CHAPTER 3

Affected Environment

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CHAPTER 3: AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the characteristics of the existing environment that could be affected by the proposed management alternatives. This is done in compliance with the guidelines contained in the National Environmental Policy Act and Section 1502.15 of the regulations for implementing that act developed by the Council on Environmental Quality (1978). Chapter 1 introduced the impact topics that may be affected by the proposed actions or the No-action Alternative. This section establishes the basis for "Chapter 4: Environmental Consequences", which addresses the effects the alternatives may have on the impact topics. Each impact topic addressed is as listed in chapter 1. A summary of climate change is also included in this introduction, with resource specific information provided under each impact topic in this chapter.

In this chapter...

- Climate Change
- Natural Resources
- Cultural Resources
- Visitor Use and Experience
- Park Operations and Facilities

CLIMATE CHANGE

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). In general, climate change may result from (USEPA 2008):

- Natural factors, such as changes in the sun's intensity or slow changes in the earth's orbit around the sun;
- Natural processes within the climate system (e.g., changes in ocean circulation, acidification, or temperature); and
- Human activities that change the atmosphere's composition (e.g., burning fossil fuels) and the land surface (e.g., deforestation, reforestation, urbanization, desertification, etc.).

The earth's climate has changed many times during the planet's history, with events ranging from ice ages to long periods of warmth. Historically, natural factors such as volcanic eruptions, changes in earth's orbit, and the amount of energy released from the sun have affected the earth's climate. Human activities associated with the Industrial Revolution also changed the composition of the atmosphere and, therefore, are very likely influencing the earth's climate. For example, over the past 200 years, the burning of fossil fuels and deforestation caused concentrations of heat-trapping "greenhouse gases" to increase significantly in the atmosphere (USEPA 2008). As concentrations of these gases continue to increase in the atmosphere, the earth's temperature is climbing above past levels (IPCC 2007; United Nations Environment Programme 2007; U.S. Climate Change Science Program 2008). Most warming in recent decades is likely the result of human activities (IPCC 2007). For example, the recent United Nations report (IPCC 2007) stated that "Observational evidence from all continents and most oceans shows that many natural systems are being affected by regional climate changes, particularly temperature increases." The report further states that, "A global assessment of data since 1970 has shown it is likely that anthropogenic warming has had a discernible influence on many physical and biological systems."

Over the past 200 years the oceans have absorbed nearly half the carbon dioxide produced by human activities. One effect has been to produce carbonic acid, thus

increasing acidity and lowering the pH of surface seawater by 0.1 pH unit. Projections based on different emission scenarios give additional reductions in average global surface ocean pH of between 0.14 and 0.35 units by the year 2100 (IPCC 2007). This seawater acidity is probably higher than has been experienced for hundreds of millennia, and there is convincing evidence that such acidification will impair the process of calcification by which animals, such as molluscs, make their shells from calcium carbonate.

Scientists are certain that human activities are changing the composition of the atmosphere, and that increasing the concentration of greenhouse gases will change the planet's climate (USEPA 2008; IPCC 2007). However, they are not sure by how much it will change, at what rate it will change, or what the specific effects will be. Observed effects include sea level rise, shrinking glaciers, changes in the range and distribution of plants and animals, trees blooming earlier, temperature increases, lengthening of growing seasons, ice on rivers and lakes freezing later and breaking up earlier, and thawing of permafrost. Climate change affects sea level; amounts of precipitation intensity and runoff; height, duration, and frequency of ocean waves; and long-term tracks, intensity, and frequency of coastal storms (Nicholls 2002).

Potential Present and Future Impacts of Climate Change

Studies predict that coastal barrier islands and their natural and cultural resources will be affected by sea level rise and potential stronger storm events resulting from climate change. Relative sea level is currently rising in northeastern North Carolina at a rate of 16 to 18 inches (40 to 46 centimeters) per century, a substantially higher rate than the 7 inches (18 centimeters) per century 100 years ago and the 3 inches (8 centimeters) per century rate 200 years ago. The current rate will likely continue to increase as the climate continues to warm (Riggs et al. 2008 in NPS 2010e), but much of government, business, organization, and individual response to the challenges of climate change is undetermined. Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). Given the complex interactions among multiple factors and the uncertainties over human response to climate change on the barrier islands, the level of uncertainty about possible effects on specific resources or impact topics over the 15- to 20- year planning period makes analysis for impacts of climate change in this document speculative. It is assumed that future NPS management efforts would incorporate measures to address resiliency and that such measures would have beneficial effects for natural and cultural resources as they adapt to as yet unknown conditions that may change over future decades. The effects of climate change are not the result of management actions, yet influence resource conditions in as yet unknown ways, with possible long-term, major adverse effects. Since the effects of climate change are not the result of management actions, they are not incorporated into the environmental consequences chapter.

Sea Level Rise Impacts on North Carolina

The North Carolina Coastal Resources Commission, Science Panel on Coastal Hazards, reviewed a range of possible sea level rise scenarios and their associated levels of plausibility. The panel determined that the most likely sea level rise scenario for North Carolina is a rise of 0.4 to 1.4 meters (15 inches to 55 inches) by 2100 (NCCRC 2010). The panel also recommended a rise of 1 meter (39 inches) by 2100 to be adopted for policy and planning purposes (NCCRC 2010).

According to the National Centers for Coastal Ocean Science, major impacts

of sea level rise in North Carolina are increased erosion, flooding, and storm damage (NCCOS 2011). Because of North Carolina's gently sloped coastal plain, a sea level rise of 1 centimeter (0.4 inch) could result in an inundation of 20 to 100 meters (66 to 328 feet) of land area over the next century (Pilkey 2004 in NCCOS 2011). Over the past 25 years, shoreline erosion has consumed approximately 125 square kilometers (48 square miles) of land area, as much as 60% of wetlands in northeastern North Carolina (Riggs and Ames 2003 in NCCOS 2011). Ninety-three miles (150 kilometers) of shoreline from Cape Hatteras to Virginia average 4.7 feet (1.4 meters) of erosion per year (NCCOS 2011). However, shoreline recession rates vary dramatically and are a function of shoreline type, geometry, and composition; geographic location, size, and shape of the associated coastal water body; coastal vegetation; water level; and storm frequency and intensity (Riggs and Ames 1993 in NCCOS 2011). Rising sea levels may flood beaches and bluffs and force estuarine waters up river valleys and adjacent land slopes, allowing salt water to infiltrate farther inland and upstream (NCCOS 2011). Higher salinity affects surface and groundwater, impairing water supplies, ecosystems, and coastal farmland as well as harming aquatic plants and animals (NCCOS 2011). Higher storm surges, even from relatively minor storms, can be expected from rising sea levels causing storm damage along coasts (NCCOS 2011). Coastal North Carolina is expected to receive a tropical storm once every four years, and a tropical cyclone every 1.3 years (State Climate Office of North Carolina in NCCOS 2011). Increased hurricane intensity may possibly be linked to a warming ocean (NCCOS 2011).

Though natural evolution and change are an integral part of our national parks, **climate change** will fundamentally transform the natural and cultural landscapes of national parks in the not-too-distant future.

NATURAL RESOURCES

This section describes natural resource characteristics of the existing environment that could be affected by the proposed management alternatives. Impact topics included in this section are floodplains, wetlands, species of concern, and vegetation.

Floodplains

The Federal Emergency Management Agency defines geographic areas as flood zones according to varying levels of flood risk. Each zone reflects the severity or type of flooding in the area. According to the Federal Emergency Management Agency's Flood Insurance Rate Maps, Fort Raleigh National Historic Site is within a Special Flood Hazard Area subject to inundation by the one percent annual chance flood (100-year flood). The site contains areas within Zone AE, indicating that Base Flood Elevations have been determined. The Base Flood Elevation is the water-surface elevation of the one percent annual chance flood. The Base Flood Elevations are 7 feet (2.1 meters) in the southern portion of the national historic site, 8 feet (2.4 meters) in the center of the national historic site, and 10 feet (3 meters) in the northeastern portion of the national historic site. The portion of the national historic site that contains Pear Pad Road, the Waterside Theatre parking lot, and the Fort Raleigh National Historic Site headquarters is located within Zone X, indicating areas of 0.2% (500-year flood) annual chance flood and areas of one percent annual chance flood with average depths of less than 1 foot or with drainage areas less than one square mile (FEMA 2006).

The shorelines of the Fort Raleigh National Historic Site are within Zone V, indicating a Coastal High Hazards Area. This area extends from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action. The area landward of Zone V is referred to as Coastal Zone A. The principal

sources of flooding in Coastal Zone A areas are associated with astronomical tides, storm surges, seiches (standing waves), or tsunamis. Areas subject to wave heights between 3 and 1.5 feet (1 to 0.5 meters) (Coastal Zone A) are not shown on the Flood Insurance Rate Maps (NC DCCPS 2008). Figure 8 depicts the flood zones in and around the national historic site (note that the figure below is for reference only; refer to the Federal Emergency Management Agency's Flood Insurance Rate Maps for detailed information).

Climate Change

Climate change affects sea level, amounts of rainfall, intensity and amount of runoff, the height duration and frequency of ocean waves, and long-term tracks, intensity and frequency of coastal storms (Nicholls 2002) that could, in turn, affect floodplains. Climate change is expected to increase the extent and frequency of coastal flooding (Loehman and Anderson 2009) from storm surges and sea level rise. Changes in the frequency of severe storms and increased rainfall intensity could further aggravate flooding and storm damage (Titus and Richman 2001 in Loehman and Anderson 2009).

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coastline as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's floodplains. Increased sea level and storm events may affect the ability of the landscape to convey flood waters as sea level and landscape features change. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur (Schafale 2010). Specific impacts to the national historic site are as yet unknown.

Wetlands

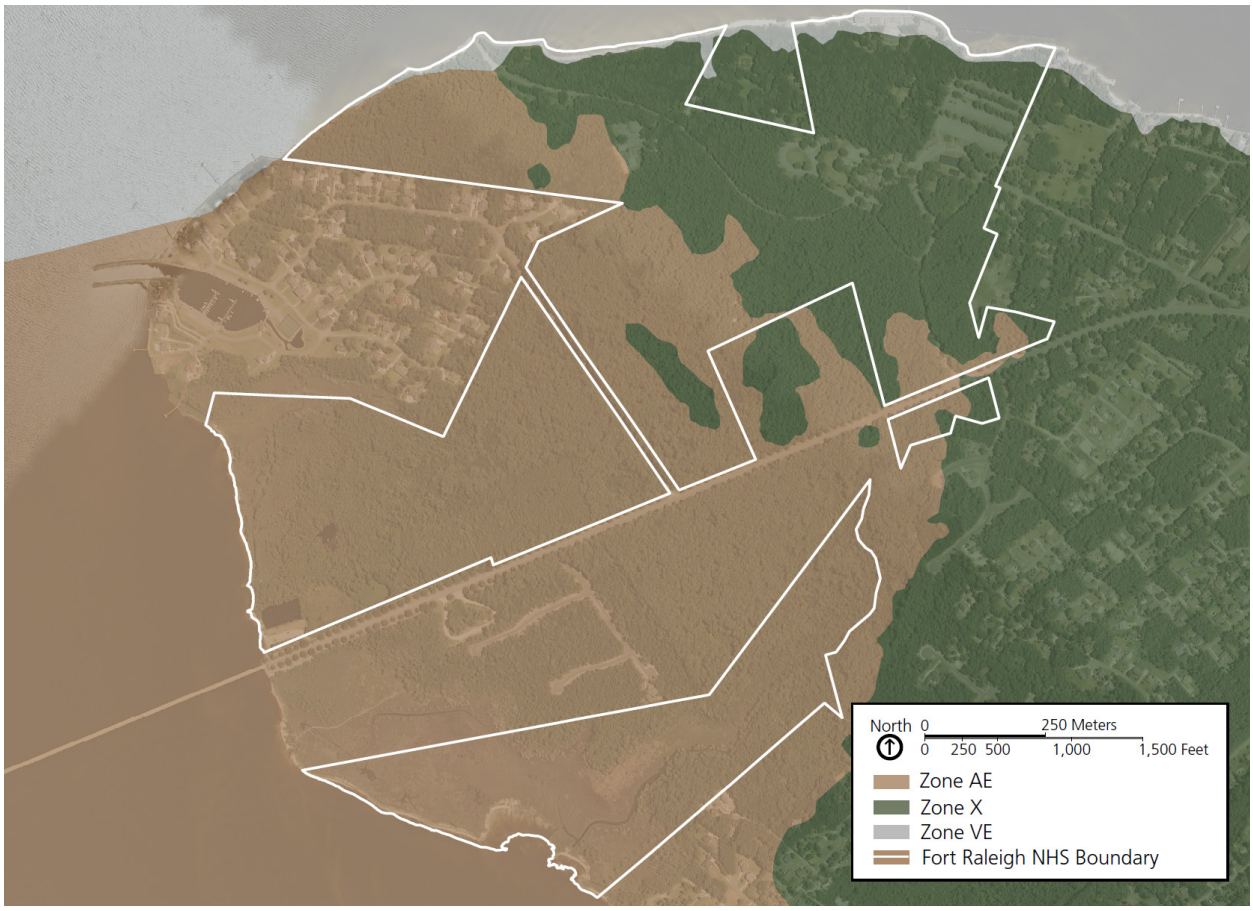
This section provides a summary of the numbers, types, functions, and values of wetlands identified within the national historic site. Information to complete this assessment was identified from interactive maps available through the National Wetland Inventory and the NPS (USFWS 2011a; NPS 2006a) and from other available information.

