

OUTER BANKS TOURISTS' PREFERENCES, SENSITIVITIES, AND ENVIRONMENTAL
PERCEPTIONS: A CASE STUDY OF CAPE HATTERAS NATIONAL SEASHORE

by

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Tourism is the driving economic force for North Carolina's Outer Banks, attracting millions of visitors every year. However, through the combined effects of increased human activity and development, storms, sea level rise, and climate change, portions of the island chain are disappearing. This study seeks to better understand why visitors choose the Outer Banks, how aware and concerned they are about environmental changes occurring there, and how that may affect their beach destination choice in the future. To address these questions, a survey of 137 visitors at Cape Hatteras National Seashore was undertaken. The relative sensitivity to seven environmental variables is considered and differences in perception among local and non-local beachgoers are compared. Analyses of scores and responses to survey questions show that scenery and uncrowded beaches are the primary reasons for choosing the Outer Banks, followed closely by location and accessibility. Visitors appear to be generally conscious of the changing environment there, with a majority of respondents saying they were aware of environmental changes at the Outer Banks prior to being surveyed. However, only half of respondents indicate experiencing effects from these changes during their visit. As such, respondents expressed environmental changes as having little to no effect on their decision to return, with over 95% claiming they will still recommend the Outer Banks and revisit in the future. For many, the fact

that the Outer Banks remains relatively undeveloped compared to other East Coast beaches constitutes enough reason to return in spite of other changes.

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CHAPTER 1: INTRODUCTION

Climate change and the corresponding environmental impacts are perhaps the greatest threats facing our world. Industries such as tourism that are closely linked to the natural environment rely on certain climatic and environmental conditions. Tourism is a leading industry in the United States (U.S.), with beaches serving as the most popular tourist destination (Houston, 2013). While beach tourism is the most popular, it is also arguably the most volatile and susceptible to climate change.

For North Carolina's Outer Banks, tourism is the driving economic force, attracting millions of seasonal visitors every year (Strother & Vogelsong, 2002). Pristine beaches translate to a thriving local economy, and the Outer Banks beaches have experienced an increase in seasonal visitors over the years (Strother & Vogelsong, 2002; Houston, 2013). However, this places a strain on the natural environment, particularly that of a barrier island. While many tourists visit the Outer Banks each year, many may not know that some beaches are "falling off the map." Through the combined effects of human activity, storms, development, and sea level rise, portions of the island chain are disappearing, with these effects being exacerbated by climate change (Riggs et al., 2011; Peach, 2014). While sea level rise and climate change are perhaps the most publicized, there are many other interrelated environmental changes occurring at the Outer Banks.

The influence of these environmental changes on Outer Banks tourism has been mostly overlooked despite the industry's dependence on the natural environment. Previous studies highlight local resident opinion regarding environmental changes, but the tourist perspective has received surprisingly little attention (Dowling, 1993; Holdnak et al., 1993). As such, there is a critical need for research regarding tourists' perceptions and understandings of environmental

changes. This study develops a better understanding of the Outer Banks' tourist landscape and how tourists perceive the local environmental changes by addressing the following research questions:

1. Why do tourists choose to visit the Outer Banks as opposed to other beaches?
2. To what extent are tourists aware of environmental changes occurring at the Outer Banks? From what sources do they obtain their information?
3. To what extent are environmental changes of concern to tourists? Which changes are they most concerned about?
4. To what extent will environmental changes affect tourists' plans to return to the Outer Banks in the future?

Answers to these research questions are valuable as tourist behavior ultimately impacts the local, regional, and state economies. Tourists drive the Outer Banks' economy, and thus, it is important to understand their opinions on and awareness of environmental changes, and how these beliefs may affect their willingness to visit the Outer Banks in the future. While the findings of this research may be specific to the Outer Banks, they may also provide valuable information applicable to similar tourism destinations throughout the world. This research can be compared to research at other coastal locales to develop broader understandings and a more holistic view of perceptions of environmental changes and their influence on tourism and recreation decision making. Millions of people live on and travel to the coast, domestically and internationally, making coastal management one of the premier concerns of our time.

CHAPTER 2: LITERATURE REVIEW

In order to better understand what attributes of the Outer Banks tourists value and how they perceive environmental changes there, it is important to review previous research on preferences, sensitivities, perceptions, and decision-making behavior related to beach destinations and environmental conditions. However, there can be no meaningful discussion on environmental perception without first exploring the physical environmental changes in question. First, this literature review addresses the implications of climate change on coastal environments and the specific environmental changes observed and projected for the Outer Banks. Additionally, human activity and efforts to counteract these physical changes through preventative and adaptive measures are considered. Further, beach preferences and perceptions are examined, and the evolving nature of tourists' awareness of environmental impacts and changes is discussed. Lastly, the nature of beach tourism is presented for both beaches in general and the Outer Banks specifically, including both the economic contributions and the dependence on the natural environment.

Coastal Environmental Changes

i. Physical Environmental Changes at a Glance

The existing literature indicates a majority of the scientific community agrees the world's climate is warming (Intergovernmental Panel on Climate Change, IPCC, 2007). The factors causing this shift in climate have been the subject of much research and debate, particularly with respect to human's ability to influence climate (Edgell & McCormick, 2016). However, it is widely accepted by scientists that climate change is occurring, and there is an increasing body of evidence to support that it is anthropogenic in nature (IPCC, 2007; Saunders et al., 2012; U.S.

Global Change Research Program, USGCRP, 2017). The goal of this research is not to debate the causes of climate change, insomuch as to discuss the impacts on the environment, the implications for humans, and, most of all, the effects on Outer Banks tourism. Over the past 150 years, and especially the last 60 years, the Earth's warming has led to changes in many environmental variables (USGCRP, 2017).

The general consensus on global environmental change among scientists is that the environment is changing at an unprecedented pace (Environmental Protection Agency, EPA, 2017a). Environmental change is a broad term used to encompass a variety of physical alterations to the natural environment. While global phenomena, these changes are occurring at different degrees in different landscapes. In particular, coastal landscapes worldwide are undergoing some of the most drastic and rapid changes due to the complex interaction among waves, wind, and ocean currents (Phillips & Jones, 2006; Gopalakrishnan et al., 2011). At the confluence of land, sea, and air, coasts are subjected to many environmental forces. As a result, the coastal environment is constantly changing, without even considering the effects of human activity and climate change (Phillips & Jones, 2006; EPA, 2017b). Climate change is compounding morphological changes that coastal areas already experience, while also creating new challenges. (EPA, 2017b).

Since climatic changes often intensify existing morphological changes, it can be difficult to distinguish between the two. This research addresses both climatic changes and morphological changes, referring to them broadly as environmental changes. The primary environmental changes addressed in this thesis include sea level rise, beach erosion, shoreline migration, dune erosion, higher temperatures, increased storm frequency and severity, and larger waves than normally experienced.

ii. *Climatic Changes*

Climate change manifests as shifts in mean conditions, such as increasing mean annual temperature and sea level, but also as changes in climate variability, including more intense storms and flooding (National Park Service, NPS, 2018b). The climatic changes addressed in this study include sea level rise, higher temperatures, increased storm frequency and severity, and larger waves than normally experienced. Global average sea level rise has already been observed and is expected to continue, possibly at greater rates than previously observed (USGCRP, 2017). It is largely accepted that one meter, or 39 inches, is a reasonable possibility for global average sea level rise by 2100 (Saunders et al., 2012). The actual extent of sea level rise will be largely determined by future emissions of heat-trapping gases (Saunders et al., 2012). As such, there is considerable variability in sea level rise projections; however, global average sea level is projected to rise at least several inches in the next 15 years and one to four feet by 2100 (Saunders et al., 2012; USGCRP, 2017) (Table 2.1). Sea level rise will be higher than the global average on the East and Gulf Coasts of the United States due to subsidence (Fitzpatrick, 2013; EPA, 2016 & 2017b; USGCRP, 2017). The USGCRP (2017) warns “a rise of as much as eight feet by 2100 cannot be ruled out.”

