, amphibians, landbirds, and plant communities.
- Ongoing implementation of beach management activities to balance impacts of recreational activities on natural resources.
- Continued the Sea Turtle Volunteer Program in 2015, which allows the local public to assist with the management and protection of sea turtles. Approximately 50 volunteers assisted CAHA staff in 2015 with sea turtle stewardship.
- In 2012, began educational outreach addressing the impacts of artificial lighting on sea turtles. The program is in collaboration with multiple state and federal agencies, as well as local realty rental agencies. More than 5,000 brochures and 2,600 light-switch stickers have been distributed.

**Cultural Resources**

- Park partners include Chicamacomico Historical Association, North Carolina Department of Natural and Cultural Resources, North Carolina State Graveyard of the Atlantic Museum, Ocracoke Preservation Society, Outer Banks History Center, Outer Banks Lighthouse Society, and Hatteras Island Ocean Center.
- Museum Collection Hurricane Plan developed for the Outer Banks Group Hurricane Plan in 2015.
- East Carolina University (ECU) completing a sea level rise study on Cape Hatteras National Seashore historic structures (PEPC 149758).
- The park hosted a Nationally Significant Cultural Landscapes and a National Park Service Facilities Maintenance Software System (FMSS) Workshop in 2015.
- Bodie Island Lighthouse First Order Fresnel Lens cleaned biannually by Cultural Resources staff.
- Bodie Island Lighthouse Stairs Engineering Study commenced in 2016.
- Condition Assessment of Cape Hatteras Lighthouse completed in 2015.
- Historic American Building Survey (HABS) team documenting structures at Cape Hatteras Light Station.
- Surfboat CAHA 20 loaned to Amagansett Life Saving Station for restoration work and exhibit in 2014.
- Museum Resource Center (MRC)/Bally Building heating, ventilation, and air conditioning replaced in 2016 in order to improve environmental conditions for museum collection.
- Analyze environmental monitoring data quarterly for the Cape Hatteras museum collection stored in the Museum Resource Center/ Bally Building and on display at the Cape Hatteras Light Station Museum of the Sea.
- Seven Cape Hatteras maritime artifacts conserved at Harpers Ferry Conservation lab in 2015.
- Annual reporting requirements are completed including Annual Museum Inventory, National Catalog, Archeological Sites Management Inventory System (ASMIS), Federal Archeological Activities, Outer Banks Group Annual Property Inventory, National Historic Preservation Act (NHPA) Section 106, and Collection Management reports.
- Resource Management staff assisted with development of NPS Centennial Exhibit for the Outer Banks Group at the Outer Banks History Center in 2016.
- In 2016, park staff began assisting Salvo Cemetery Descendants Committee with erosion issues at Salvo Day Use Area.
- Bodie Island Light Station and Ocracoke Light Station Cultural Landscape Reports completed in 2015–2016.
- Ocracoke Light Station Historic Structures Report completed in 2015.
- Cape Hatteras Lighthouse Historic Structure Report completed in 2015.
- Park partnered with the Hatteras Island Genealogical and Preservation Society and the Outer Banks Lighthouse Society to complete the Cape Hatteras Light Station Circle of Stones Amphitheater in 2015.
- Determination of Ineligibility for the National Register was made for the Frisco Pier in 2015.
- Park staff regularly tracks and manages eight outgoing artifact loans from the Cape Hatteras museum collection.

- Park provides storage and manages the Cape Lookout National Seashore museum collection.

**Visitor Experience**

- After a five-year renovation, the Bodie Island Lighthouse was opened in 2013 to the public for climbing the first time. This program provides a unique visitor experience that complements the climb at Cape Hatteras Lighthouse.
- Collaboration between Resource Management and Interpretive Divisions established and created a new sea turtle nest excavation program for the park in 2013. This park-wide program reveals resource management efforts not often seen by the public and allows visitors to experience one of the park's primary natural resources.
- An Off-Road Vehicle Management Plan/ Environmental Impact Statement was implemented in 2012.
- In 2012, the partnership with the Outer Banks National Scenic Byway began. Highway 12 received National Scenic Byway recognition and runs the length of the seashore, connecting northern and southern counties in eastern North Carolina, and highlights points of interest along the way.
- The park's on-line presence with virtual audiences has been enhanced through various social media platforms and the development of a mobile app in 2016.
- New wayside exhibits throughout the park have improved visitor orientation, safety, and resource topic messaging.
- The safety of visitors is a park priority. Law enforcement officers work closely with local law enforcement agencies to facilitate both park staff and visitor safety.
- In 2014, the park began implementing a professionalized occupational safety and health program.