The U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency formally define wetlands as, "Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas," (USACE 1987). Lakes and ponds are also classified as wetlands by the U.S. Fish and Wildlife Service (Cowardin, et al. 1979). Wetlands are defined according to the types of vegetation, soils, and hydrology on a given site (Cowardin, et al. 1979).

Wetlands perform many ecological functions that have associated value to humanity, including (NPS 2003a):

- Surface water storage (flood control);
- Shoreline stabilization (wave damage protection/shoreline erosion control);
- Groundwater recharge (some types replenish water supplies);
- Sediment removal and nutrient cycling (water quality protection);

Figure 8. Fort Raleigh National Historic Site Floodplain Map



- Support of aquatic productivity (fishing, shell fishing, and waterfowl hunting), production of trees (timber harvest);
- Production of herbaceous growth; and
- Provision of plant and wildlife habitat (plant/wildlife/nature photography, nature observation, and aesthetics).

Figure 9 and Table 8 detail the types and general location of wetlands that occur within Fort Raleigh National Historic Site. Natural processes such as shoreline erosion would be allowed to prevail in most areas, including the pond on the north shore, adjacent to US 64. This pond is considered a wetland. The spit of shoreline dividing the pond would be expected to be breached during storm activity, thereby affecting the ponded wetland status. There are other wetlands within the national historic site that have not yet been delineated. A Technical Assistance Request has been made through the Natural Resource Program Center to assist the Outer Banks Group with delineation of wetlands and development of appropriate management strategies for their continued protection.

Figure 9. Fort Raleigh National Historic Site Wetlands Map

Table 8. Wetland Types Occurring within Fort Raleigh National Historic Site[1]

National Wetland Inventory Code Abbreviation [2]	National Wetland Inventory Classification	Class/SubClass	Modifiers
E2EM1Pd	[E] Estuarine, [2] Intertidal, [EM] Emergent, [1] Persistent, [P] Irregularly Flooded, (d) Partially Drained/Ditched	[EM] Emergent - Characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants. [1] Persistent - Dominated by species that normally remain standing at least until the beginning of the next growing season. This subclass is found only in the Estuarine and Palustrine systems.	[P] Irregularly Flooded – Tidal water floods the land surface less often than daily. (d) Partially Drained/ Ditched – Hydrologically altered but soil moisture is sufficient to support some hydrophytes.
PFO4/1C	[P] Palustrine, [FO] Forested, [4] Needle-Leaved Evergreen, [1] Persistent , [C] Seasonally Flooded	[FO] Forested - Characterized by woody vegetation that is 6 meters tall or taller. [4] Needle-leaved Evergreen - Woody gymnosperms with green, needle-shaped, or scale-like leaves that are retained by plants throughout the year; e.g., black spruce (*Picea mariana*). [1] Persistent - Dominated by species that normally remain standing at least until the beginning of the next growing season. This subclass is found only in the Estuarine and Palustrine systems.	[C] Seasonally Flooded - Surface water is present for extended periods especially early in the growing season but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface.
PSS1A	[P] Palustrine, [SS] Scrub-Shrub, [1] Broad-Leaved Deciduous, [A] Temporarily Flooded	[SS] Scrub-Shrub - Includes areas dominated by woody vegetation less than 6 meters (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions [1] Persistent - Dominated by species that normally remain standing at least until the beginning of the next growing season. This subclass is found only in the Estuarine and Palustrine systems.	[A] Temporarily Flooded - Surface water is present for brief periods during growing season, but the water table usually lies well below the soil surface. Plants that grow in both uplands and wetlands may be characteristic of this water regime.

Table 8. Wetland Types Occurring within Fort Raleigh National Historic Site[1]

National Wetland Inventory Code Abbreviation [2]	National Wetland Inventory Classification	Class/SubClass	Modifiers
PSS7C	[P] Palustrine, [SS] Scrub-Shrub, [7] Evergreen, [C] Seasonally Flooded	[SS] Scrub-Shrub - Includes areas dominated by woody vegetation less than 6 meters (20 feet) tall. The species include true shrubs, young trees (saplings), and trees or shrubs that are small or stunted because of environmental conditions [7] Evergreen – A plant community where evergreen trees or shrubs represent more than 50% of the areal coverage of trees and shrubs. The canopy is never without foliage; however, individual trees and shrubs may shed their leaves.	[C] Seasonally Flooded - Surface water is present for extended periods especially early in the growing season but is absent by the end of the growing season in most years. The water table after flooding ceases is variable, extending from saturated to the surface to a water table well below the ground surface.
PUBHx	[P] Palustrine, [UB] Unconsolidated Bottom, [H] Permanently Flooded, [x] Excavated	[UB] Unconsolidated Bottom - Includes all wetlands and deepwater habitats with at least 25% cover of particles smaller than stones (less than 6-7 centimeters), and a vegetative cover less than 30%.	[H] Permanently Flooded - Water covers the land surface throughout the year in all years. [x] Excavated - Lies within a basin or channel excavated by man.

1 Source: U.S. Fish and Wildlife Service National Wetland Inventory, 2011a.

2 [P] Palustrine - The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, emergents, mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean derived salts is below 0.5 parts per trillion. Wetlands lacking such vegetation are also included if they exhibit all of the following characteristics: are less than 8 hectares (20 acres); do not have an active wave-formed or bedrock shoreline feature; have at low water a depth less than 2 meters (6.6 feet) in the deepest part of the basin; and have a salinity due to ocean-derived salts of less than 0.5 parts per trillion.

[E] Estuarine – The Estuarine System describes deepwater tidal habitats and adjacent tidal wetlands that are influenced by water runoff from and often semi-enclosed by land. They are located along low-energy coastlines and they have variable salinity.

[2] Intertidal – This is defined as the area from extreme low water to extreme high water and associated splash zone.

Climate Change

Climate change affects sea level, amounts of rainfall, intensity and runoff, height, duration and frequency of ocean waves, and long-term tracks, intensity and frequency of coastal storms (Nichols 2002) that could affect wetlands and associated vegetation, especially communities in close proximity to national historic site shorelines. Climate change is expected to increase the extent and frequency of coastal flooding (Loehman and Anderson 2009) from storm surges and sea level rise.

Freshwater and brackish wetlands, common to the mid- and south Atlantic coasts, are particularly sensitive to sustained or pulsed salinity penetration; such pulses are expected to increase in magnitude and frequency with climate change and may likely result in a transition to more salt tolerant species (Boesch et al. 2000 in Loehman and Anderson 2009). Salt marshes may be able to survive rates of sea-level rise as high as 50 centimeters (20 inches) in 50 years, an estimate that is lower than the expected rise in sea level for much of the coastal U.S. over the next 100 years (Boesch et al. 2000 in Loehman and Anderson 2009). Local subsidence or hydrologic changes, however, could increase the rate of relative sea level rise experienced by individual marshes, potentially exceeding the local threshold of some salt marshes to adapt (Boesch et al. 2000 in Loehman and Anderson 2009).

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's resources including wetlands. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur (Schafale 2010). Specific impacts to the national historic site are as yet unknown.

Species of Concern

The NPS is required under the Endangered Species Act to ensure that federally listed species and their habitats are protected on all lands within the agency's jurisdiction. In addition, the NPS manages state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible (NPS 2006a).

Species of concern include species with federal or state endangered, threatened, or candidate for listing status, as well as locally rare species. Species of concern historically known, presently known, or potentially occurring in the national historic site were identified based on recent NPS resource studies (NPS 2011a), Fort Raleigh National Historic Site Fiscal Year 2010 Government Performance and Results Act Species of Management Concern list, as well as the North Carolina Natural Heritage Program's Virtual Workroom 2-mile radius search database (NCNHP 2011) (see Appendix C for more information).

There are two federally listed species (one bird and one reptile) of concern that are presently known or potentially occurring at the national historic site, and 14 North Carolina listed species (three birds, two reptiles, three insects, and six plants). A federally listed species of concern refers to those species that may require concentrated conservation actions, but do not have legal protection under Section 7 of the Endangered Species Act (USFWS 2011b). Federal species of concern are recommended for consideration by federal agencies undertaking management actions. They are not species officially designated as candidate species for Section 7 protection.

Both federal and state listed species are included in Table 9, along with habitat and occurrence information.

Special status species were last surveyed in the national historic site from 1996 to 1997. A Technical Assistance Request was submitted in fiscal year 2011 to conduct rare plant inventory and mapping for the Outer Banks Group at Cape Hatteras National Sea Shore, Fort Raleigh National Historic Site, and Wright Brothers National Monument. Future funding and completion of the inventory will provide the national historic site with more information regarding species of concern within its boundaries.

Climate Change

Plant-animal interactions such as pollination, seed dispersal, and insect control depend on synchrony between species. Although some species may respond to climate change at similar rates and maintain synchrony, for other species the loss of synchrony (such as mismatched timing between larval emergence and growth of host plants) may have detrimental effects (Burkett et al. 2005 in Loehman and Anderson 2009). Because different species are likely to respond differently to climate change, current ecological communities may ultimately be replaced by entirely new assemblages of species (Root et al. 2003 in Loehman and Anderson 2009). Changes in terrestrial and aquatic species compositions are likely to occur as ranges shift, contract, or expand. Rare species and communities may disappear, and more common species may become rare (Burns et al. 2003 in Loehman and Anderson 2009).

Range-restricted species (such as those at high elevations) and endemics will likely be the first to experience severe range contraction and extinction due to climate change (Parmesan 2006 in Loehman and Anderson 2009). Behavioral and genetic responses to climate change have been documented across multiple studies in marine, freshwater, and terrestrial ecosystems, in both plant and animal communities (Parmesan 2006 in Loehman and Anderson 2009). Birds have exhibited a variety of responses to warming trends including earlier breeding dates, range expansions, and asynchronous life history events (Marra et al. 2005 in Loehman and Anderson 2009).

Species of concern, regardless of listing status, are especially vulnerable to changes in habitat, water quality, air and water temperature, and other anticipated effects of climate change in the Outer Banks region of North Carolina. For example, sea level rise and increases in severe weather events may increase erosion at the national historic site, permanently altering the remaining dune, maritime forest and marsh communities on Roanoke Island. The resulting loss of habitat and species may effectively eliminate some species of concern from the national historic site.

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's resources. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur that would alter habitat for some species of concern(Schafale 2010). Specific impacts to the national historic site are as yet unknown.

Vegetation

The flora of Fort Raleigh National Historic Site includes those species associated with North Carolina's barrier islands. The

Table 9. Species of Concern

Common Name (*Scientific Name*)	Status	Habitat and Occurrence
Federal Listed Species		
Birds		
Black rail *(Laterallus jamaicensis)*	Federal: Species of Concern NC: Special Concern	In North Carolina, the black rail is found primarily in the brackish marshes dominated by black needlerush, with varying amounts of finer grasses, such as slatmeadow cordgrass and/or salt-grass marshes (*Distichlis spicata*). The species is known to be a fairly common permanent resident in the extensive brackish marshes of the eastern and southern portions of Roanoke Island. Fussell (1997a) identified black rail that vocally respond to tape recorded calls in winter, concluding that permanent resident individuals exist on the island. The study also identified the brackish marsh south of US 64/264 as moderately suitable breeding habitat and marginal wintering habitat (Fussell 1997a). Threats include loss and degradation of habitat due to drainage, dredging, filling, impounding, mining, and pollutant discharge (Todd 1977; Tiner 1984; Kerlinger and Sutton 1989; Kerlinger and Wiedner 1990 in NatureServe 2010). The black rail is also affected by predators, inclement weather conditions, human disturbances, and environmental contamination (NatureServe, 2010).
Reptiles		
Northern diamondback terrapin *(Malaclemys terrapin terrapin)*	Federal: Species of Concern NC: Special Concern	The northern diamondback terrapin is found within coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches in brackish and salt water (NatureServe 2010). The turtle burrows into mud when inactive and in Virginia, has been observed hibernating in moist sand 8 meters from the high tide mark (Ernst and Barbour 1972 in NatureServe 2010). Nesting occurs in the sandy marsh edge, offshore island, or dune (vegetated or un-vegetated) above the high tide mark (NatureServe 2010). The northern diamondback terrapin eats mainly marine clams, snails, worms, crabs and scavenges and takes live food (Ernst and Barbour 1972 in NatureServe 2010). Threats include water pollution, development, and heavy recreational use of beaches and dunes (NatureServe 2010). The northern subspecies (essentially Dare County) *Malaclemys terrapin terrapin* has a U.S. status of Federal Species of Concern while the southern subspecies (essentially the southern half of the coast) *Malaclemys terrapin centrata,* has no U.S. status (NCNHP 2011). The northern diamondback terrapin is listed as present in the national historic site and a species of management concern (NPS 2010b).