Table 2.1: Projections of Global Mean Sea Level Rise (in inches) (Saunders et al., 2012)

	2030			2050			2100		
	Low End	Central Projection	High End	Low End	Central Projection	High End	Low End	Central Projection	High End
National Research Council (2012)	3.3	5.3	9.1	6.9	11.0	19.0	19.8	32.6	55.2
Vermeer and Rahmstorf (2009)	5.5	7.1	8.7	11.0	14.6	18.5	30.7	47.6	68.9
IPCC (2007)	N/A	N/A	N/A	N/A	N/A	N/A	7-15	N/A	10-23

While the true extent of future sea level rise is uncertain, it is well accepted that global average sea levels have risen and will continue to rise (USGCRP, 2017). Since 1900, a global average sea level rise of seven to eight inches has been documented, with approximately three inches of sea level rise occurring since 1993 (USGCRP, 2017). Much of the U.S. Atlantic Coast is experiencing sea level rise equal to or greater than the global average, with the sinking land surface resulting in higher observed rates of sea level rise relative to the land (Fitzpatrick, 2013; EPA, 2016 & 2017b; USGCRP, 2017). Accordingly, above average rates of sea level rise have been observed at Cape Hatteras National Seashore (CAHA) (Sallenger et al., 2012; Saunders et al., 2012). While sea level rise rates along northeastern North Carolina have fluctuated over the past 18,000 years, the overall trend has been upward (Riggs et al., 2011). The present rate of sea level rise for North Carolina's coast is about 18 inches per century, with sea level being expected to rise between 39 and 55 inches by the year 2100 (Riggs et al., 2011). Based on a USGS assessment of sea level rise vulnerabilities among different portions of the Atlantic Coast, the Rocky Mountain Climate Organization (RMCO) suggests that CAHA is in a "top tier" of vulnerability to sea level rise compared to other Atlantic Coast national seashores (Saunders et al., 2012; U.S. Geological Survey, USGS, 2014) (Figure 2.1). The assessment was based on tidal range, wave height, coastal slope, shoreline change, vulnerability to erosion, and historical rate of relative sea level rise. Most of the seashore lands are less than one meter above sea level (Saunders et al., 2012). As a result, the USGS estimates that the lightly developed areas along CAHA could be broken up by new inlets or lost to erosion if sea level rises two feet by the year 2100 (EPA, 2016). As mentioned earlier, current projections have sea level rising closer to three or four feet by 2100.

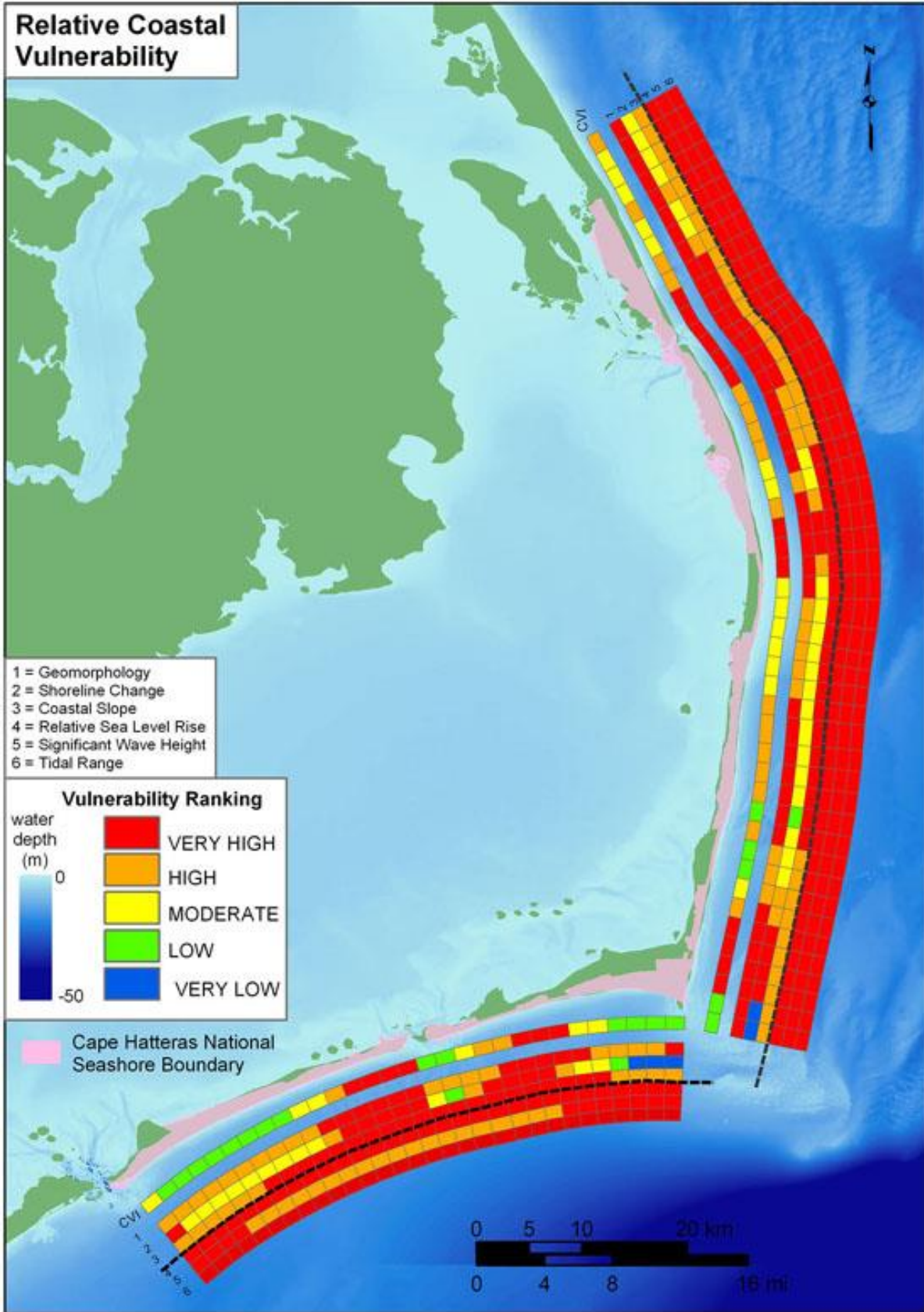


Figure 2.1: Coastal Vulnerability Assessment (USGS, 2014)

Higher temperatures are a principal component of global climate change and the driving force of many other interrelated environmental changes. Global average temperature has become markedly warmer in the past century, with an approximate 1.8°F temperature increase observed since 1901 (USGCRP, 2017). Much of this warming has occurred since the 1970s, with the current period being the warmest stretch in the history of instrumental temperature measurements (Saunders et al., 2012; USGCRP, 2017) (Figure 2.2).

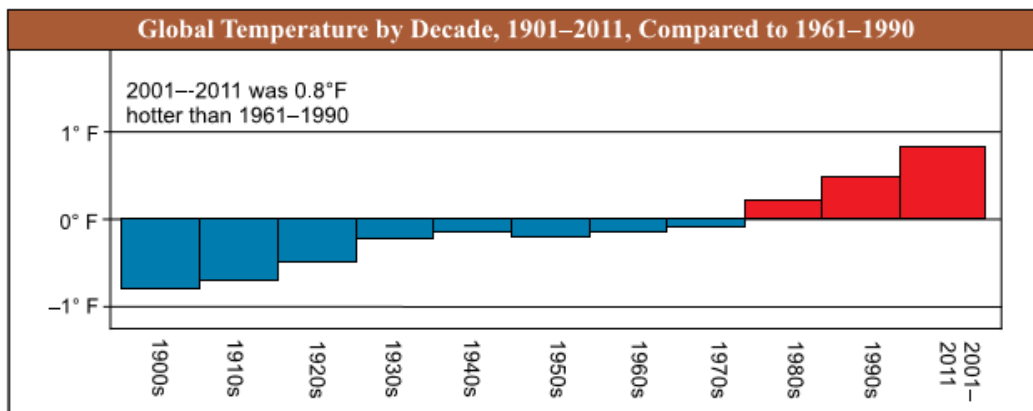


Figure 2.2: Global Temperature by Decade (National Climatic Data Center, NCDC, & National Oceanic and Atmospheric Administration, NOAA, 2012)

The U. S. has experienced temperature increases similar to global averages, with records indicating a 1°F to 2°F temperature increase currently, compared to the 1960s and the 1970s (Saunders et al., 2012; USGCRP, 2009). Temperature trends based on weather stations with long-term records on CAHA indicate a clear temperature increase, with a particular uptick in recent years highlighted by 2001-2011 being 1.2°F warmer than 1961-1990 (Saunders et al., 2012) (Figure 2.3).