**Park Infrastructure**

- Restored the Bodie Island Lighthouse and opened for the first time to climbing.
- Resurfaced three off-road vehicle (ORV) parking areas at ramps 27, 55, and 67; installed new ORV beach access to include Ramp 25, a parking area and boardwalk; installed new ORV beach access Ramps 48, 63, and 32; and a parking area at Ramp 32; and extended Inside (Interdunal) Road.
- Replaced the Ocracoke campground waterline, lift stations and interior plumbing and fixtures; and rehabilitated the interiors of the Frisco and Oregon Inlet Campgrounds comfort stations and showers, including interior plumbing and electrical.
- Replaced decking and utility hook-ups for electric and water service at Silver Lake on Ocracoke.
- Replaced the Oregon Inlet Boat ramp to include new finger piers and an ADA-compliant floating dock.
- Reduced the park footprint with the demolition and removal of 16 park buildings to include the associated roads and parking areas.

# Chapter 4. Key Issues and Challenges for Consideration in Management Planning

In 1937, Congress designated approximately 67 miles of the North Carolina Outer Banks along the Bodie, Hatteras, and Ocracoke Island coasts as the nation's first National Seashore. Cape Hatteras National Seashore was created for the purposes of preserving natural and cultural resources, while also providing recreational use and enjoyment compatible with preserving the unspoiled barrier island ecosystem. Outdoor activities along the park's coastal waters and inland sounds include fishing, swimming, off-road vehicle use, strolling along beaches, and water sports such as kayaking, surfing, kiteboarding, and paddle boarding. Park staff will continue to work towards preserving the park's resources while managing for high-quality visitor experiences. Park managers will focus on the following topics over the coming years:

**Partnerships and Community Relationships**
The park intends to build and strengthen community relations, recognizing the importance of community, history, and local cultures in effectively managing the park's resources and enhancing visitor experiences. Park management and staff will continue to build trust and partner with the community, as well as all user groups, to preserve park resources and provide for visitor enjoyment. Partnership and community initiatives could include: collaborating on youth and education programs; enhancing health and wellness opportunities; and growing volunteer programs. The park will recognize the importance of our employees and their role in community relations and perceptions. In an effort to provide additional resources to the park and allow park users to support the places they want to help steward, the park plans to develop a philanthropic partner also known as a park friends group.

**Science Informing Management**
The park plans to improve the quality, quantity, and breadth of scientific data used for management and decision-making. Although the park experiences 2 to 3 million visits every year, the National Park Service has few data about park visitors. For example, what activities do they prefer to engage in? How to they obtain information about conditions, activities, and resources? What is the carrying capacity of the park to protect resources while providing exceptional experiences for recreation, relaxation, and solitude? The park seeks to gather information about and understand how visitors experience the park; how park users affect wildlife; the factors that affect the quality and availability of habitat for wildlife; the impact of past human actions; and the feasibility of implementing habitat restoration projects. Scientific information to help understand the current and projected impacts of climate change and sea level rise is also critical to improving park management. Projected sea level rise impacts may make it difficult, if not impossible, to preserve all resources and experiences. Although the impacts of climate change on the frequency, magnitude, and intensity of storms are unknown, it is likely that sea level rise will exacerbate storm impacts. Consequently, the park faces difficult and complicated decisions regarding where, when, and if to rebuild structures and visitor facilities post-storm. Therefore, collecting scientific information such as physical monitoring data, vulnerability analyses, and appropriate scenario plans will help set the stage for long-term planning.

**Workforce Leadership Development**
Park management will focus on developing and improving leadership skills within the park's workforce including: building and maintaining a safety culture; building trust, transparency, and credibility throughout the organization; providing hands-on opportunities for staff to grow skills and careers; and mentoring staff on team and project management. The park will accomplish these objectives through strategic hiring decisions, implementing interdisciplinary workgroups, and providing staff with training and development opportunities.