Table 9. Species of Concern

Common Name (*Scientific Name*)	Status	Habitat and Occurrence
North Carolina Listed Species		
Birds		
Black-throated green warbler – coastal plain population (*Dendroica virens waynei*)	NC: Significantly Rare	The black-throated green warbler – coastal plain population is located within a narrow belt of forested wetlands of the outer Coastal Plain from southern Virginia to the Edisto River in South Carolina (Cely N.D.). This species has one of the most restricted breeding distributions of any warbler in the southeastern United States (Cely N.D.). It is rarely found farther than 40 to 48 kilometers (25 to 30 miles) inland from the coast (Cely N.D.). Population size and trends are unknown, although it is suspected of disappearing or declining from southeastern Virginia and parts of North Carolina (Watts and Paxton 2002 in Cely N.D.) as well as areas devastated by Hurricane Hugo in South Carolina in 1989 (Cely pers. obs. In Cely N.D.). In southern Virginia and coastal North Carolina, the species is closely associated with Atlantic white cedar (*Chamaecyparis thyoides*) (Cely N.D.). Where cedar is scarce or absent, birds are found primarily in non-alluvial forested wetlands or transitional zones between uplands and wetlands, where, as a canopy or subcanopy species, it uses blackgum (*Nyssa sylvatica*), laurel oak (*Quercus laurifolia*), sweetgum (*Liquidamber styraciflua*), bald cypress (*Taxodium distichum*), "wet" loblolly pine (*Pinus taeda*), and red maple (*Acer rubrum*) (Cely N.D.). In Virginia and North Carolina, Watts and Paxton (2002) found higher than expected warbler use in survey plots containing loblolly pine, Atlantic white cedar, and bald cypress and less than expected use in those plots with pond pine (*P.serotina*) and hardwoods (Cely N.D.). As a canopy/subcanopy species, short timber rotations may negatively affect the species (Cely pers. obs.; Sprunt 1953 in Cely N.D.). Alterations of hydrology and wetlands drainage also pose potential problems; however, little is known about the species breeding biology, status, and habitat use (Cely N.D.). The black-throated green warbler – coastal plain population is listed as present in the national historic site and a species of management concern (NPS 2010b).
Bald eagle *(Haliaeetus leucocephalus)*	Federal: Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) NC: Threatened	Breeding habitat most commonly includes areas close to (within 4 kilometers or 2.5 miles) coastal areas, bays, rivers, lakes, or other bodies of water that reflect the general availability of primary food sources, including fish, waterfowl, and seabirds (Andrew and Mosher 1982; Green 1985; Campbell et al. 1990 in NatureServe 2010). Bald eagles preferentially roost in conifers or other sheltered sites in winter in some areas; this species typically selects the larger, more accessible trees (Buehler et al. 1991, 1992 in NatureServe 2010). Perching in deciduous and coniferous trees is equally common in other areas (e.g., Bowerman et al. 1993 in NatureServe 2010). Communal roost sites used by two or more eagles are common, and some may be used by 100 or more eagles during periods of high use (NatureServe 2010). Winter roost sites vary in their proximity to food resources (up to 33 kilometers or 21 miles) and may be determined to some extent by a preference for a warmer microclimate at these sites (NatureServe 2010). Fussell (1997a) concluded that migrating individuals visit the shorelines of Fort Raleigh National Historic Site occasionally to rarely and nesting by eagles within national historic site boundaries is extremely unlikely at this time. In addition, use of the area by individuals on a long-term basis is also very unlikely because of a poor food supply (Fussell 1997a). Major threats include habitat loss, disturbance by humans, biocide contamination, decreasing food supply, and illegal shooting (Evans 1982; Green 1985; Herkert 1992 in NatureServe 2010).

Table 9. Species of Concern

Common Name (*Scientific Name*)	Status	Habitat and Occurrence
Peregrine falcon (*Falco peregrines*)	NC: Endangered	Peregrine falcons are found in various open situations from tundra, moorlands, steppe, and seacoasts, especially where there are suitable nesting cliffs, to mountains, open forested regions, and human population centers (AOU 1983 in NatureServe2010). When not breeding, occurs in areas where prey concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports (NatureServe 2010). Birds often nest on ledges or holes on rocky cliffs or crags, and may also nest in river banks, tundra mounds, open bogs, large stick nests of other species, tree hollows, and man-made structures (e.g., ledges of city buildings, bridges, rock quarries, and raised platforms) are used locally (Cade 1982 in NatureServe 2010). In the United States, the Atlantic coast from New Jersey to South Carolina and the barrier islands of the Texas Gulf Coast are important feeding areas for long-distance migrants (NatureServe 2010). Peregrine falcons primarily feed on birds, and rarely take small mammals, lizards, fish, or insects (NatureServe 2010). The birds may hunt up to several kilometers from nest sites (NatureServe 2010). Threats include loss of wetland habitat of primary prey, poachers robbing nests, shooting by hunters, and food chain contamination from use of persistent pesticides (NatureServe 2010). Reintroduced populations in some areas of the eastern United States (e.g., barrier islands of the mid-Atlantic states) may be threatened by increasing human disturbance and use of nesting habitat (Byrd and Johnston 1991 in NatureServe 2010). The peregrine falcon is listed as present in the national historic site and a species of management concern (NPS 2010b). Peregrine falcons have been recorded to annually nest in the national historic site and fledge chicks (NPS 2010b).
Carolina watersnake *(Nerodia sipedon williamengelsi)*	NC: Special Concern	Carolina watersnakes are found in salt or brackish marshes and are endemic to North Carolina (NCNHP 2011). The species is listed as present in the national historic site and a species of management concern (NPS 2010b).
Timber rattlesnake (*Crotalus horridus*)	NC: Special Concern	The timber rattlesnake's preferred habitat in its southern range consists of hardwood forests, swampy areas and floodplains, wet pine flatwoods, river bottoms, hydric hammocks, and hardwood forests and cane fields of alluvial plain and hill country (NatureServe 2010). The species primarily feeds on small mammals, but may also include birds, bird eggs, lizards, and other small animals (NatureServe 2010). Threats to the species include loss of habitat; habitat fragmentation, and isolation of populations, which may become small and nonviable; and direct mortality caused by humans (including illegal snake hunters) and vehicles as habitat is encroached upon by urban/residential development (Brown, in Tyning 1992; Brown 1993 in NatureServe2010). The timber rattlesnake is listed as present in the national historic site and a species of management concern (NPS 2010b).

Table 9. Species of Concern

Common Name (*Scientific Name*)	Status	Habitat and Occurrence
Butterflies		
Giant swallowtail butterfly *(Papilio cresphontes)*	NC: Significantly Rare	Giant swallowtail butterflies are primarily associated with coastal areas in maritime forests or thickets, but may also be found in the foothills and mountains near prickly ash (*Zanthoxylum* sp.) or hoptree (*Ptelea trifoliate*), or gardens (NCNHP 2011; NatureServe 2010). The species breeds in a variety of habitats with suitable native or non-native Rutaceae (including citrus groves) (NatureServe 2010). The giant swallowtail butterfly has been found near The Elizabethan Gardens and is presumed to occur in the nearby mature Maritime Evergreen Forest (Schafale 2010). The last recorded observance near the national historic site was in 2007 (NCNHP 2011).
Northern oak hairstreak butterfly (*Satyrium favonius Ontario*)	NC: Significantly Rare	The northern oak hairstreak butterfly is associated with oak-dominated woods, usually in dry sites (NCNHP 2011). Oak species are the primary hosts for the butterfly (NCNHP 2011). The last recorded observance near the national historic site was in 1977 (NCNHP 2011).
Little metalmark (*Calephrys hesseli*)	NC: Significantly Rare	The little metalmark is found from southern Maine south along the Atlantic coastal plain to Gulf Coast of northern Florida (butterfliesandmoths.org N.D.). The species inhabits coastal plains swamps and stream banks and associated barrens (NCNHP 2011). Atlantic white cedar is the primary caterpillar host for the little metalmark. Adult butterflies feed primarily on nectar from flowers including swamp milkweed (*Asclepias incarnate)*, shadbush (*Amelanchier* sp.), sand myrtle (*Leiophyllum buxifolium)*, sweet pepperbush (*Clethra* sp.*)*, highbush blueberry (*Vaccinium* sp.*)*, buttonbush (*Cephalanthus occidentalis)*, and dogbane (*Apocynum cannabinum*) (NCNHP 2011). The little metalmark is listed as present in the national historic site and a species of management concern (NPS 2010b).
Blue witch grass (*Dichanthelium caerulescens*)	NC: Endangered	Blue witch grass is primarily associated with wet savannas with a calcareous influence (NCNHP 2011). The last recorded observance near the national historic site was in 1898 (NCNHP 2011).
Ringed witch grass (*D. annulum)*	NC: Significantly Rare	Ringed witch grass occurs in dry sandy or rocky open woods and borders of thickets (NCNHP 2011). The species was last observed within a 2-mile (3.2 kilometer) radius of the national historic site in 1958 (NCNHP 2011).
Moundlily yucca *(Yucca gloriosa)*	NC: Significantly Rare	Moundlily yucca is a rare evergreen shrub found along North Carolina's coast. Primary habitat for this species includes dunes and is associated with yaupon (*Ilex vomitoria*) and southern redcedar (*Juniperus silicicola*) shrubs (Cook 2011). The flowering / fruiting period for the species occurs during October (Fussell 1997b). Moundlily yucca is currently pending NPS confirmation in the national historic site (NPS 2010b).

Table 9. Species of Concern

Common Name (*Scientific Name*)	Status	Habitat and Occurrence
Twig-rush (*Cladium mariscoides*)	NC: Significantly Rare – Other	Twig-rush occurs in open, sunny, wet areas dominated by sedges (NatureServe 2010). Primary habitat for this species includes: calcareous and saline marshes and swamps; patterned water tracks, spring fens, and calcareous fens; and wetlands and swales of the Atlantic coastal plain and the Great Lakes (NatureServe 2010). Threats to twig-rush include sedimentation, land-use conversion, habitat fragmentation, forest management practices, exotic species, and beach migration (NatureServe 2010; Fussell 1997b). Twig-rush was observed by 1997 (Fussell 1887b) and is currently a species of management concern (NPS 2010b).
Saltmarsh spikerush (*Eleocharis halophila*)	NC: Threatened	Saltmarsh spikerush was reported as a tentative observation of species in 1997 (Fussell 1997b) and is currently listed as a species of management concern (NPS 2010b). Current threats include competition with common reed (*Phragmites australis)* in marsh areas and land development (NPS 2010b).
Winged seedbox (*Ludwigia alata*)	NC: Significantly Rare - Peripheral	Winged seedbox inhabits a broad spectrum of wetland habitats, but mostly near-coastal types, including wet to ponded dune swales, brackish marshes, fresh tidal marshes (including "wind tide marshes" in Virginia), wet pockets in maritime forests, pond cypress depressions, shores of freshwater lakes, margins of spring-fed rivers, margins of blackwater rivers, wet hammock woodlands on oolite, roadside ditches, and borrow pits (NatureServe 2010). Currently, it is found in seven counties in North Carolina and is likely declining due to development of coastal counties; however, no hard data exist (NatureServe 2010). Winged seedbox was observed in 1997 (Fussell 1997b) and is currently a species of management concern for the national historic site (NPS 2010b). Threats include beach migration and competition with common reed in marsh areas (NPS 2010b).

Source: Species of concern were obtained from NPS 2010b, NPS 2011, and NCNHP 2011. References are provided in Appendix C.

national historic site contains a variety of communities ranging from vegetation-stabilized sand dunes on its eastern shore, interior maritime forests, and extensive tidal marsh swamps in the southern area of the national historic site (NPS 2010c). The pervasive vegetative character of the site is secondary growth woodland, with open areas that include overhead tree canopy (NPS 2010c). Information on State-listed plant species is provided in the "Species of Concern" section of this chapter.