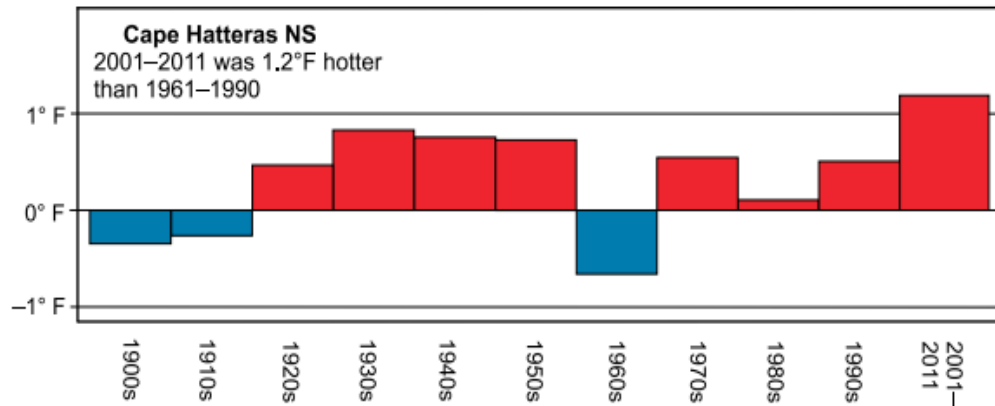


Figure 2.3: CAHA Temperature by Decade (NCDC & NOAA, 2012)

As with sea level rise, projections for future temperature increases are largely determined by future emissions. The RMCO developed two projections for future year-round average temperature increases at CAHA, one with lower emissions and one with medium-high emissions. Projections are a 1.9°F to 3.7°F temperature increase by 2090 in the first, lower emission scenario, and a 3.0°F to 7.0°F temperature increase in the second, higher emission scenario (Saunders et al., 2012). Further, the greatest temperature increases are expected to occur in the summer months and are projected to be accompanied by a much higher heat index (USGCRP, 2009; Saunders et al., 2012). Lastly, heat waves are predicted to become both more common and more extreme (Saunders et al., 2012; USGCRP, 2017).

Increased storm frequency and severity are additional facets of climate change. The strength of coastal storms on the Atlantic Coast has increased in the last 30 years in conjunction with an approximate 2°F sea-surface temperature increase (USGCRP, 2009; Saunders et al., 2012). It is projected that Atlantic hurricanes will continue to strengthen this century, including “higher peak winds, rainfall intensity, and storm-surge height and strength” (Saunders et al. 2012, 17).

While stronger storms are occurring across the Atlantic, the Outer Banks is especially vulnerable due to their unique geography. First, barrier islands are particularly vulnerable to the effects of strengthened storms, as greater storm surge prompts more frequent and extensive overwash and erosion (Saunders et al., 2012). Also, North Carolina juts out farther east into the Atlantic Ocean than any other state on the South Atlantic coast, helping make North Carolina the most hurricane-prone state north of Florida, susceptible to landfalling and offshore storms. CAHA marks the state’s easternmost extent, and its effect can be observed in CAHA’s historical hurricane frequency. Forty-nine hurricanes have passed within 65 miles since 1852, far exceeding the frequencies for all other Atlantic Coast national seashores from north to south aside from Cape Lookout, just south of CAHA (Saunders et al., 2012) (Table 2.2). North Carolina’s mid-latitude location also makes North Carolina vulnerable to nor’easters in addition to hurricanes.

Table 2.2: Number of Hurricanes Passing within 65 miles of the Atlantic Coast National Seashore since 1852 (NCDC & NOAA, 2012)

National Seashore	Hurricanes
Cape Cod NS	12
Fire Island NS	11
Assateague Island NS	13
Cape Hatteras NS	49
Cape Lookout NS	43
Cumberland Island NS	18
Canaveral NS	24

In response to stronger storms, average summer wave heights along the Atlantic Coast have also increased since 1975 (USGCRP, 2009; Saunders et al., 2012). Using buoy data and models based on wind patterns, scholars suggest waves are steadily increasing in size from Cape Hatteras, North Carolina to West Palm Beach, Florida (Blumenthal, 2010). Analyses of hourly ocean wave height measurements along the Atlantic seaboard, collected by buoys since the

1970s, indicate a progressive increase during the summer months (Komar & Allen, 2008). This includes a buoy at Cape Hatteras that shows average wave heights are increasing several centimeters a year (Komar & Allen, 2008; Blumenthal, 2010). What is more alarming is that the height of the biggest waves has increased almost a foot in the past decade (Blumenthal, 2010).

iii. Morphological Changes

Morphological changes include beach erosion, shoreline migration, and dune erosion. Beach and dune erosion at major tourism destinations is an inevitable component of environmental change (Becken, 2005). Beaches are in a state of constant fluctuation, either accreting or eroding, resulting from normal actions of wind, water, and sediment supply (North Carolina Department of Environmental Quality, NCDEQ, 2016). Beach erosion can result from even slight fluctuations in water level achieved by wave action and currents, especially during storms and heavy rainfall events. Climatic changes have been shown to accelerate natural beach erosion (Saunders et al., 2012). Scholars often attribute chronic beach erosion to anthropogenic interventions, such as coastal development, in conjunction with increased storm frequency and severity and sea level rise (West et al., 2001). Sea level rise allows waves to penetrate farther inland, amplifying erosion gradually over time, while hurricanes and nor'easters can remove sand from a beach suddenly and rapidly. Wind and disruption of sediment transport by human-built structures can also cause beach erosion (NCDEQ, 2016). The sum of these changes is a net removal of sand from the beach, making the beach both narrower and lower in elevation (USGS, 2016).

It is believed that approximately 70% of the world's sandy beaches are receding (Bird, 1985; United Nations World Tourism Organization, UNWTO, 2007). Within the U.S. alone,

widespread beach erosion has been reported at numerous tourist destinations (Moore et al., 1999; Morton & McKenna, 1999), with some estimates suggesting that as many as 80% to 90% of the sandy beaches in the U.S. are receding (Leatherman, 1993; Kreisel et al., 2005). The situation is more severe in some locations than others, but due to the nature of simple barrier islands, the Outer Banks is particularly vulnerable. In the seven-mile stretch of CAHA from Avon to Buxton, the beach has receded around 2,500 feet in the past 150 years, with that portion of the island narrowing to 25 percent of its original width (Peach, 2014; Tucker, 2015). Studies for other portions of CAHA, albeit over shorter time periods, yield similar erosional trends (Figure 2.4).

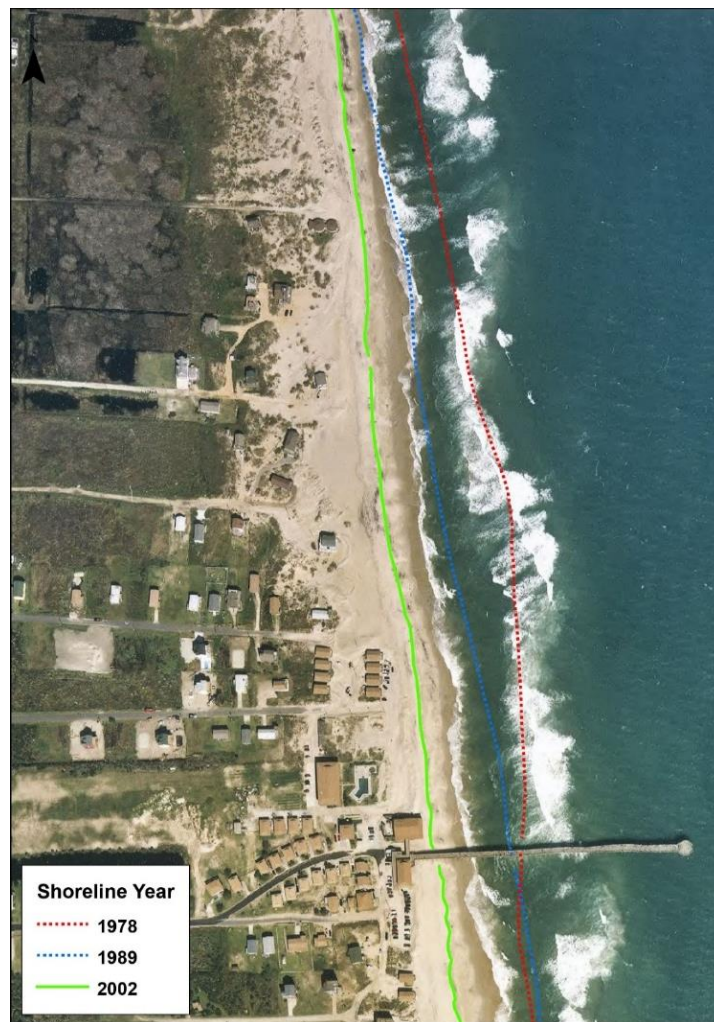


Figure 2.4: Orthophotograph from 2002 showing long-term shoreline erosion from 1978 to 2002 in Rodanthe (USGS, 2017)

When water levels are sufficiently high, dunes located on the backshore of the beach are also subject to erosion. Dune erosion occurs when large or high-energy waves, often the result of a storm, advance past the backshore of the beach to the dunes, carrying away sand as they recede (Saunders et al., 2012; USGS, 2016). CAHA has an extensive dune network separating the oceanfront from North Carolina Highway 12 (NC 12), the main thoroughfare of the Outer Banks. As storms strengthen, waves enlarge, and beaches recede, the dunes are increasingly vulnerable to erosion, making land and infrastructure farther inland susceptible to storm surge and flooding.