**National Park Experience**
The park will actively work to enhance the National Park Service experience for park visitors including: strengthening the park's identity as a unit of the National Park Service; providing more and enhanced visitor experiences; and proactively engaging youth. Examples of strengthening the park's National Park Service identity include: improving park signage and way-finding; increasing staff presence and engagement with visitors; and improving communication with visitors using the best available technology. Enhancing the visitor experience could include: providing new or improved campground programs; expanding camping seasons; improving the safety, accessibility and appearance of visitor facilities; providing new or improved wildlife programs; and enhancing recreation opportunities through new or improved hiking and paddling water trails. Examples of more fully engaging youth could include: providing more robust educational programs; engaging local schools and teachers in park programs; hosting multi-day in-park experiences for youth; and conducting outreach and providing opportunities specifically for urban and minority youth groups.

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## See Also:

Collection of Natural Resource-Related References

Collection of Cultural Resource-Related References

Collection of Visitor Experience-Related References

# Glossary

See the State of the Parks home page for a link to a complete glossary of terms used in State of the Park reports. Definitions of key terms used in this report are as follows:

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| Americans with Disabilities Act (ADA) | Law enacted by the federal government that includes provisions to remove barriers that limit a disabled person's ability to engage in normal daily activity in the physical, public environment. |
| Archeological Sites Management Information System (ASMIS) | The National Park Service's standardized database for the basic registration and management of park prehistoric and historical archeological resources. ASMIS site records contain data on condition, threats and disturbances, site location, date of site discovery and documentation, description, proposed treatments, and management actions for known park archeological sites. It serves as a tool to support improved archeological resources preservation, protection, planning, and decision-making by parks, centers, regional offices, and the national program offices. |
| Baseline Documentation | Baseline documentation records the physical condition of a structure, object, or landscape at a specific point in time. A baseline provides a starting point against which future changes can be measured. |
| Carbon Footprint | Carbon footprint is generally defined as the total set of greenhouse gas emissions caused by an organization, event, product, or person. |
| Climate Friendly Park | The NPS Climate Friendly Park designation requires meeting three milestones: completing an application; completing a comprehensive greenhouse gas (GHG) inventory; and completing a Climate Action Plan, which is the actions, policies, programs, and measures a park will put into place to reduce its GHG emissions. |
| Cultural Landscapes Inventory (CLI) | A Cultural Landscapes Inventory describes historically significant landscapes within a park. The inventory identifies and documents each landscape's location, size, physical development, condition, characteristics, and features, as well as other information useful to park management. |
| Curation | National parks are the stewards of numerous types of objects, field notes, publications, maps, artifacts, photographs, and more. The assemblage of these materials comprises a museum collection. Curation is the process of managing, preserving, and safeguarding a collection according to professional museum and archival practices. |
| Exotic Plant Management Team (EPMT) | One of the ways the NPS is combating invasive plants is through the Exotic Plant Management Team Program. The program supports 16 Exotic Plant Management Teams working in more than 225 park units. EPMTs are led by individuals with specialized knowledge and experience in invasive plant management and control. Each field-based team operates over a wide geographic area and serves multiple parks. |
| Facility Condition Index (FCI) | FCI is the cost of repairing an asset (e.g., a building, road, bridge, or trail) divided by the cost of replacing it. The lower the FCI number, the better the condition of the resource. |
| Foundation Document | A park Foundation Document summarizes a park's purpose, significance, resources and values, primary interpretive themes, and special mandates. The document identifies a park's unique characteristics and what is most important about a park. The Foundation Document is fundamental to guiding park management and is an important component of a park's General Management Plan. |