The national historic site's landscape is heavily wooded and dominated by live oak (*Q. virginiana*), laurel oak, blackjack oak (*Q. marilandica*), sassafras (*Sassafras albidum*), American holly (*I. opaca*), yaupon holly, loblolly pine (*Pinus tæda*), flowering dogwood (*Cornus florida*), wax myrtle (*Myrica cerifera*), and redbay (*Persea borbonia*) (NPS 2010c). Other species observed at the national historic site include: Virginia creeper (*Parthenocissus quinquefolia*), english ivy (*Hedera helix*), black cherry (*Prunus serotina*), osmanthus (*Osmanthus* sp.), hickory pignut (*Carya glabra*), red mulberry (*Morus rubra*), black oak (*Q. velutina*), water oak (*Q. nigra*), willow oak (*Q. phellos*), persimmon (*Diospyros* sp.), shortleaf pine (*Pinus echinata*), spruce pine (*P. glabra*), eastern red cedar (*J. virginiana*), serviceberry (*Amelanchier sp.*), silktree (*Mimosa* sp.), sparkleberry tree (*Vaccinium arboreum*), sumac (*Rhus* sp.), sweetbay magnolia (*Magnolia virginiana*), moundlily yucca, baccharis (*Baccharis halimifolia*), American beautyberry (*Callicarpe Americana*), Carolina jasmine (*Gelsemium sempervirens*), grape (*Vitus* sp.), greenbriar (*Smilax* sp.), poison ivy (*Toxicodendrum radicans*), trumpet flower (*Campsis radicans*), blueberry (*Vaccinium* sp.), partridgeberry (*Mitchella repens*), and silkgrass (*Pityopsis aspera*) (NPS 2010c).

Vegetation at the national historic site has had European influences since the 1600s and was completely deforested during the Civil War (Schafale 2010; NPS 2010c). During the 1960s, a mix of native and exotic trees, shrubs, and groundcovers were planted at the national historic site in an area from the Waterside Theatre parking lot to The Elizabethan Gardens parking lot. Tree species planted included natives such as longleaf pine (*Pinus palustris*), live oak, American holly, dogwood, redbud (*Cercis canadensis*), southern magnolia (*Magnolia grandiflora*), sweetgum (*Liquidamber styraciflua*), sourwood (*Oxydendrum arboretum*), black walnut (*Juglans nigra*), eastern red cedar, and sassafras, as well as the naturalized exotic, crape myrtle (*Lagerstroemia indica*). Native shrub species planted included inkberry (*Ilex glabra*), yaupon holly, sweetshrub (*Calycanthus floridus*), and moundlily yucca. Exotic shrubs and groundcovers planted included leucothoe (*Leucothoe* sp.), cotoneaster (*Cotoneaster horizontalis*), gardenia (*Gardenia florida*), and liriope (*Liriope spicata*). Most of the species planted in the 1960s appear to be present, with the exception of many of the exotic shrubs (NPS 2010c). Existing natural vegetation communities bear limited resemblance to their native condition; however, characteristic flora have re-established beneath the historic site's successional forest canopy (Schafale 2010).

Virginia creeper (*Parthenocissus quinquefolia*), one of the many species found at the national historic site.

Natural Communities

Vegetation at the national historic site was inventoried in 2010 by the North Carolina Natural Heritage Program and

has been described as containing four distinct vegetation communities: Maritime Evergreen Forest, Successional Wet Pine Flatwoods and Coastal Fringe Sandhill, Tidal Cypress – Gum Swamp, and Tidal Freshwater Marsh (Schafale 2010).

Maritime Evergreen Forests occur in sheltered areas of barrier islands but are subject to the extremes of the maritime environment, primarily salt water spray that shapes the canopy and excludes some tree species (Schafale 1990). These forests are also subject to periodic severe disturbance by wind and heavy salt spray of hurricanes (Schafale 1990). The Successional Wet Pine Flatwoods and Coastal Fringe Sandhill communities are identified near the tidal creek in the southern area of the national historic site. These communities suggest overgrown longleaf pine communities, but have been reported to represent former fields (Schafle 2010). More information on Maritime Evergreen Forests and the Successional Wet Pine Flatwoods and Coastal Fringe Sandhill communities are provided in the Fort Raleigh Maritime Forest Significant Natural Heritage Area discussion below.

The portion of the national historic site south of U.S. Highway 64, near Weir Point and the tidal creek, contains Tidal Cypress-Gum Swamp and Tidal Freshwater Marsh. Tidal Cypress-Gum Swamp areas of the national historic site are dominated by pond cypress (*Taxodium ascendends*) with some red maple (*Acer rubrum var. trilobum*) and swamp bay (*Persea palustris*). There is a substantial shrub layer of wax myrtle and swamp rose (*Rosa palustris*). The herb layer is fairly dense, with royal fern (*Osmunda regalis*), Virginia chainfern (*Woodwardia virginica*), Lizard's tail (*Saururus cernuus*), and green arrow arum (*Peltandra virginica*) abundant.

Tidal Freshwater Marsh occurs along the tidal creek, and extends well inland from Croatan Sound. Intact areas of marsh are dominated by Jamaica swamp sawgrass (*Cladium jamaicense*), with some common three-square (*Schoenoplectus pungens*); however, large areas have become dominated by common reed. Inland on the tidal creek, is a transitional area with wax myrtle dominant and dense herbaceous vegetation that includes arrowhead (*Sagittaria* sp.), smartweed (*Persicaria* sp.), marsh fern (*Thelypteris palustris*), climbing hempvine (*Mikania scandens*), and herb of grace (*Bacopa monnieri*). This area likely only recently converted to marsh from former swamp and will presumably continue to change, becoming more open and dominated by Jamaica swamp sawgrass. This area is susceptible to common reed invasion. A large ditch has been excavated through the most extensive portion of the marsh, separating it from inland areas.

Fort Raleigh Maritime Forest, North Carolina Significant Natural Heritage Area

A Significant Natural Heritage Area is an area of land or water identified by the North Carolina Natural Heritage Program as important for conservation of the State's biodiversity. Significant Natural Heritage Areas contain one or more Natural Heritage elements - high-quality or rare natural communities, rare species, and special animal habitats. The North Carolina Natural Heritage Program identified more than 2,000 Significant Natural Heritage Areas across the State. The Fort Raleigh Maritime Forest is currently listed as recommended for registry as regionally significant (Schafale 2010; NCNHP N.D.).

The Fort Raleigh Maritime Forest is located at the north end of Roanoke Island, within the Fort Raleigh National Historic Site boundary. The forest is divided into two areas of concern: a small area of Maritime Evergreen Forest located on the dunes near the reconstructed earth works, north of the national historic site visitor center (identified as primary concern), surrounded by a larger area of successional pine forest that occupies

the majority of the historic site (identified as secondary concern) (Figure 10). The forest totals 184.02 acres, including the 20.35-acre Fort Raleigh Maritime Forest. The Fort Raleigh Maritime Forest is reported as one of the best examples remaining in the Pamlimarle Peninsula region (Schafale 2010).

The mature Maritime Evergreen Forest of primary concern consists of dominate tree canopy of live oak, laurel oak, and loblolly pine. Understory species include swamp bay, devilwood (*Osmanthus americanus*), and American holly, in addition to smaller canopy oak species. The fairly dense shrub later is dominated by yaupon holly and includes smallflower pawpaw (*Asimina parviflora*), southern blueberry (*Vaccinium formosum*), and deerberry (*V. stamineum*).

The herbaceous layer is relatively sparse, but some areas are dominated by partridgeberry. The northern part of the primary areas is composed of younger tree species, and species along the shore are composed of shorter or younger canopy trees that are probably related to brackish water spray and storm exposure. The secondary area that makes up the majority of the forest consists of a successional Maritime Evergreen Forest. The canopy is dominated by loblolly pine, with an understory layer consisting of laurel oak, live oak, swamp bay, devilwood, as well as some red oak (*Q. falcata*) and flowering dogwood. The shrub layer is dominated by yaupon holly, with a sparse herb layer with partridgeberry sometimes common. Successional Maritime Evergreen Forest is likely a result of past clearing and farming in the area prior to establishment

Figure 10. Fort Raleigh Maritime Forest Primary and Secondary Areas of Concern

of the national historic site. A site survey indicated canopy gaps that may be attributed to southern pine beetles (*Dendroctonus frontalis* Zimmermann) (Schafale 2010).

The southern portion of the successional pine forest contains species that represent the Successional Wet Pine Flatwoods and Coastal Fringe Sandhill community. The canopy is composed of dense loblolly pine, with an understory of laurel oak, swamp bay, some dogwood, and blackjack oak. The shrub layer is well developed with blue huckleberry (*Gaylussacia frondosa*) or wax myrtle as dominant species interspersed with chinkapin (*Castanea pumila*) and sassafras. The herbacious layer varies from large patches dominated by western brackenfern (*Pteridium aquilinum*) or partridgeberry to other areas that include surge nettle (*Cnidoscolus stimulosus*), American ipecac (*Euphorbia ipecacuanhae*), and moccasin flower (*Cypripedium acaule*). The transition zone to the swamp at the south edge of the forest consists of loblolly pine, red maple, and tupelo (*Nyssa* sp.*),* with swamp bay, pink fetterbush (*Lyonia lucida*), and gray inkberry beneath. This community presumably represents former fields in this long-settled area (Schafale 2010).

Factors Affecting Natural Vegetation Communities

The national historic site is bordered by increasingly heavy development and experiences high traffic volume through the national historic site that represents a source of exotic plant seeds, feral pets, and other forms of intrusion that may affect natural vegetation communities in the national historic site. The Southeast Coast Exotic Plant Management Team surveyed and removed areas of invasive English ivy and Japanese wisteria (*Wisteria floribunda*) at the national historic site in November 2010 (NPS 2010d). The team treated four sites, totaling 6.7 acres within the national historic site, primarily around The Elizabethan Gardens (NPS 2010d). The team surveyed sites where common reed was treated in the past and recorded the location of the state-listed significantly rare moundlily yucca (NPS 2010d). An exotic form of common reed was identified to be extensive in the marshes around Weir Point (Schafale 2010).

English ivy is an exotic, invasive plant species at the national historic site.

The national historic site was treated for gypsy moths (*Lymantria dispar*) in 1999. Gypsy moths, since their introduction to the United States in 1869, have been responsible for defoliating thousands of acres of hardwood forests across the northern United States, including North Carolina. An aerial application of synthetic gypsy moth pheromone impregnated flake was applied to approximately 485 acres of forest at the national historic site, U.S. Fish and Wildlife Service property, and some private property. This action was the done in cooperation with the U.S. Department of Agriculture, Forest Service's "Slow the Spread Project" which was aimed at reducing the spread of the gypsy moth into vulnerable areas (USDA 2003).

Climate Change

Climate change affects sea level, amounts of rainfall, intensity and runoff, height, duration and frequency of ocean waves, and long-term tracks, intensity and frequency of coastal storms (Nichols 2002) that could affect habitat conditions, especially communities in close proximity to national historic site shorelines. Because different species are likely to respond differently

to climate change, current ecological communities may ultimately be replaced by entirely new assemblages of species (Root et al. 2003 in Loehman and Anderson 2009). Changes in terrestrial and aquatic species compositions are likely to occur as ranges shift, contract, or expand. Rare species and communities may disappear, and more common species may become rare (Burns et al. 2003 in Loehman and Anderson 2009).

Rising sea levels may continue to alter the national historic site (Schafale 2010). Sea level rise may increase the tidal influence on terrestrial resources, however the north end of Roanoke Island has enough slope that a 1.5-meter (4.5-foot) rise in sea level may not inundate most of it (Schafale 2010). Increased storm activity may affect the mature maritime forest on the north shore, and shoreline erosion may slowly consume the outer parts of the national historic site, however most of forest should persist for many years (Schafale 2010).

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's resources. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur (Schafale 2010). Specific impacts to the species of concern at the national historic site are as yet unknown.

CULTURAL RESOURCES

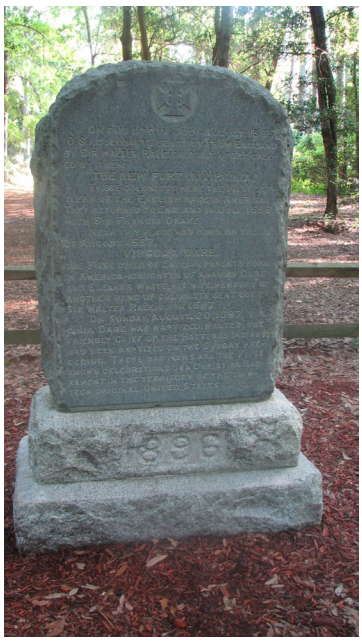
Cultural resources are aspects of a cultural system that are valued by or significantly representative of a culture or that contain significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as archeological resources, ethnographic resources, cultural landscapes, museum objects, and historic structures for NPS management purposes. This section provides a historical context for the cultural resources found at Fort Raleigh National Historic Site beginning with Native American settlements and ending with the transition to a NPS unit. Details regarding categories of known, documented cultural resources identified within the boundaries of the historic site are also provided.

Early History

Early Native American settlements persisted on Roanoke Island and other surrounding islands, forming a greater community with common leaders. The tribe living on Roanoke Island at the end of the sixteenth century grew corn, beans, squash, and spoke a dialect of the Algonquian language group. The local Algonquian community would largely shape the first English settlement on Roanoke Island. English settlers mimicked the village layout used by the Roanoke Indians, and the town of Wanchese on present day Roanoke Island was named for a member of the Roanoke Island Native American community encountered during the first English contact. However, archeological evidence of the Native American village of 'Roanoac' on Roanoke Island is nonexistent (Trebellas and Chapman 1999).