In contrast to beach and dune erosion, shoreline migration can occur with or without a net loss of sand from the beach. Although the shorelines may appear the same, they result from very different geological, biological, and physical processes (NCDEQ, 2016). Sea level rise, in particular, can cause shoreline migration without reducing the actual volume of sand on the beach (NCDEQ, 2016). A gradual landward movement of shorelines is being observed on many beaches across the world (Gopalakrishnan et al., 2011). The combined effects of climatic changes such as sea level rise and stronger storms accelerate barrier island shoreline changes, including the thinning of the island and the migration of it landward. These changes can make a barrier island become unstable to the point where it fragments and possibly disintegrates (Saunders et al., 2012).

iv. Coastal Management, Beach Maintenance, and Climate Change Adaptation

In light of these changes, it is believed that the sustainability and future growth of the tourism industry depends on policy responses to climate change (Edgell & McCormick, 2016). The growth of tourism in the U.S. over the past 25 years has only “elevated the need for sustainable tourism policy discussions with respect to the repercussions of climate change on the

tourism industry” (Edgell & McCormick, 2016, 2). The inherent vulnerability of barrier islands in combination with changes in climate make Atlantic Coast national seashores such as CAHA “among the most vulnerable units of the national park system” (Saunders et al., 2012, i). This natural conflict has led to active policy intervention to attempt to mitigate environmental changes at many beach destinations. The most notable coastal management practice includes efforts to manage and contain coastal erosion in economies that rely on tourism, such as Dare County, North Carolina, home of CAHA (Gopalakrishnan et al., 2011). At the Outer Banks and other beach destinations, public officials have been implementing various beach replenishment measures to prevent further beach erosion, recover shorelines, and protect infrastructure (Phillips & Jones, 2006).

These measures, such as beach nourishment, have proven to be effective, albeit extremely expensive, short-term solutions (Houston, 2002). Beaches that have undergone replenishment show an increase in tourist numbers, thereby providing a good return on investment in the short-term (Houston, 2013). However, attitudes toward beach nourishment vary widely, primarily as a result of the high up-front cost and temporary nature of the approach. It is only a matter of time before coastal processes redistribute sand among nourished beaches, requiring frequent maintenance and rendering the long-term success of such projects questionable. Regardless of the measures undertaken, beaches are subject to continual erosion and require regular replenishment (Buzinde et al., 2010). Despite this, some argue that in the absence of beach maintenance, the Outer Banks natural resource-based economy will likely be destroyed by the inevitable sea level rise (Riggs et al., 2011).

CAHA has undergone several beach nourishment projects dating back nearly a century. In the 1930s, before the southern portion of the island chain was designated as a national

seashore, the Works Progress Administration (WPA), Civilian Conservation Corps (CCC), and National Park Service (NPS) combined efforts to build a line of artificial, vegetated dunes stabilized with fences (Tucker, 2015). Dunes act as protection against erosion, flooding, and storms; however, artificial dunes are not as protective as natural dunes (Morton, 2002). While unnatural, these constructed Outer Banks dunes temporarily prevented flooding and encroaching sediment during major storms and helped to create the Outer Banks tourist economy (Tucker, 2015). In the late 1960s, sandbags were used in an effort to halt erosion, and the U.S. Navy built reinforced concrete groins to protect park infrastructure (Stover, 2015). Since then, the NPS has conducted only a few beach maintenance efforts at CAHA, including sand replenishment projects, construction of rock revetments, sandbagging, and planting artificial seaweed (Stover, 2015). NPS policy is to avoid interfering with natural processes, so beach maintenance projects since the park's designation have been relatively limited.

Perception

i. Destination Image

Landscape preferences and perceptions have been the subject of numerous studies. Knowledge of beach users' recreational use patterns, preferences, and opinions is useful to managing beach destinations to ensure satisfactory visitor experiences and attract the maximum sustainable number of tourists (De Ruyck et al., 1995). Chapman (1989) showed a strong relationship between tourists' motivations for visiting the beach and their choice of beach destinations. Morse et al. (1977) found that visitors have definite opinions regarding both the physical and social attributes of beaches. Tourists at highly developed and undeveloped beaches cited level of beach development as the most important influence on beach choice (De Ruyck et

al., 1995). For semi-developed beaches, tradition, socio-economic factors, and accessibility were the primary influences (De Ruyck et al., 1995). Highly and semi-developed beaches were visited for their facilities, social activities, and accessibility (De Ruyck et al., 1995). In contrast, undeveloped beaches were visited for experiencing nature, peace and quiet, uncrowded beaches, and dog friendly environments (De Ruyck et al., 1995). CAHA is largely undeveloped, as regulations are in place that restrict developers from building on it as part of its NPS site designation. However, there are eight villages within CAHA where some development has occurred, primarily in the form of rental homes and cottages.

CAHA has two to three million visitors per year, including both regional/national vacationers and local recreational users (NPS, 2007; NPS, 2017). It is important to distinguish between these visitor group types as their characteristics, use patterns, and preferences are quite different. Much of the data about park visitors comes from a 2007 study conducted by the NPS. In that year, CAHA visitation consisted mainly of 1 to 2-week summer vacationers from the eastern U.S., mainly North Carolina up to New England (NPS, 2007). These visitors came to CAHA primarily for “sightseeing, visiting lighthouses, sunbathing, beachcombing, fishing, swimming, and camping” (NPS, 2007, 17). Challenges with these visitors include their destination image, with the NPS saying that since “many of these visitors see the Outer Banks simply as a vacation beach, it is a challenge to get them to appreciate the significance of [CAHA], and that it is a unit of the NPS” (NPS, 2007, 17). The problem is compounded by the park’s entrance system. Unlike most NPS sites, villages are located along CAHA and are only accessible by driving through CAHA. Accordingly, CAHA does not charge entrance fees and lacks “adequate and effective entrance orientation/information facilities” (NPS, 2007, 17). As such, it can be easy for these vacationers to fail to recognize and appreciate it as a NPS

designated site. In response, officials have said “the park will actively work to enhance the [NPS] experience for park visitors [by] strengthening the park's identity as a unit of the [NPS]” (NPS, 2017, par. 5). They plan to do so through “improving park signage and way-finding; increasing staff presence and engagement with visitors; and improving communication with visitors using the best available technology” (NPS, 2017, par. 5).

Conversely, local recreation users are the other CAHA visitation contingent. These users are local residents of the Outer Banks area and coastal North Carolina, including people who live in villages within CAHA, who primarily frequent CAHA because it is the most convenient and accessible beach for them (NPS, 2007). Due to their proximity, these users go to CAHA frequently, but for shorter periods of time each individual trip, with many doing day trips. According to the NPS, challenges with local visitors include differing views of NPS management of beach driving, lack of understanding of park issues and management practices, and failure to attend traditional interpretive programs (NPS, 2007).

ii. Environmental Perception

It is well established that people vary in their perceptions of the natural environment (Renn et al., 1992; Hillery et al., 2001, Pendleton et al., 2001). The general public perceive the environment differently than professionals and experts. Furthermore, different members of the general public differ in their perceptions based on a range of social variables (Downing & Clark, 1976; Lucas, 1979; Martin et al., 1989). Tourist destinations attract people from many different backgrounds, and as such, they provide an ideal study area to better understand these differences in perception. Previous research has explored social variables that influence a person's environmental perception. Perceptions are thought to be influenced by a number of factors,

including demographic elements, such as age, position in life cycle, gender, education level, place of residence, and ethnicity (Lyons, 1983; Petrosillo et al., 2007). Socio-economic status, economic circumstances, cultural ties, and past experiences have also been discovered as influential parameters in determining how people perceive environmental quality (Renn et al., 1992). Culture is particularly important as it influences choice of leisure activities (Brunson & Shelby, 1992). Lastly, familiarity with and exposure to information regarding environmental quality combine with these aforementioned personal attributes to produce a person's overall understanding, appreciation, and perception of the natural environment (Buzinde et al., 2010). This suggests that a variety of social variables and personal attributes contribute to a person's perception.

Previous studies have found that tourists generally have limited awareness of wear and tear impacts on the environment, but are more perceptive of direct impacts (Lucas, 1979; Marion & Lime, 1986). This suggests that unless it affects them directly, tourists are mostly oblivious to environmental changes. However, other work shows that tourists are growing increasingly aware of impacts on the environment. For instance, Hammitt et al. (1996) found that environmental impacts to parks of most concern to tourists were multi-use trails, litter, erosion, and destructive behaviors. Increased awareness of and sensitivity to environmental impacts highlight the need for sustainable tourism planning in the future (Lucas, 1985; Hammitt et al., 1996).