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| Fundamental and Other Important Resources and Values | Fundamental resources and values are the particular systems, processes, experiences, scenery, sounds, and other features that are key to achieving the park's purposes and maintaining its significance. Other important resources and values are those attributes that are determined to be particularly important to park management and planning, although they are not central to the park's purpose and significance. These priority resources are identified in the Park Foundation Document and/or General Management Plan. The short-cut name that will be used for this will be Priority Resources. |
| Historic Integrity | Historic Integrity is the assemblage of physical values of a site, building, structure, or object and is a key element in assessing historical value and significance. The assessment of integrity is required to determine the eligibility of a property for listing in the National Register. |
| Indicator of Condition | A selected subset of components or elements of a Priority Resource that are particularly "information rich" and that represent or "indicate" the overall condition of the Priority Resource. There may be one or several Indicators of Condition for a particular Priority Resource. |
| Integrated Resource Management Applications (IRMA) | The NPS-wide repository for documents, publications, and data sets that are related to NPS natural and cultural resources. |
| Interpretation | Interpretation is the explanation of the major features and significance of a park to visitors. Interpretation can include field trips, presentations, exhibits, and publications, as well as informal conversations with park visitors. A key feature of successful interpretation is allowing a person to form his or her own personal connection with the meaning and significance inherent in a resource. |
| Invasive Species | Invasive species are non-indigenous (or non-native) plants or animals that can spread widely and cause harm to an area, habitat, or bioregion. Invasive species can dominate a region or habitat, out-compete native or beneficial species, and threaten biological diversity. |
| List of Classified Structures (LCS) | LCS is an inventory system that records and tracks the condition of the approximately 27,000 historic structures listed in the National Register of Historic Places that are the responsibility of NPS. |
| Museum Collection | NPS is the steward of the largest network of museums in the United States. NPS museum collections document American, tribal, and ethnic histories; park cultural and natural resources; park histories; and other aspects of human experience. Collections are managed by professionally-trained NPS staff, who ensure long-term maintenance of collections in specialized facilities. |
| Native American Graves Protection and Repatriation Act (NAGPRA) | A federal law passed in 1990. NAGPRA provides a process for museums and federal agencies to return certain Native American cultural items (e.g., human remains, funerary objects, sacred objects, objects of cultural patrimony) to lineal descendants and culturally-affiliated Indian tribes and Native Hawaiian organizations. |
| Natural Resource Condition Assessment (NRCA) | A synthesis of existing scientific data and knowledge, from multiple sources, that helps answer the question: what are current conditions of important park natural resources? NRCAs provide a mix of new insights and useful scientific data about current park resource conditions and factors influencing those conditions. NRCAs have practical value to park managers and help them conduct formal planning and develop strategies on how to best protect or restore park resources. |

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| North Carolina Natural Heritage Program (NCNHP) | Agency within the NC Department of Environment and Natural Resources which serves as an information clearinghouse in support of conservation of the rarest and most outstanding elements of natural diversity in the state. These elements of natural diversity include plants and animals, which are so rare, or the natural communities, which are so significant, that they merit special consideration as land-use decisions are made. |
| Priority Resource or Value | This term refers to the Fundamental and Other Important Resources and Values of a park. These can include natural, cultural, and historic resources as well as opportunities for learning, discovery, and enjoyment. Priority Resources or Values include features that have been identified in park Foundation Documents, as well as other park assets or values that have been developed or recognized over the course of park operations. Priority Resources or Values warrant primary consideration during park planning and management because they are critical to a park's purpose and significance. |
| Project Management Information System (PMIS) | A servicewide intranet application within the National Park Service to manage information about requests for project funding. It enables parks and NPS offices to submit project proposals to be reviewed, approved, and prioritized at park units, regional directorates, and the Washington Office. |
| Resource Management | The term "resources" in NPS encompasses the many natural, cultural, historical, or sociological features and assets associated with parks. Resource management includes the knowledge, understanding, and long-term stewardship and preservation of these resources. |
| Southeast Coast Network (SECN) | One of 32 Inventory & Monitoring networks established as part of the NPS Inventory and Monitoring Program. The Southeast Coast Network comprises 20 parks in Alabama, Florida, Georgia, North Carolina, and South Carolina. |
| Specific Measure of Condition | One or more specific measurements used to quantify or qualitatively evaluate the condition of an Indicator at a particular place and time. There may be one or more Specific Measures of Condition for each Indicator of Condition. |
| Visitor and Resource Protection (VRP) | VRP includes, among other responsibilities, protecting and preserving park natural and cultural resources, enforcing laws that protect people and the parks, fire management, search and rescue, managing large-scale incidents, and on-the-ground customer service. |