The first English exploration party arrived on Roanoke Island in July 1584 to explore and gather information. This initial survey party left two months later with two local Native Americans, Manteo and Wanchese, and recommendations for further exploration. Roanoke Island was a preferred site because it could be used for attacks on Spanish shipping, another purpose for colonization besides resource extraction and claiming territory for British

interests. The next English ships arrived in June 1585 with 107 colonists and provisions to stay. Wanchese and Manteo also returned to Roanoke Island on this voyage. The site on Roanoke Island proved to be a poor base for privateering (piracy with government authorization and targeted at a specific enemy) due to a shallow harbor and as a result, long term plans involved finding a more suitable permanent site. The expedition led by Ralph Lane built homes, a fort, and a science center, but all these structures were abandoned in June 1586 due to conflicts with the local Native Americans and other hardships. Fifteen men were left by a supply expedition that arrived shortly after the colonists' departure (Trebellas and Chapman 1999).



Virginia Dare, the first English child born in the New World, is memorialized at the national historic site.

On June 22, 1587, the "lost colony" arrived off the Outer Banks to make contact with the 15 remaining men left by the previous English party. These 110 colonists were to proceed to the Chesapeake region, but stayed at Roanoke Island for unknown reasons. The colonists cleaned up the fort and built new housing, in addition to occupying the former dwellings from the year before. This settlement became the "Cittie of Ralegh." At this site, now archeologically unaccounted for, the first child of English parents, Virginia Dare, was born in North America. In August 1587, John White, the leader of the expedition and grandfather to Virginia Dare, returned to England to recruit more colonists and bring back provisions (Trebellas and Chapman 1999).

Three years later, in March 1590, John White returned to Roanoke Island to find the colony abandoned. The colonists were presumed to have fled to Croatoan Island or to have mixed with the Native Americans, but no evidence remains (Trebellas and Chapman 1999). Nevertheless, the historical importance of this colonization attempt cannot be underestimated. "The Roanoke Island colony, while never successful, set the precedent for future English colonization efforts in the New World … [It] marked the transition from a military outpost to a settlement of both men and women attempting to establish a permanent foothold in North America." (Trebellas and Chapman 1999). The "Cittie of Ralegh" has not been identified archeologically. Remains of the fort were found, but some historians and archeologists believe this fort is from a later date. The location of the "science center" associated with Ralph Lane's expedition was identified, but the changing coastline of Roanoke Island may put the missing settlement areas underwater (Trebellas and Chapman 1999).

Roanoke Island continued to be populated by Native Americans after the original English attempts at colonization. However, by the mid 1600s, European Americans began to migrate into the area. An agreement was reached in 1654 for the Roanoke Indians to move inland so British colonists could occupy the more valuable land along the coast. Settlers soon began filtering down from current-day Virginia, tending cattle and growing tobacco (Trebellas and Chapman 1999).

19th Century History

A farming- and fishing-based community persisted on Roanoke Island throughout the 1800s. The Dough Farm and Cemetery is evidence of this community. The Outer Banks region did not provide the necessary elements for a plantation society, so slavery took on a different form on Roanoke Island. For instance, slaves often fished for their masters, which would have been a much different lifestyle than that which their counterparts experienced on the mainland. The U.S. Census of 1850 listed the total population of Roanoke Island at 610, consisting of 442 residents and 168 slaves (Crumley 2005).

During the Civil War, the Outer Banks and Roanoke Island were at a strategic location important to naval penetration of the Southern defenses in North Carolina, as well as a conduit for military access to the strategic naval base at Norfolk, Virginia. This area of the North Carolina coastline provided a crucial supply line for the transport of goods. As a result, the Confederacy placed a priority on defense of the Outer Banks and Roanoke Island, constructing several forts (Forts Huger, Blanchard, and Bartow) and earthworks on the northern end of Roanoke Island. Nevertheless, General Ambrose Burnside and his Union forces captured the island in February 1862. The ensuing transfer of power gave rise to a Freedmen's Colony on Roanoke Island, a notable part of the area's past (Crumley 2005).

"After Burnside's victory, he appointed Vincent Colyer as Superintendent of the Poor in the Department of North Carolina on March 30, 1862. . . . It was incumbent upon Colyer to organize and find employment for the contrabands [former slaves] by initially having them construct earthworks on Roanoke Island, New Bern, and Washington. Docks were also constructed on Roanoke Island to receive the large volume of supplies that the Union Navy ferried in for both soldiers and contrabands. Like many other Northerners, Colyer was not an ardent abolitionist but was pragmatic and did not believe in the South's 'peculiar institution' of slavery." (Crumley 2005). At this time, runaway slaves or contrabands took advantage of the safe haven provided by areas in the South controlled by Union troops. The geographic separation from the mainland that Roanoke Island offered gave runaway slaves an even greater sense of security and led to a large Freedmen's Colony. (A more detailed description of the Freedmen's Colony is provided in the Ethnographic Resources section below.)

The post-Reconstruction period on Roanoke Island was relatively uneventful, with the exception of the establishment of U.S. Lifesaving Service Stations on the Outer Banks in the 1870s. These stations were built along the U.S. Eastern seaboard to assist in the rescue of imperiled ships. The Atlantic Ocean off the coast of the Outer Banks was a dangerous, yet heavily trafficked area, with the apt nickname of "The Graveyard of the Atlantic" (Crumley 2005). As the 20th century approached, the only way to reach Roanoke Island was via boat. The primary means for employment, other than in the Lifesaving Service, were either fishing or farming.

20th Century History

In 1901, Reginald Fessenden chose Roanoke Island as a site for radio experimentation. His work led to the island's distinction as the location of the first commercially adaptable radio broadcast in North America.

Fessenden resided at a hotel in Manteo and built an experimentation station on the western portion of the island at Weir's Point, in the location that U.S. Highway 64 now intersects with the bridge connecting the mainland. It is now believed that the greater portion of Fessenden's site is submerged (Crumley 2005). Another first, the Wright Brothers flight at Kitty Hawk in 1903, was

noted throughout the Roanoke Island Community as well (Trebellas and Chapman 1999).

The early 20th century brought tourism to Roanoke Island and created an economy very different from the island's previous farming and fishing livelihood. The Roanoke Island Historical Association was formed in the late 19th century and placed the first marker to commemorate the Roanoke Colony in 1894 (Trebellas and Chapman 1999). Historical tourism became a much greater part of Roanoke Island in the 20th century. By the 1920s, the birthday of Virginia Dare was becoming an important annual event for Roanoke Island. A bridge to the mainland was opened in 1928, and greater plans to accommodate more tourists were planned. At about this same time, there was a "renewed interest in making Fort Raleigh a landmark. Dare County not only was connected to the mainland by a bridge but it also had ten miles of highway running through it. Tourism was anticipated to surge, and the Fort Raleigh site was viewed as a possible attraction that could draw tourists on a year-round basis. There were questions raised as to why the Wright Brothers were getting a memorial while Virginia Dare was being overlooked. It was suggested that either the state or national government take over the Fort Raleigh site and develop it into a viable project." (Crumley 2005).

The Great Depression slowed private development, but New Deal programs came to Roanoke Island in the form of Civilian Conservation Corps camps, Works Progress Administration funds, Coast Guard facilities, and Paul Green's *The Lost Colony* production in 1937. *The Lost Colony* outdoor symphonic drama, which has presented over 4,000 performances (Crumley 2005) has played a large role in the history of Fort Raleigh National Historic Site. Crumley's *Roanoke Island Special History* (2005) describes it as such:

> In a very early template of the concept of "build it, they will come," playwright Paul Green was commissioned to write the script for the production. Green was a native of North Carolina whose roots were in rural Harnett County. In 1927, he won the Pulitzer Prize for his Broadway play, *In Abraham's Bosom*, which was a depiction of black life in the South. Green was also the first playwright from the South to receive both national and international recognition for his work. What was seminal about his work was that Green had formulated a new dramatic art form that is now known as symphonic drama, which combined historical circumstances along with music, dance, and dialogue. His works attracted prominent stars of the era, such as Bette Davis and Will Rogers, to perform parts in them. Andy Griffith, star of *Matlock* and the classic *Andy Griffith Show*, both long-running television series, along with the silver screen hit, *No Time for Sergeants* to his credit, played the part of Sir Walter Raleigh for seven seasons during the 1940s and early 1950s, prior to achieving national prominence.
>
> It was obvious that the date for the grand opening of *The Lost Colony* in 1937 was not selected at random. The Fourth of July, America's birthday, was the day of the initial performance of a play that is now over sixty-five years old and the longest running outdoor stage show in American history. *New York Times* drama critic Brooks Atkinson attended the show's opening performance and wrote, "Paul Green has written a history with a compassion that turns its characters into unconscious symbols of a brave new world." A review such as that, having a national exposure, could not help but attract an audience far

> beyond the limited boundaries of Dare County and North Carolina.

The North Carolina Historical Commission assumed control of the site as a state park in 1934, and it received federal assistance to commemorate and reconstruct the early English settlement (Trebellas and Chapman 1999). With the grand opening of *The Lost Colony* production in 1937, President Franklin D. Roosevelt made an appearance on Roanoke Island. Then, in 1939, ownership and management responsibilities were transferred to the NPS. Two years later, Fort Raleigh National Historic Site was established to commemorate Sir Walter Raleigh's colonies and the birthplace of Virginia Dare, the first child of English parents born in America. The Roanoke Island Historical Association would maintain a stake in the site through a cooperative agreement. Fort Raleigh National Historic Site was expanded and improved throughout the remainder of the century, exhibiting its current inventory of recreated structures and interpretation (Crumley 2005).

National Register of Historic Places

Fort Raleigh National Historic Site was initially placed on the National Register of Historic Places in 1966, with additional revisions submitted in 1978 (NPS 1978). The National Register of Historic Places documentation was amended in 1999 to re-evaluate earlier research (NPS 1999). The site is listed on the National Register of Historic Places under both Criteria A and D, for its association with events that made a significant contribution to the broad patterns of our history and for its potential to yield information important in history, respectively. Tables 10 and 11 list archeological resources and historic structures discussed within the most recent evaluation (Prentice and Groh 2010). The tables indicate whether each resource contributes to the overall site, if it has been located, and if it has been determined to be eligible for listing on the National Register of Historic Places.

According to the National Register of Historic Places nomination update, Fort Raleigh National Historic Site "is bounded by a series of landscape features and imaginary lines that intersect to form a polygon around the area containing the contributing historic resources. Beginning at the Roanoke Sound, the boundary runs south and east along the eastern edge of The Elizabethan Gardens for approximately 800 feet. It then runs east for approximately 850 feet to the southwestern corner of the Waterside Theatre parking lot. The boundary follows the edge of the parking lot north and east for approximately 300 feet to the trail leading from the parking lot to Waterside Theatre. It then runs along this trail for approximately 350 feet and turns north and east along the edge of Waterside Theatre for almost 325 feet. The boundary then follows the edge of the Roanoke Sound to the beginning." (Trebellas and Chapman 1999).

The 1999 National Register of Historic Places re-evaluation established two contexts that can be used to assess eligibility and evaluate integrity of individual resources within the overall site:

> "Context A, 'The Roanoke Colonies and Fort Raleigh,' addresses the long recognized context for the site, 'English Exploration and Settlement on Roanoke Island and the Outer Banks of North Carolina, 1585-1590,' and describes the unsuccessful English colonies on the island. This context is related to the NPS interpretive theme of Peopling Places, as well as certain aspects of North Carolina history, such as English Exploration and Settlement of the Carolinas. Context B, 'Fort Raleigh National Historic Site: Preservation and Recognition,' outlines the early preservation and commemoration of the Roanoke

Table 10: Archeological Resources

Archeological Resource	Date	Contributing[1]	Located	Eligible for listing on the National Register of Historic Places
Fort Raleigh	800-1965	Yes	Yes	Yes
Outwork and Science Center	1585-1586	Yes	Yes	Yes
Cittie of Raleigh	1585-1590	No	No	Yes
Dough Farmstead	1860-1965	No	Razed	No
Village Stockade	1936-1950	No	Razed	No
Gates	1936-1950	No	Razed	No
Museum	1936-1950	No	Razed	No
Chapel	1934-1965	No	Razed	No
Ananias Dare Cabin	1936-1950	No	Razed	No
John White House	1936-1950	No	Razed	No
Blockhouse (Storehouse)	1934-1965	No	Razed	No
Cabin #1	1936-1950	No	Razed	No
Cabin #2	1936-1950	No	Razed	No
Dough Cemetery	800-1950	No	Yes	No
Dough Cemetery Plot	1827-1906	No	Yes	No
WPA Medical Area	1930s	No	Yes	No
Trash Pit	1900-1950	No	No	No
Old Faithful	Circa 1850	No	Yes	No
Fort Huger (Fort Reno)	1861-1867	No	No	No
Area A	1861-1867	No	Yes	No
Area D	1861-1867	No	Yes	No
Area E	1861-1867	No	Yes	No
Area F	1861-1867	No	Yes	No
Artifact Scatter	1861-1867	No	Yes	No
Roadside Dump	Circa 1850-1900	No	No	No
Camp Foster/Freedmen's Colony	1861-1867	No	Yes	Yes
Freedmen's Colony	1861-1867	No	No	Yes
North Shore	Circa 1800-1850	No	Yes	No
Alder Branch Marsh	5000 B.C. – 1650	No	Yes	No
High Ridge	Circa 1800-1890	No	Yes	No
Tart Etheridge	Circa 1850-1875	No	Yes	No
Camp Wirth	1930s	No	Yes	Yes
Camp Wirth Trash Dump #1	1930s	No	Yes	No
WPA Shoreline Trash Dump	1930s	No	Yes	No
Old Ferry Road (Freedom Trail)	1862-1950	No	Yes	No

[1]The reason most resources are not considered as contributing to site status is due to the fact that they have not yet been located.