Previous studies, for example Hammitt et al. (1996) and Hillery et al. (2001), have not focused exhaustively on the beach environment, but rather a variety of landscapes. Hammitt et al.'s (1996) study focused on the southeastern U.S., but explored inland parks such as the Blue Ridge Parkway, the Chattahoochee River National Recreation Area, and the Chickamauga and Chattanooga National Military Park. Hillery et al.'s (2001) study looked at ten sites in Central

Australia. As such, there is a notable deficiency in research pertaining specifically to tourists' perceptions of coastal environmental changes in the U.S.

Most of the previous research has studied environmental perception during relatively non-dynamic periods, or less chaotic times of environmental change than we are currently experiencing due to accelerations in climate change. This has created a scarcity of research on perceptions of coastal landscapes that are experiencing receding shorelines and undergoing beach replenishment (Buzinde et al., 2010). However, Hall and Staimer (1995) found that beach erosion is the number one concern that tourists have about beaches, and restoring beaches can increase their attractiveness to tourists. To illustrate this point, 74% of those surveyed in 1989 said the New Jersey shore was "going downhill" (Zukin, 1998). However, by 1998, only 27% of those surveyed said the New Jersey shore was in decline, with 86% saying that the shore was one of the state's best features (Zukin, 1998). The difference between the initial survey in 1989 and the latter in 1998 was the largest beach nourishment project to date in the world in terms of volume of sand (U.S. Army Corps of Engineers, 2001). Further, in a study of Southern California residents, Hanneman et al. (2005) found that beach width is also one of the primary explanatory variables in beach choice for public beaches. Houston (2013) also suggests that tourism to beaches is affected by beach width, arguing that as beach width decreases, visitors choose other destinations, such as foreign beaches. While beach tourism is still thriving, Houston (2013) indicates that changing beach conditions can influence tourists' choices of beach destinations. This highlights the need to strike a balance between sustaining a viable coastal economy and preserving the natural resources on which that economy is based (Riggs et al., 2011).

Scott et al. (2003, 180) stated that "the current understanding of how recreational users and tourists respond to climate variability is very limited," including both their use patterns and

destination choices. Considering the fact that efforts to maintain, repair, and replenish beach destinations are often, in part, implemented to satisfy tourists as revenue generators, it is surprising that tourists’ perceptions, experiences, and attitudes on environmental changes have not received sufficient scholarly attention (Buzinde et al., 2010). Tourists’ perceptions have largely been ignored from the debate on coastal adaptation and environmental change (Buzinde et al., 2010). However, these perceptions are critically important because, although tourists are not primary decision makers or permanent residents, their opinions and the way these opinions influence their vacation location choices have drastic economic implications.

Beach Recreation and Tourism

i. Economic Impact of Tourism

Despite the changing beach environment, beach tourism still remains popular. Simultaneous to these eroding beaches and disappearing shorelines, there has been an increase in beach tourism (Houston, 2013). In 2017, CAHA ranked second among Atlantic Coast national seashores in visitors and visitor spending, and first in jobs supported (Table 2.3).

Table 2.3: Spending and Jobs from Visitors to Atlantic National Seashores (NPS, 2018c; NPS, 2018d)

	Visitors in 2017	Visitor Spending in 2017	Jobs Supported in 2017
Cape Cod NS	4,125,418	\$177 million	2,100
Fire Island NS	456,392	\$19.4 million	209
Assateague Island NS	2,347,167	\$99.8 million	1,280
Cape Hatteras NS	2,433,703	\$152 million	2,220
Cape Lookout NS	399,357	\$20.9 million	309
Cumberland Island NS	51,937	\$2.1 million	30
Canaveral NS	1,598,586	\$101 million	1,410
Total	11,412,560	\$572.2 million	7,558

According to NPS visitor use statistics (2018d), CAHA recorded 2.4 million non-local visitors in 2017, its highest visitation since 2003. While there is no entry fee for CAHA, tourist spending on transportation, food, and lodging when visiting the park directly affects many other sectors of the economy. A 2018 NPS report shows that 2.4 million non-local visitors spent an estimated \$152 million in communities near CAHA in the 2017 fiscal year (NPS, 2018c) (Figure 2.5). That spending supported 2,220 jobs in the local area, \$59.8 million in labor income, \$104 million in value added, and had a cumulative benefit of \$187 million to the state economy (NPS, 2018c) (Figure 2.6).

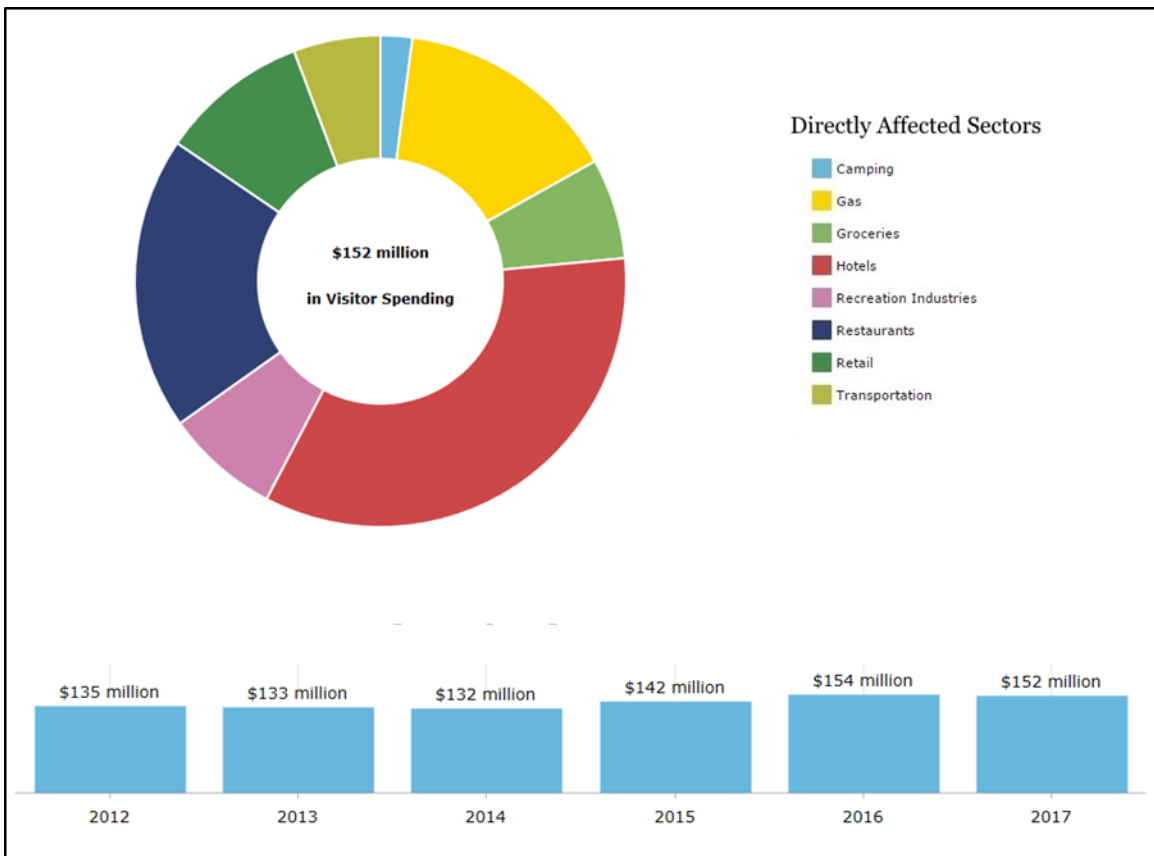


Figure 2.5: Total Visitor Spending in Communities near CAHA (NPS, 2018c)

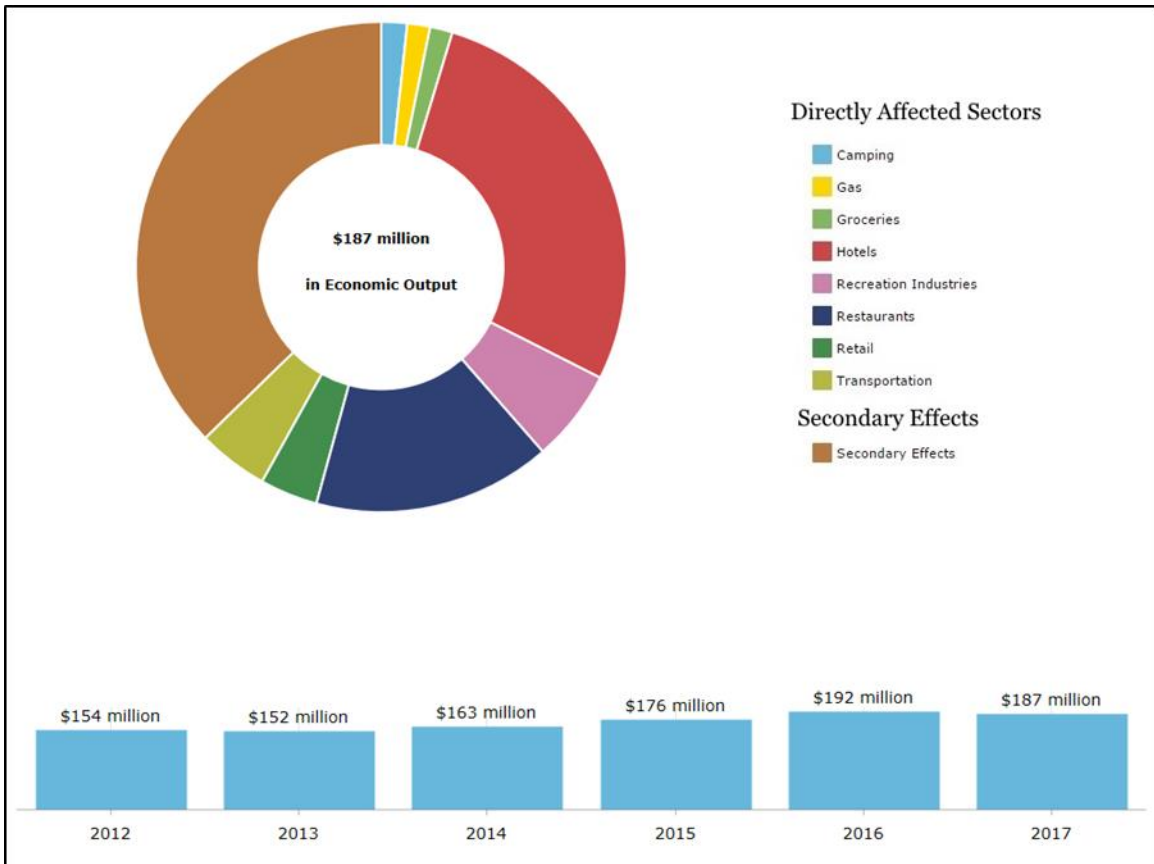


Figure 2.6: Total Economic Output Contributed to CAHA Gateway Economies (NPS, 2018c)

Local communities depend on beach tourism at these national seashores (Saunders et al., 2012). Dare County, especially, “is almost entirely dependent on beach-going and nature-based visitation” to neighboring CAHA (Saunders et al., 2012, 2). Tourism is the number one industry in Dare County, “with 61% of the county’s employment related to the tourism industry” (Saunders et al., 2012, 2). The Dare County labor force increases by as much as 75% during the summer, and the revenue in the peak season represents upwards of 70% of the annual economy (Saunders et al., 2012; Nettles, 2017). As such, the importance of CAHA to the local, state, and national economy cannot be overstated.

ii. *Environmental Impacts on Tourism*

Few industries are more dependent on the outcomes of climate change than the tourism industry, particularly the beach tourism industry (Bin et al., 2007; Edgell & McCormick, 2016). Environmental changes affect many aspects of tourism and park management, including both direct and indirect impacts “from natural and cultural resources to park operations and visitor experience” (NPS, 2018b, par. 1). For example, changes in temperature may have direct repercussions on visitors, as summers could be intolerably hot, thus hindering physical activities and leading to increased heat exhaustion (Becken & Hay, 2007; Saunders et al., 2012; Edgell & McCormick, 2016). Moreover, storms have the potential to change coastlines and wreak havoc on resort homes and tourism services (Edgell & McCormick, 2016). Indirectly, temperature increases and the associated changes, such as sea level rise, stronger storms and beach erosion, can “transform the natural environment that attracts tourists in the first place” (Becken & Hay, 2007, xvii). These environmental changes, and their direct and indirect impacts, threaten the sustainability of tourism in the future (Edgell & McCormick, 2016). As a result, these changes come with a potentially severe economic impact if a threshold is crossed in which tourists no longer wish to visit a particular destination (Bin et al., 2007).

CHAPTER 3: STUDY AREA

The Outer Banks is a series of narrow barrier spits and barrier islands along Virginia's southeastern coast and North Carolina's northern coast, separating mainland eastern North Carolina from the Atlantic Ocean (Figure 3.1). This study focuses on the Currituck, Dare, and Hyde County portions of the island chain, not including Carteret County and defining the southern extent as Ocracoke. Further, the approximately 12-mile stretch of the Outer Banks at its origin in Virginia is not considered, focusing only on North Carolina's Outer Banks starting in Corolla.

North Carolina boasts 301 miles of coastline stretching southward from the Outer Banks to the South Carolina border, making the state second only to Florida in Atlantic Ocean coastline (U.S. Census Bureau, 2011). Spanning over 120-miles long, North Carolina's Outer Banks accounts for much of the state's coastline and coastal tourism economy (Outer Banks Chamber of Commerce, 2018b). The Outer Banks is known for its pristine beaches, which make the region one of the primary vacation destinations in the U.S. (Riggs et al., 2011). In addition to its natural beaches, "the Outer Banks is home to many natural and historic attractions" (Outer Banks Chamber of Commerce, 2018b, par. 2). The region includes the site of the first child born of English parents in the New World, Virginia Dare, the "Lost Colony" of Roanoke, the "Graveyard of the Atlantic", and the first successful airplane flight, all of which are memorialized on the Outer Banks today. The destination features five distinct lighthouses, including the tallest brick lighthouse in North America, four nearby national wildlife refuges (Mackay Island, Currituck, Alligator River, and Pea Island), three NPS sites (Cape Hatteras National Seashore, Fort Raleigh National Historic Site, and Wright Brothers National Memorial), and one of the three North Carolina Aquariums (Outer Banks Chamber of Commerce, 2018b).

The Outer Banks is also home to Nags Head Woods Nature Preserve and Jockey's Ridge State Park, North Carolina's most visited state park, known for having the tallest sand dunes on the East Coast with peaks at over 90 feet (Outer Banks Visitors Bureau, 2018a; b). The rich natural resources and cultural heritage of the area have been attracting visitors for many years.

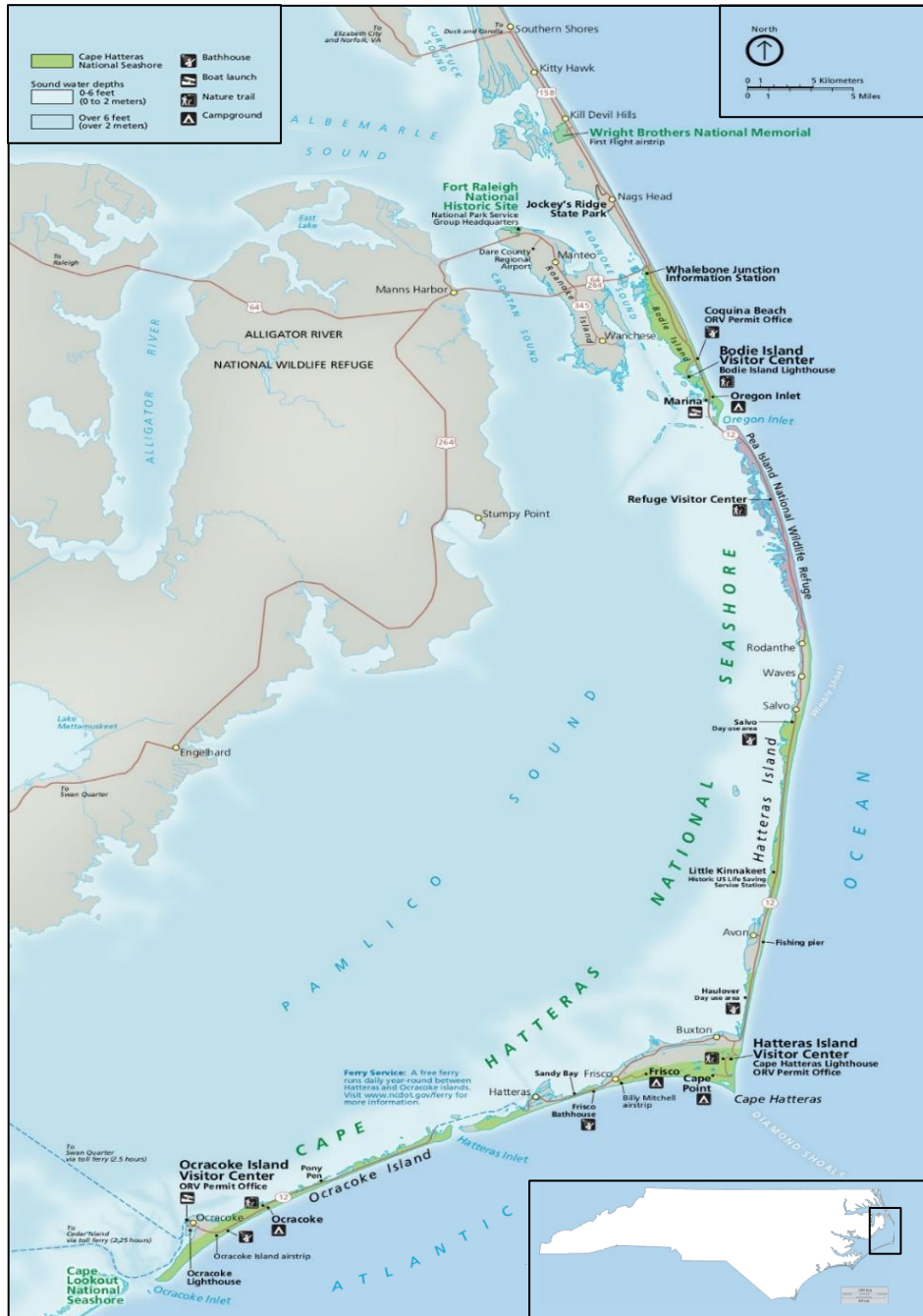


Figure 3.1: Map of Cape Hatteras National Seashore (NPS, 2018a)