Source: Prentice and Groh 2010

Table 11: Historic Structures

Historic Structures	Date	Contributing	Located	Eligible for Listing on the National Register of Historic Places
Fort Raleigh Reconstructed Earthwork Fort	1947-1953	Yes	Yes	Yes
Waterside Theatre	1937-1970	No	Yes	No
Prince House	1940-2012	No	Yes	No
Northeast Ossuary	800-1650	No	Yes	No
Camp Wirth Building #1	1930s	No	Yes	No
Camp Wirth Building #2	1930s	No	Yes	No
Camp Wirth Cistern	1930s	No	Yes	No
Camp Wirth Waste Water Vaults	1930s	No	Yes	No

Source: Prentice and Groh 2010

> colonies and the fortification known as Fort Raleigh, as well as its connection to national preservation movements. This context relates to the themes of Creating Social Institutions and Movements and Expressing Cultural Values. It also reflects certain aspects of North Carolina history, such as Historic Preservation and Social and Humanitarian Movements." (Trebellas and Chapman 1999).

The significance statements for Fort Raleigh National Historic Site are described relative to their context. For 'Context A,' the amended National Register of Historic Places documentation states that "the site of the science center associated with the Roanoke colonies has national significance under Criterion D. It represents the only tangible evidence of the Elizabethan age in North America and marks the site of the first English colonizing efforts, which led the way for future successful English colonies in the New World. The science center is nationally significant under Criterion D for the proven potential of its archeological resources to yield information on the first English settlement in North America. Although there are no extant structures, and the settlement site and fortification have yet to be located, the archeological findings over the last fifty years document the establishment of a sixteenth-century science center within the Fort Raleigh National Historic Site boundary which is eligible for the National Register of Historic Places." For 'Context A,' the amended National Register of Historic Places documentation reports that, "While the Fort Raleigh National Historic Site is nationally significant for its association with early English colonization efforts in North America (see Context A), the preservation and commemoration efforts of the site for more than 135 years represent an additional area of significance. The site is exceptional for the degree of local and state attention and for the richness of its historical associations." (Trebellas and Chapman 1999).

Archeological Resources

The boundaries of Fort Raleigh National Historic Site encompass a broad range of archeological sites that embody nearly the full spectrum of eastern Carolina Native American culture, the American Civil War including the African-American Freedman's Colony, a Depression era Works Progress Administration camp, and the life and career of radio pioneer, Reginald Fessenden (National Park Service 1992).

An Archeological Overview and Assessment of Fort Raleigh National Historic Site was completed in 2010 (Prentice and Groh, 2010). This assessment "presents a summary of previous archeological investigations conducted within the park as well as detailed accounts of all known archeological resources. The overview also evaluates the efficacy of past research and offers recommendations regarding protection and management of these resources. These recommendations are based on NPS policy and regulations, the goals of Fort Raleigh National Historic Site's Resource Management Plan (National Park Service 2000), the Regionwide Archeological Survey Plan (Keel et al. 1996), previous archeological investigations, and current plans affecting the cultural resources of Fort Raleigh National Historic Site as outlined by park management."

As listed in Tables 10 and 11, several archeological resources have been identified near or within the national historic site, including the former science center from the Ralph Lane Colony in 1585 to 1586. The Ralph Lane Colony included a center for scientific investigation of North America. Thomas Hariot, an English scientist, and Joachim Ganz, a metallurgist from Prague, oversaw the investigation of North American resources in an equipped structure that is speculated to have been protected by the earthen fort. Pieces of laboratory equipment, including crucibles, glassware, and distilling flasks, were discovered near the area where the original fort is thought to have been. Many of the other archeological resources are known to have existed within or adjacent to the current boundary of the national historic site also would be considered eligible for inclusion in the National Register of Historic Places, but their exact location is presently undetermined.

Climate Change

Climate change affects sea level, amounts of rainfall, intensity and runoff, height, duration and frequency of ocean waves, and long-term tracks, intensity and frequency of coastal storms (Nichols 2002) that could affect archeological sites, especially sites located in the vicinity of shorelines. Natural disasters such as hurricanes, tropical storms, northeasters, and tornadoes can also result in site alterations. Rapid erosion along areas such as Roanoke Sound, Albemarle Sound, and Croatan Sound causes loss of archeological sites, damage to site integrity and loss of diagnostic data. By mixing older and new deposits, storms can make definition of different site occupants, functions, or periods of use difficult, if not impossible.

Epic storms and changing sea levels can adversely affect submerged resources. That is, archeological resources in shallow waters could be damaged by high frequency waves of long duration. Or, increased sea levels could offer some measure of protection. Rising sea levels and frequent storm events can contribute to the physical damage to or loss of coastal historical and archeological resources. Climate change could contribute to unanticipated changes in the types of vegetation and location of vegetation communities on the island, affecting archeological sites. However, the levels and types of change cannot, at present, be determined.

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's archeological resources. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration

of shoreline erosion would potentially occur (Schafale 2010). Specific impacts to archeological resources at the national historic site are as yet unknown.

Ethnographic Resources

Ethnographic resources are defined by the NPS as any "site, structure, object, landscape, or natural resource feature assigned traditional legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it" (NPS 28, Cultural Resource Management Guideline, 181). Ethnographic resources are cultural resources that are uniquely understood from the specific viewpoint of particular people or groups. These resources have a special importance relative to these people or groups that is different from the more general qualities observed or enjoyed by the general public (NPS 2010b). While not formally documented, there exists the potential for an ethnographic resource at Fort Raleigh National Historic Site in the form of a connection to the landscape held by descendents of the inhabitants of the Freedmen's Colony of the 1860s.

First Light of Freedom memorial commemorating the Underground Railroad.

Roanoke Island was the setting for an historic experiment during the Civil War. Following the island's occupation by Union forces in 1862, it became a haven for African-American families from throughout the region. Their presence prompted the Union Army to establish a Freedmen's Colony on the northern end of Roanoke Island. This colony, similar to others established by the Union Army, gave African Americans their first tastes of independence and freedom. However, like other sites, it was short-lived (NPS 2011d).
Labeling slaves as "Contraband of War," the Union Army emancipated them, offering a new start on Roanoke Island. Soon, hundreds of slaves from the interior of the state made the journey to Roanoke Island. By May 1863, the population situation was so acute that the Federal government seized many local lands and established a formal colony. Major General John G. Foster, commander of the Department of North Carolina, instructed Army chaplain Reverend Horace James as "Superintendent of Blacks in North Carolina" to "settle the colored people on the unoccupied lands and give them agricultural implements and mechanical tools… and to train and educate them for a free and independent community." According to Assistant Superintendent George O. Sanderson, a sergeant with the 43rd Massachusetts Infantry, the Freedmen's Colony was laid out on the north end of the island using "compass, chart and chain, and a gang of choppers" among "the old groves of pine, gum and cypress" (NPS 2011d).

A local census in 1864 reported that 2,212 black freedmen resided on the island. A church and several schools with seven teachers were established, as well as a sawmill operation. The next year, the Superintendent reported 561 houses had been built and the population had increased to 3,901. At the end of the war, a government order restored all lands that were confiscated by the Union Army back to the original owners. The black residents on Roanoke Island failed to receive the rights and privileges to their homesteads promised by the government when they established the colony. Further government orders that

reduced food rations and other necessities of life ushered the beginning of the end. The colony's population declined by half from 1865 to 1866 as residents left to seek a new life elsewhere. By late 1866, the Freedmen's population had dwindled to a few families and, by 1867, the colony was officially decommissioned (NPS 2011d).

The Freedmen's Colony on Roanoke Island never became the self-sufficient community its planners envisioned. Its isolation and the transfer into the army of most of the working men made the residents more and more dependent on the government for support. It did, however, provide homes for the families of soldiers, brought education for the first time to the colony's residents, and gave them a renewed sense of hope. Furthermore, while most of the freedmen returned to the mainland, many descendants still live, work, and raise their families on Roanoke Island today (NPS 2011d).

In 2003, the national historic site hosted an event in which the Roanoke Island Freedmen's Colony was received into the Underground Railroad Network to Freedom, a nationwide program of sites that represent the story of the Underground Railroad (NPS 2003b). African Americans whose heritage is linked to the Freedmen's Colony, both those who still live nearby and those who have moved away, may still value the north end of Roanoke Island as the place where their forefathers first experienced freedom from slavery. This sense of place and events that occurred are meaningful to descendants. This is embodied in the stories passed down over generations, and in the feeling of pride and of "belonging" to this area. As such, landscapes within the national historic site may function as an ethnographic resource. The First Light of Freedom Memorial is located in the plaza immediately adjacent to the visitor center. It was placed on site in 2001 as part of the North Carolina Civil War Heritage Trail, funded via a State of North Carolina grant received by the Freedmen's Remembrance Committee. In addition, there is a wayside exhibit that highlights the Freedmen's Colony located in a plaza beside the visitor center. Two ranger-led interpretive sessions are also held twice weekly with national historic site visitors.

Climate Change

Increased storm frequency and intensity along with rising sea levels are anticipated consequences of climate change. Damaging storms and erosion could adversely impact ethnographic resources and places important to the national historic site's culturally associated peoples. Some terrestrial sites/resources may be at risk of submersion as sea levels rise. Alteration of the barrier islands associated with climate change may also accelerate shoreline erosion. These changes may cause impacts to some resources and places important to culturally associated peoples to occur. Specific impacts to the ethnographic resources at the national historic site are as yet unknown.

Cultural Landscape

A cultural landscape is defined as "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person or exhibiting other cultural or aesthetic values. . . . Like historic buildings and districts, these special places reveal aspects of our country's origins and development through their form and features and the ways they were used (NPS 2011b)." According to a cultural landscape inventory completed in 2010 for Fort Raleigh National Historic Site (NPS 2011c), the landscape continues to reflect the national historic site's unique development patterns from three different periods of significance.

The Cultural Landscape Inventory provides a useful planning tool to successfully implement management actions with consideration of features and patterns that contribute to the cultural landscape. This inventory indicates that the most

important natural feature of the cultural landscape of Fort Raleigh National Historic Site is the shoreline along Roanoke Sound, Albemarle Sound, and Croatan Sound. Over the years this shoreline has been modified and continues to be threatened by natural forces. Shoreline erosion along these banks has been an ongoing problem and has required protective measures to prevent further damage. The erosion protection efforts can be seen from Dough Cemetery and Waterside Theatre on the north end of the national historic site. Tidal movements and storm destruction have been a part of the history of the cultural landscape, and have contributed to the loss of some of the national historic site. In addition to natural features such as the shoreline, other features that combine to contribute to the overall cultural landscape include the following: spatial organization, land use, topography, vegetation, circulation, buildings and structures, and small-scale features such as benches and trash cans (NPS 2011c).

The settlements in 1584, 1585 to 1586, 1587, and 1590 constitute the first period of significance. Although elements from this period are not readily observable, archeological resources may remain within the national historic site boundaries that date to this time of attempted permanent settlements. However, the Cultural Landscape Inventory states that because there is a lack of known remains, the site is considered to have little integrity from this period of significance (NPS 2011c).

The second period of significance, 1860 to 1953, centers around efforts to preserve and commemorate the site. During this period, significant man-made site features were introduced to the landscape that enhanced its interpretive value. Examples of landscape features from this time include the Raleigh Colony/Virginia Dare Monument, Waterside Theatre, interpretation of the "Cittie of Ralegh," interpretation of the science center, the Thomas Hariot Nature Trail, The Elizabethan Gardens, the memorials of Franklin Delano Roosevelt's speech and his attendance at the twenty-third performance of *The Lost Colony*, restoration of natural vegetation, erosion control measures at Dough Cemetery and Waterside Theatre, reconstructed earthwork fort based on archeological studies performed by Jean D. Harrington, and the Freedmen's Colony interpretation and First Light of Freedom monument. According to the Cultural Landscape Inventory, the site has moderate integrity overall in relation to this period of significance, with some changes implemented over time (NPS 2011c).

Reconstructed earthen fort.