Much of the Outer Banks' land mass, main attractions, and resort and vacation areas are located in Dare County, encompassing about 90 miles of coastline from Duck to Hatteras (Outer Banks Chamber of Commerce, 2018b). Dare County ranked fourth among North Carolina's 100 counties in tourism dollars in 2016, receiving \$1.1 billion in domestic travel expenditures and generating \$102.31 million in state and local taxes (Visit North Carolina, 2017). Dare County also ranked fourth in the state in direct employment in the tourism sector, with 13,160 employees (Visit North Carolina, 2017). The difference, however, between Dare County and the three counties ranked ahead of it is that tourism accounts for far more of its overall revenue proportionally (Table 3.1). Mecklenburg County, Wake County, and Guilford County, ranked one through three respectively in tourism dollars and employment, benefit from other industries in addition to tourism. These counties, the three most populated in North Carolina, also include the large cities and population centers of Charlotte, Raleigh, and Greensboro, the three largest cities by population in North Carolina. In contrast, Dare County is the 66th most populated county, while Currituck County ranks 74th and Hyde County 99th. Lacking many other industries, the Outer Banks region is heavily dependent on Outer Banks tourism.

Table 3.1: Dare County Tourism (Visit North Carolina, 2017)

	Domestic Travel Expenditures	Employees in Tourism Sector	Year-Round Population (2016 estimate)	Domestic Travel Expenditures per Year-Round Resident
Dare County	\$1.1 billion	13,160	36,387	\$30,231/person
Guilford County	\$1.3 billion	15,530	520,230	\$2,499/person
Wake County	\$2.2 billion	22,740	1,026,748	\$2,143/person
Mecklenburg County	\$5.2 billion	50,770	1,053,545	\$4,936/person

While official tourism figures for 2017 had not been released by the time of this project, it is projected that Buncombe County, which includes Asheville, will surpass Dare County for fourth in tourism (Morris, 2017). This comes despite a Dare County tourism revenue increase in 2017 (Morris, 2017). Lee Nettles, the managing director of the Dare County Tourism Board, credited Buncombe's surge to its recent addition of about 25 percent more hotel rooms, accommodating a large tourism industry (Morris, 2017). Between limited land and environmental restrictions under the Coastal Area Management Act (CAMA), the Outer Banks "simply [does not] have the potential for expansion" (Morris, 2017). Another likely factor is the longer tourism season at non-beach destinations, with summer and fall both being popular seasons for travelers to mountain destinations.

The Outer Banks is not a continuous stretch of islands, with coastal storms and other factors creating inlets that separate the islands. The Outer Banks currently consists of five "islands": Bodie, Roanoke, Pea, Hatteras, and Ocracoke. Bodie Island is actually a barrier spit extending south from Virginia. These islands are very remote, bordered to the west by the Currituck, Albemarle, Croatan, Roanoke, and Pamlico Sounds and to the east by the Atlantic Ocean (Saunders et al., 2012). Due to the shifting nature of barrier island chains and the occasional formation and dissolution of inlets, Pea Island has previously been contiguous with Bodie or Hatteras Island. The dynamic nature of these islands is both part of their allure and part of their burden. Long-established morphological changes, in conjunction with climate variability, human interference, and other interrelated environmental changes, threaten the sustainability of this thin, broken strand of islands (Riggs et al., 2011). The identity of this fragile national treasure and the thriving tourism economy it supports are in jeopardy. The major ongoing environmental changes and challenges that are addressed in this thesis include sea level rise,

beach and dune erosion, shoreline migration, increasing temperatures, increasing storm frequency and severity, and larger waves than normally experienced.

CAHA is the United States' first national seashore, authorized by Congress in 1937 and designated in 1953 when enough land was donated (Saunders et al., 2012; NPS, 2017).

According to the NPS's foundation statement:

The purpose of Cape Hatteras National Seashore is to permanently preserve the wild and primitive character of the ever-changing barrier islands, protect the diverse plant and animal communities sustained by the coastal island processes, and provide for recreational use and enjoyment that is compatible with preserving the distinctive natural and cultural resources of the nation's first national seashore (NPS, 2011, 9).

The national seashore covers a large portion of the Outer Banks, from Nags Head to Ocracoke, encompassing 24,470 acres and approximately 74 miles of ocean coastline. CAHA preserves and protects parts of four barrier islands: Bodie Island, Pea Island, Hatteras Island, and Ocracoke Island (NPS, 2007). These islands are mostly very narrow and low-elevation, often less than 500 yards wide and one meter above sea level (Saunders et al., 2012). The islands also contain Pea Island National Wildlife Refuge and several communities, former fishing villages. Although not officially part of the park, these eight villages predate the park and accommodate many park visitors (NPS, 2007). The full length of the seashore is accessible by NC 12, with bridges and ferries that serve Ocracoke Village at the southern end (Saunders et al., 2012).

CAHA was chosen as the study site because of the lack of commercialization, representing a relative best-case scenario for environmental degradation resulting from human development. While CAHA is undeveloped compared to other stretches of the Outer Banks, it is

not immune to environmental changes, as natural processes still take their course. Since the NPS owns and operates CAHA, information regarding visitor use, reports on environmental changes, and history of beach maintenance are readily available and accessible to the public. The combination of vulnerability to environmental changes, a tourism economy, and national park protection make Cape Hatteras National Seashore an interesting case study for climate change perception, environmental hazards, and natural resource management research.

CHAPTER 4: METHODOLOGY

To address the research questions, a survey of CAHA beachgoers was undertaken, following approval by the Institutional Review Board (IRB) at East Carolina University (Appendix A) and issuance of a Scientific Research and Collecting Permit by the NPS. Survey responses produced quantitative and qualitative data. Quantitative data were analyzed in SPSS using descriptive statistical analyses, Chi square tests, and (independent) one-way analysis of variance (ANOVA) tests. Qualitative data were analyzed through content coding for open-ended responses.

Data Collection

i. Survey Sample and Implementation

While the study area for this research included the whole Outer Banks region, data collection was centered in CAHA. That is, participants were recruited solely at CAHA, but survey questions included the whole Outer Banks. It was important to include both CAHA and its surrounding areas so participants were better able to address survey questions and had the opportunity to differentiate between CAHA and the periphery areas. Data were collected using a 26-item questionnaire survey administered in person using a convenience sample of CAHA beachgoers (Appendix B). Individuals were recruited from multiple locations and sites within CAHA including off-road-vehicle beach access areas, walkover beach access areas, and sound-side access areas (Figure 4.1). Surveys were conducted at different locations in the National Seashore to account for its size and diversity, as well as differences in recreation patterns among visitors. Individuals were approached and asked if they would be willing to take part in the research. Those who agreed to participate were administered an on-site survey.