Most of the primary features that serve to define the site are in the approximate location where they existed during the 1860 to 1953 period. However, vegetative patterns have altered throughout this period, and no historic cultural vegetation has been identified. The original spatial organization of the site prior to the 1960s is difficult to discern today due to the Mission 66-era changes to the national historic site (discussed in the paragraph below), including the relocation or abandonment of roadways and construction of new buildings, roads, and parking lots. However, the historic core of the site maintains many aspects of the original design. The landscape within the boundaries of the national historic site possesses a moderate to high level of integrity of setting and feeling in relation to its 1860 to 1953 period of significance, especially in the historic core of the national historic site, where Waterside Theatre and the Thomas Hariot Nature

Trail still retain their visual relationships to Roanoke Sound. The site has only moderate integrity of materials and workmanship because many features have been replaced or heavily altered since the period of significance (NPS 2011c).

The third period of significance relates to Mission 66 development at the national historic site from 1963 to 1966. During this timeframe, the visitor center, Outer Banks Group Support Office (formerly the Cape Hatteras Group Headquarters), the plaza and walk complex adjacent to these buildings, The Lost Colony Activities Building, four staff residences on Pear Pad Road, and the restroom building and generator rooms near the Outer Banks Group Support Office, were constructed. The Mission 66 program was initiated by the NPS after World War II to address the rapid increase in visitors to the national parks. In general, Fort Raleigh National Historic Site retains good integrity for this third period of significance. The buildings and site features (primarily the plaza and walk complex) remain in their original locations, reflect their original design, retain their original setting, retain their original materials, reflect their original workmanship, and convey the feeling and association of the Mission 66 period of significance.

Climate Change

Increased storm frequency and intensity along with rising sea levels are anticipated consequences of climate change. Increasing storms and high winds have the potential to adversely impact cultural landscapes, diminishing the integrity of landscape features (spatial organization, land use patterns, circulation systems, topography, vegetation, and other character-defining elements). Increased potential for shoreline erosion as a result of sea level rise and intensity and frequency of storms may affect the national historic site's shoreline along Roanoke Sound, Albermarle Sound, and Croatan Sound.

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's resources including the cultural landscape. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur (Schafale 2010). Physical changes (erosion, effects from flooding) to the landscape associated with climate change may alter resources that contribute to the national historic site's cultural landscape. Specific impacts to the national historic site are as yet unknown.

Museum Collections

Museum collections consist of prehistoric and historic objects, artifacts, works of art, archival material, and natural history specimens. Fort Raleigh National Historic Site has almost 57,000 items in their museum collections. Most of these are archival materials, of which 41,915 items have been catalogued; approximately 15,000 items (also mostly archival items) remain uncatalogued. The majority of the collections are stored in the Museum Resource Center within the national historic site. A few artifacts are on display in the national historic site's visitor center. A 2,800-square-foot, state-of-the-art artifact laboratory and depository (i.e., the Museum Resource Center) enables Fort Raleigh National Historic Site museum collections to be conserved and studied on-site (NPS 2010a).

Climate Change

Increased storm frequency and intensity along with rising sea levels are anticipated consequences of climate change. Museum collections stored in the Museum Resource Center at the national historic site may potentially be destroyed or damaged by storms, high winds, and flooding. The 2007 Park Museum Collection Storage Plan recommends that collections be moved to facilities further inland. The existing curatorial building at Fort Raleigh National Historic Site would serve as a museum research room, processing space, and support for other resource management functions.

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's resources including museum collections. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur (Schafale 2010), thus further potentially affecting museum collections and their storage. Specific impacts to the national historic site are as yet unknown.

Historic Structures

Fort Raleigh National Historic Site contains four historic structures that contribute to the site's eligibility: The Roanoke Colony/ Virginia Dare Monument, the F.D.R. Marker, the Franklin D. Roosevelt Theater Marker, and the reconstructed fort (Table 11). The Roanoke Colony/Virginia Dare Monument was erected at a different site from its current location in 1896. However, the marker was moved to examine archeological evidence and the marker's setting was not changed. This granite plaque marks the first phase of preservation and commemoration of the first English settlement in North America. It describes the original settlement and fort as well as the baptism of Virginia Dare, the first child born of English parents in North America. The date of erection, November 24, 1896, and the name of the officers of the Roanoke Colony Memorial Association were inscribed on the back by a Wilmington, North Carolina stone cutter. The marker stands near where the original Fort Raleigh and settlement are thought to have been.

Two separate markers commemorate Franklin Delano Roosevelt's visit to Fort Raleigh on August 18, 1937. The F.D.R. Marker marks the spot where Franklin Delano Roosevelt made a short speech outside Waterside Theatre. The marker simply reads "SPOKE F.D.R. 8/18/37." The structure is composed of a one foot square concrete slab set into the ground. The other Franklin D. Roosevelt Theater Marker marks the spot where Roosevelt watched the 23rd performance of *The Lost Colony* performance. The marker's structure is a 22 ¼ foot by 17 ½ foot polished granite plaque at the entry area to Waterside Theatre. The exact date that both markers were erected is not known, but corresponds to shortly after Roosevelt's visit to the national historic site.

One of the two markers commemorating Franklin Delano Roosevelt's visit to Fort Raleigh on August 18, 1937.

The reconstructed fort was built between 1947 and 1953. It was built to duplicate the specifications of a late 16th century earthwork fort similar to what the original colonists on Fort Raleigh erected in 1585 to 1586. The placement of the reconstructed fort is thought to be close to the original location of the first colony's fort.

Other structures present at Fort Raleigh National Historic Site, but considered not historically significant, include the Visitor Center, Hatteras Group Headquarters building, Waterside Theatre, Maintenance Area (Trebellas and Chapman 1999) and the Prince House. The North Carolina State Historic Preservation Office determined that the Prince House was not eligible for the National Register, so the removal of this structure will not affect a National Register-listed property.

Climate Change

Increased storm frequency and intensity along with rising sea levels are anticipated consequences of climate change. Increasing storms and high winds have the potential to adversely impact historic structures, diminishing their architectural and historical integrity as character-defining structural and architectural features are damaged or irreparably lost.

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's historic structures. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur (Schafale 2010), and may further threaten historic structures. Structures not considered historically significant at the present may be eligible for future listing on the National Register of Historic Places, and future effects from climate change could therefore impact these resources. Specific impacts to the historic structures are as yet unknown.

VISITOR USE AND EXPERIENCE

Visitation at the historic site has remained fairly steady over the past decade, averaging 280,999 persons per year (Table 12). Visitation is highest during summer months (May through August), and averaged 49,653 visitors per month during the summer of 2010 (Table 13). High summer visitation is primarily associated with *The Lost Colony* productions held at the national historic site's Waterside Theatre. In 2008, the Lindsay Warren Visitor Center also experienced the highest levels of visitation during the period of May through August, and it is assumed that this trend is consistent across all sampling years (NPS 2010a).

Table 12. Annual Visitors to Fort Raleigh National Historic Site, 2000-2010

Year	Number of Visitors*
2000	244,750
2001	267,464
2002	278,565
2003	177,263
2004	270,050
2005	276,071
2006	299,432
2007	321,717
2008	311,751
2009	338,212
2010	305,711

Source: NPS 2011e

*Note: Visitor totals include both recreational and non-recreational visits. Data are presented from the NPS Statistics Office. The methods used to estimate visitation are detailed at: http://www.nature.nps.gov/stats/CountingInstructions/FORACI1993.pdf.

Table 13. Total Monthly Visitors to Fort Raleigh National Historic Site, 2010

Month	Number of Visitors*
January	4,851
February	5,042
March	9,184
April	17,642
May	25,382
June	43,729
July	70,557
August	58,946
September	25,836
October	23,733
November	14,385
December	7,768

Source: NPS 2011e

*Note: Visitor totals include both recreational and non-recreational visits. Data are presented from the NPS statistics office. January, February, and April were adjusted for the large increase in construction vehicle traffic.

Visitation at Fort Raleigh National Historic Site consists mainly of vacationers from eastern states (Carolinas to New England), as well as many visitors from the Midwest (NPS 2010a). Tuesdays, Wednesdays, and Thursdays are highest use days for vacationers during summer months (NPS 2010a). According to a visitor study conducted in 2002, 79% of visitors were family groups. Nearly one-third of visitors were North Carolina or Virginia residents, and most were at the national historic site either to explore its historical significance or to attend *The Lost Colony* production. Organized school or other education groups are common visitors in the national historic site during fall and spring seasons. Local residents tend to use the national historic site's trails for walking/hiking, dog walking, horseback riding (appropriate on the Freedom Trail only), kayaking, fishing, picnicking, bike riding (appropriate on the Freedom Trail only), birding, and nature study throughout the year (NPS 2010a).

Slightly over three-quarters of visitors surveyed were at the national historic site for the first time (NPS 2002). Just under one-fourth of visitors stop at the national historic site's visitor center (NPS 2010a). Although most respondents indicated that crowding did not detract from their experience, those who did feel crowded reported the problem to be worse in the afternoon (NPS 2002). A more recent 2008 visitor survey indicated that 76% of visitors considered the overall quality of facilities, services, and recreational opportunities at the national historic site to be "very good." Eighteen percent gave the national historic site a "good" rating, and the remaining percentages were negligible (NPS 2008a).

A variety of experiences are available to visitors to the national historic site, ranging from enjoyment of history, to exercise, to drama. Several historical narratives appeal to visitors and include the stories of European colonization, the Freedmen's Colony, the Civil War, and Reginald Fessenden (see Cultural Resources section for in-depth descriptions of each of these elements). The Lindsay Warren Visitor Center provides access to park staff and volunteers that orient visitors to Roanoke Island through exhibits, artifacts, and a 17-minute national historic site video. NPS-led interpretive programs are also offered to visitors throughout the week and address England's first colonization efforts in America and other Roanoke Island stories. Visitors also have the opportunity to learn about archaeological investigations conducted at the national historic site to reveal the area's cultural past in greater detail. Interpretive programming schedules are available at the visitor center as well as on the national historic site's website. The national historic site contains a small restored fortification associated with England's first New World settlement, and is a tangible trace of part of the infrastructure built during the 1585 to 1586 time period. An annual celebration of Virginia Dare's birthday is held on August 18 by The Elizabethan Gardens, *The Lost Colony*, and Fort Raleigh National Historic Site.

The national historic site contains two walking trails (Thomas Hariot Nature Trail and Freedom Trail) that provide visitors natural solitude, recreation, and an opportunity to learn about Roanoke Island history. The Thomas Hariot Nature Trail provides visitors a short (20-minute) glimpse of what Thomas Hariot and the explorers experienced during their time on the island. The trail provides wayside signs to interpret the New World's natural resources and the commodities they produced. The Freedom Trail is a 1.25-mile (one way) out and back trail beginning near The Elizabethan Gardens through the national historic site to the island's western edge. The trail provides a viewshed that the native Algonquians would have experienced during their inhabitation, as well as signs that discuss the Civil War Battle of Roanoke Island. The trails are intended for pedestrian use, and bicycle and horse riding have also been observed on the trails from time to time.

Other popular activities include visits to the national historic site's partner organizations, *The Lost Colony* outdoor symphonic drama and The Elizabethan Gardens. *The Lost Colony* provides visitors the opportunity to witness the nation's first and longest-running outdoor symphonic drama that recounts the events leading to the disappearance of the English colonists that settled in the area over 400 years ago. The production features music, dance, drama, action, and special effects performed in the historic site's open-air Waterside Theatre. Backstage tours (limited to 50 people) and gourmet picnics are also provided through *The Lost Colony* production. Adjacent to and outside the boundaries of the national historic site is The Elizabethan Gardens - funded and supported by the Garden Club of North Carolina. The Elizabethan Gardens is one of the finest examples of 16th century gardens. The gardens provide views of Roanoke Sound and seasonal arrays of flowering plants, shrubs, and trees.

Climate Change

Climate change may affect visitor experience at the national historic site in a variety of ways, ranging from altered timing of visitation to restrictions on public access. Longer, hotter summers may shift the spring and fall visitation seasons, and visitation may decline during the hottest summer months or during months with increased storms. Visitor facilities may need to be upgraded or moved to withstand flooding or severe storm events. Energy expenditures for cooling buildings may increase in the summer and decline in the winter. Pollen-based allergies and outbreaks of mosquito-borne diseases may also increase. Sea level rise and erosion, resulting in the need to protect sensitive resources, may eliminate visitor access to specific areas of the national historic site.

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's natural and cultural resources that may in turn affect visitor experience. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur (Schafale 2010), with increased potential to affect existing visitor opportunities and experiences at the national historic site. Permanent to temporary physical impacts to visitor facilities (for example, storm damage to the visitor center or the Waterside Theatre) may effectively eliminate visitor opportunities that are currently popular among national historic site visitors. Specific impacts to the visitor use and experience are as yet unknown.

PARK OPERATIONS AND FACILITIES

Staffing

Fort Raleigh National Historic Site staff provide the full scope of functions and activities to accomplish management objectives and perform duties that include resource protection and management, visitor services, interpretation and education, law enforcement, public health and safety, and maintenance. There are 4.95 full-time employees (referred to as full-time equivalents) serving Fort Raleigh National Historic Site (2011) (Table 14). Seasonal interpretive staff provides additional services to the visitor center, presenting programs, conducting school tours, presenting education programs in local and area schools, roving the site, developing interpretive products, and researching the history and resources of the site (Table 15). Fort Raleigh National Historic Site is managed under the Outer Banks Group, including Cape Hatteras National Seashore and Wright Brothers National Memorial. Staffing is shared throughout the Outer Banks Group. The following information was summarized / excerpted from *Fort Raleigh National Historic Site Long-Range Interpretative Plan* (NPS 2010a).

Table 14. Current Fort Raleigh National Historic Site Staff Levels

Department	Full Time Equivalents
Interpreter	1
Interpretation Seasonal Employees	0.7
Interpretation Park Guide	0
Interpretation Supervisor	0.5
Maintenance Supervisor	0.25
Maintenance Level 4	0.5
Maintenance Level 5	1
Law Enforcement	1
TOTAL	**4.95**

Source: NPS 2010a

Park Infrastructure and Facilities

Buildings and structures within Fort Raleigh National Historic Site include facilities constructed during the 1960s for the national historic site expansion, Waterside Theatre buildings, water treatment plant structures, maintenance buildings, four employee residences on Pear Pad Road, two houses at the end of Dare Avenue, and structures installed to control shoreline erosion around the national historic site (Figures 3 and 4).

The Lindsay Warren Visitor Center, Outer Banks Group Administrative Building, and *The Lost Colony* Activities building, restroom facilities, and generator room buildings were constructed as part of the Mission 66 development in the visitor area of the national historic site (NPS 2010c). The Lindsay Warren Visitor Center is a 6,000-square-foot facility that contains an information desk near the front doors, a large open lobby containing several interpretive wall panels and seating, an Eastern National bookstore, a separate

Table 15. 2008 Interpretive Staff

Position Title	Status	FTE
Headquarters		
Outer Banks Group Chief of Interpretation	Permanent Full-time	1
Outer Banks Group Interpretive Activities Assistant	Permanent Full-time	1
Fort Raleigh NHS		
Year-Round Park Ranger	Permanent Full-time	1
Summer Park Ranger	Seasonal Full-time	0.5
Summer Park Ranger	Seasonal Full-time	0.3
Winter Park Guide	Seasonal Full-time	0.5
Project Funded		
Summer Park Ranger	Seasonal Full-time	0.2 (shoulder season)
Summer Park Guide	Seasonal Full-time	0.3
Winter Park Guide	Seasonal Part-time	0.05 (2 days/week)
Winter Park Guide*	Seasonal Part-time	0.05
	TOTAL	**4.9**

*Wright Brothers National Memorial seasonal who covered Fort Raleigh National Historic Site visitor center two days/week
Source: NPS 2010a

1,200-square-foot exhibit area, a 750-square-foot audio visual auditorium with 70 seats, and a paneled anteroom, the Elizabethan Room, leading into the auditorium (NPS 2010c). A paved patio is located between the visitor center and the Outer Banks Group Administrative Building where interpretive programming is presented by park staff (NPS 2010c). The Outer Banks Group Administrative Building houses staff offices for Fort Raleigh National Historic Site, Cape Hatteras National Seashore, and the Wright Brothers National Memorial, and is located southwest of the visitor center (Figure 4) (NPS 2010c).

Originally constructed in 1937, Waterside Theatre contained approximately 3,500 seats comprised of a lower and upper area with two radiating aisles and a center aisle. The stage was built with a log chapel, several log buildings, and a long palisade as a backdrop. The original theater structure and several of the support buildings were damaged by a hurricane in 1944 and completely destroyed by fire in 1947. The theater was reconstructed in 1947, only to be damaged by a hurricane in 1960. The rebuilt Waterside Theatre was dedicated in 1962, and renovated from 1998 to 2001. Waterside Theatre stands today as a the theater structure with seating, two concession buildings, dressing rooms, a lighting booth, two lighting towers, and a theater office building. The 1,498 seat theater can be accessed using four aisles in the upper and lower tiers. The stage includes a chapel, two open sided buildings, and two shingle-roofed half-timbered structures all surrounded by a log palisade. Support structures include the Costume Shop, a backstage building, and other small wood-framed buildings (NPS 2010c).

Buildings associated with the water treatment plant are located off Pear Pad Road along what was Manns Harbor Ferry Road. The complex includes a large water storage tank, another tank, a small concrete block building, and three small storage sheds. Drawings from 1964 for this area indicate that at that time, a Pump House,

two wells with pumps, and a 2,000-gallon water storage tank were installed (NPS 2010c).

The maintenance yard is located west of the water treatment plant on Pear Pad Road and includes the Museum Resource Center, the Museum Resource Center Garage (also known as the "Bally building"), and the Maintenance Building. The Museum Resource Center is a 2,800square-foot facility that provides a secure environment for the protection and preservation of the museum collections of the Outer Banks Group. The facility contains three separate storage areas, each with its own climate control system, and allows records and artifacts to be sorted and stored under controlled temperature and humidity conditions. The Museum Resource Center Garage provides storage for large artifacts that are too large to be stored in the Museum Resource Center, such as items the size of boats or vehicles. The Maintenance Building serves as storage for maintenance equipment (NPS 2010c).

To the west, along Pear Pad Road, are four residences used as seasonal staff housing. Two other residences, located in the northeast corner of the national historic site, are the Beehive (constructed in 1960) and the Prince houses (constructed in 1972). These two buildings have been used to house *The Lost Colony* cast and crew on a seasonal basis; however both of these structures are threatened by shoreline erosion and are no longer viable for occupancy (NPS 2010c).

Other structures within the national historic site include the Dough Family Grape Arbor and structures along the shoreline that control erosion. The Dough Family Grape Arbor is located on an island in the Waterside Theatre parking lot. The arbor is about 6 feet high and supports a large grape vine, which is the only visible remaining feature left from the Dough family homestead (NPS 2010c).

Shoreline erosion has been an ongoing problem at the national historic site. A series of groins (wooden structures perpendicular to the shoreline) were installed on the western end of the site near the Pear Pad Road turn-around. Granite rip-rap has been installed to slow erosion in other areas such as the shoreline along the northern boundary. Since 1941, a series of jetties has been constructed close to Waterside Theatre to protect it from erosion. In 1978, concrete block revetments were installed along the shoreline to protect both Dough Cemetery and Waterside Theatre from erosion (NPS 2010c).

Roads and Parking

Visitors enter the site via U.S. Highway 64. The entrance road extends northwest approximately 1,000 feet before it splits in two directions. Fort Raleigh Road runs northward and becomes a loop that leads to a large parking lot primarily used for Waterside Theatre, and two smaller parking lots used for the visitor center. National Park Drive runs northwest toward parking for the NPS Outer Banks Group administrative offices and terminates in a loop that offers parking for The Elizabethan Gardens and the Freedom Trail trailhead. The site's roadways do not present any particularly notable risks. However, the lack of adequate parking for The Elizabethan Gardens and *The Lost Colony* production has created safety problems because of the lack of overflow parking. Visitors park along the entrance road and other areas not appropriate for parking, which creates a safety issue for pedestrian access to these cars, as well as enforcement issues (NPS 2007).

Riprap and groins have been used to protect the Fort Raleigh National Historic Site shoreline from ongoing erosion.

Park Monuments and Trails

The national historic site provides visitors with a variety of experiences and opportunities for interpretation of the national historic site's various historic themes through signage, monuments, and trails.

The First Light of Freedom Memorial is located in the plaza immediately adjacent to the visitor center. It was placed on site in 2001 as part of the North Carolina Civil War Heritage Trail, funded through a State of North Carolina grant received by the Freedmen's Remembrance Committee.

The Raleigh Colony/Virginia Dare Monument is located along the sidewalk leading from the visitor center plaza to the earthen fort. It was first placed on the grounds in 1896 and was relocated in the mid-1930s and then again circa 1950. It was funded by the Roanoke Colony Memorial Association and received by the national historic site as part of the transfer of lands to the U.S. Government.

One Franklin D. Roosevelt Marker is located between the earthen fort and Waterside Theatre. A flat, one-foot square concrete slab, the marker commemorates the spot where President Roosevelt spoke in 1937. Additionally, a small, polished granite marker is located in Waterside Theatre to honor Roosevelt's presence on the 350th anniversary of Virginia Dare's birth.

Thomas Hariot Nature Trail begins along the sidewalk to Waterside Theatre and circles through approximately one-half mile of "pocket wilderness," occasionally giving glimpses of the sound. Small interpretive signs along the trail, some with excerpts from Thomas Hariot, describe many of the natural resources the English found and how those raw materials might be used for sustenance or profitable trading. The Freedom Trail is a 1.25-mile (one way) out and back trail beginning near The Elizabethan Gardens through the national historic site to the island's western edge. The trail provides a viewshed that the native Algonquians would have experienced during their inhabitation, as well as signs that interpret the Civil War Battle of Roanoke Island.

Partner/Cooperating Organizations and Associations

Chartered in 1932, the Roanoke Island Historical Association is a non-profit organization whose mission is to celebrate the history of the first English colonies on Roanoke Island as well as honor the founders of *The Lost Colony* symphonic drama through theater performances,

education, and literature. The Roanoke Island Historical Association has served as the producer of *The Lost Colony* since its debut, which was July 4, 1937, making it the longest-running outdoor symphonic drama in the nation. *The Lost Colony* symphonic drama is housed entirely on NPS land and within its structures. The relationship between Fort Raleigh National Historic Site and Roanoke Island Historical Association is legislated by the 1941 order that established the national historic site. NPS and the Roanoke Island Historical Association signed a revised formal agreement on December 17, 2009 for 10 years ending on December 16, 2019. The Roanoke Island Historical Association's use of the national historic site includes the historic Waterside Theatre, as well as 16 associated structures that serve as dressing rooms, costuming, a technicians' workshop, rehearsal areas, backstage spaces, day-use activities, and administration. *The Lost Colony* is presented nightly (except Sundays) from mid-June to late August, and children's theater and theater workshops are held during the day. Total attendance in 2008 was 69,682 visitors. The Roanoke Island Historical Association is governed by a board of directors and is composed of approximately 300 members (2008 membership).

The Elizabethan Gardens was created by The Garden Club of North Carolina as a memorial to the first colonists and as an example of the estate gardens owned by wealthy backers of the colony. The Elizabethan Gardens features a Tudor-style entrance gate, sunken garden, herb garden, rose garden, 400 year-old (estimated) live oak, marble statue of an imagined young Virginia Dare, and the world's largest bronze statue of Queen Elizabeth I. The Elizabethan Gardens is located on property owned by the Roanoke Island Historical Association that is leased to the Garden Club of North Carolina for $1.00 every 50 years. The Elizabethan Gardens provides special programming during summer months and special events and classes throughout the year. The Elizabethan Gardens is supported by its own membership base as well as from the Garden Club of North Carolina. The Elizabethan Gardens are also a popular (fee-based) venue for weddings and private events hosting from 20 to 400 guests. Total attendance at The Elizabethan Gardens in 2008 was 150,000 visitors.

The First Colony Foundation, a non-profit organization established in 2004, conducts archeological and historical research, public education, and interpretation relating to the settlement efforts of Roanoke Island in the 1580s. The Foundation relies on the resources and support of several academic institutions, archeologists, and historians and cooperative support from the NPS Southeast Archeology Center in Tallahassee, Florida. The First Colony Foundation sponsors regular archeological digs and research at the national historic site to identify and reveal the sites of the first New World English colonies. The Foundation has presented lectures regarding its research and findings to the public in the national historic site's auditorium.

Eastern National, the national historic site's cooperating association, provides educational products and services to national historic site visitors. The association operates a bookstore in the Lindsay Warren Visitor Center and contributes funds that support national historic site interpretive programming.

Climate Change

Increasing frequency and intensity of severe storms and floods may pose threats to roads and trails, administrative facilities, and other park resources and infrastructure (Loehman and Anderson 2009). As predicted storm frequency increases, more time may be spent by NPS staff as part of clean up or reconstruction efforts. Visitor facilities may need to be upgraded or moved to withstand flooding or severe storm events. In addition, energy expenditures for cooling buildings may increase in the summer and decline

in the winter as a result of longer, hotter summers.

Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009 in NPS 2010e). The potential for sea level rise to cause opening of new tidal inlets in the Outer Banks barrier islands or the collapse of the barrier islands themselves (Schafale 2010) may cause more drastic changes to occur to the national historic site's park operations and facilities. Collapse or alteration of the barrier islands may cause marshes to convert to salt marsh, tidal range and tidal influence may increase and spread farther inland, and acceleration of shoreline erosion would potentially occur (Schafale 2010), with increased potential to affect day to day operations of the national historic site. Permanent to temporary physical impacts to national historic site facilities (for example, storm damage to the visitor center or the Waterside Theatre) may increase demands on NPS staff. Specific impacts to the national historic site's operations and facilities are as yet unknown.

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