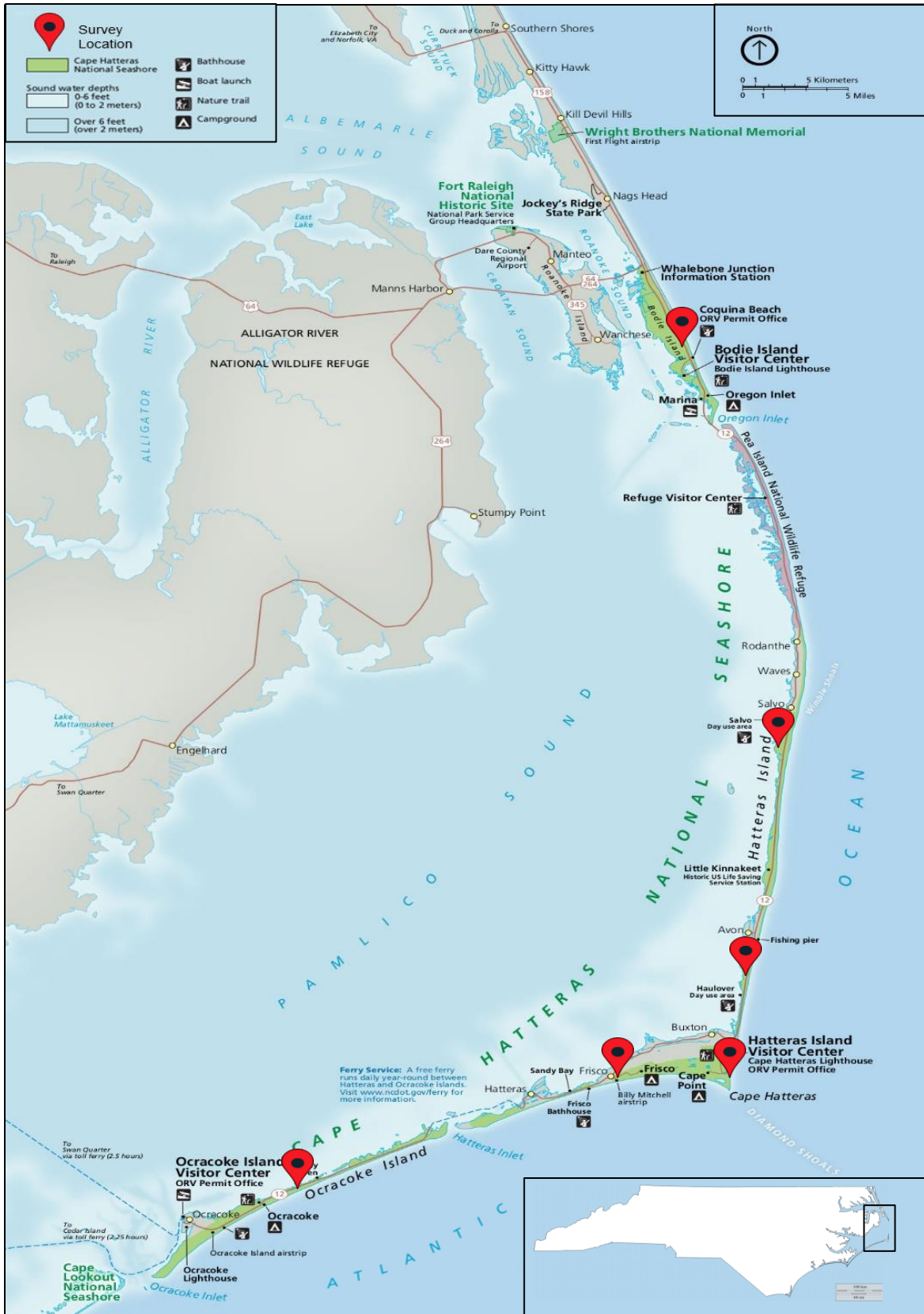


Figure 4.1: Map of Cape Hatteras National Seashore Survey Locations (NPS, 2018a)

Surveys were printed on paper and participants were given a pen and a clipboard with the survey attached. In general, participants completed the survey in no more than ten minutes. When participants returned their completed surveys, the time, date, and location of the survey were recorded. Data were collected on selected days between July and September 2017 because it is the high tourist season. Specific days were chosen based on researcher availability and forecasted weather conditions. Ultimately, data collection was completed over five trips totaling 13 days, including both weekdays and weekends. Surveys were administered between 10:00 am and 7:00 pm. In total, 137 surveys were completed.

Before this research was approved and this study conducted, the survey was pre-tested with a small group of individuals at East Carolina University. Their feedback was used to confirm that the survey content and syntax were understandable and unambiguous. The survey was adjusted and finalized based on the results of the pre-test.

ii. Survey Development and Structure

The goal of the survey was to determine why people choose the Outer Banks, if they feel the destination is threatened by environmental changes, and if environmental changes compromise their experiences and their desire to return. Numerous studies have used surveys to gather data on beach use and environmental perception (Hillery et al., 2001; Pendleton et al., 2001; Petrosillo et al., 2007; Buzinde et al., 2010). To gather the data needed to answer the research questions, the survey was designed to elicit responses relevant to participants' perceptions of the Outer Banks and their awareness and concerns for environmental changes occurring there, to be compared against their demographic circumstances. While visitors were

surveyed at CAHA, survey questions and exercises did not inquire about CAHA specifically, but rather the Outer Banks in general.

The survey was composed of 26 questions, including a combination of closed response and open-ended questions. Most survey questions featured multiple-choice options where respondents chose one answer from a list. Some multiple-choice questions instructed respondents to choose all answers that applied, and several specified “other” as a choice, allowing respondents to supply an answer that was not listed. A number of the survey questions consisted of various 5-point Likert scales (1 = not at all important, 5 = extremely important; 1 = not at all, 5 = to a very great extent; 1 = very negatively, 5 = very positively; 1 = much less likely, 5 = much more likely; 1 = not at all likely, 5 = extremely likely) to evaluate what attributes of the Outer Banks visitors value, which environmental changes concern and affect them, and how well the destination is meeting their needs. Additionally, there were three open-ended questions to allow respondents to provide their more detailed thoughts and opinions on these matters. Finally, the survey included one set of agree/disagree questions to gauge respondents’ positions on statements provided regarding their knowledge of, belief in, and concern for environmental changes.

The survey began with several questions about respondents’ demographic information. Demographic data were included because previous perception studies suggest socio-economic and geographic factors such as age, gender, ethnicity, income, education, place of residence, cultural ties, and past experiences influence perceptions of the environment (Lyons, 1983; Renn et al., 1992; Petrosillo et al., 2007). The survey also inquired about respondents’ visitation characteristics, including their property ownership on the Outer Banks, frequency of visits, past personal experiences, and travel arrangements. These questions regarding demographic variables

and visitation characteristics were structured in an effort to characterize respondents' profiles to be compared with their preferences, sensitivities, and environmental perceptions to determine any patterns.

Following the demographic questions, the survey transitioned to questions that were designed to elicit responses that address the research questions (Table 4.1). First, respondents were asked about why they choose, or in the case of first time visitors, chose, the Outer Banks. This included a list of eleven specific attributes for respondents to rate their importance, in addition to an open-ended question for solicitation of additional attributes respondents value. Next, respondents were asked in what activities they participate, or plan to participate, at the Outer Banks and if they have ever changed their choice of beach destination in the past because of beach conditions. The set of questions that followed shifted to environmental changes, asking respondents about their knowledge, sources of knowledge, and concern for environmental changes in general. Respondents were then probed about the significance of seven specific environmental changes that have been observed. Here, they were asked to rate the extent to which they thought each change was a problem as well as the effect each change might have on their experience at the Outer Banks and their decision to return. Again, respondents were given the opportunity to provide additional information through an open-ended question about environmental variables not included among the seven supplied. The survey culminated by asking respondents to rate their likelihood to recommend and revisit the Outer Banks based on their perceptions and to provide any measures that could be taken to improve their experiences at the Outer Banks.

Table 4.1: Research Questions and Corresponding Survey Items

Research Question	Survey Question
Why do tourists choose to visit the Outer Banks as opposed to other beaches?	Q12 Please indicate how important the following are in your decision to visit the Outer Banks.
	Q13 Are there any other important reasons you chose to visit the Outer Banks? Please write them below.
To what extent are tourists aware of environmental changes occurring at the Outer Banks? From what sources do they obtain their information?	Q15 Have you ever changed your choice of beach destination in the past because of beach conditions?
	Q16 How would you rate your current knowledge of environmental changes at the Outer Banks?
	Q20 Of the changes you are familiar with, where/how did you learn about them? Check all that apply.
	Q25 For the following questions please write "A" for agree, "D" for disagree, or "NS" for not sure. <ul style="list-style-type: none"> I had heard about environmental changes at the Outer Banks prior to this survey.
To what extent are environmental changes of concern to tourists? Which changes are they most concerned about?	Q17 How worried are you about environmental changes at the Outer Banks?
	Q18 To what extent do you believe the following are problems at the Outer Banks?
	Q19 Of these changes, which do you think is most significant?
	Q25 For the following questions please write "A" for agree, "D" for disagree, or "NS" for not sure. <ul style="list-style-type: none"> I believe that environmental changes should be taken into account when policymakers are developing plans for current and future development at the Outer Banks. More research is needed for me to accept these environmental changes at the Outer Banks. I am concerned about environmental changes at the Outer Banks. Nothing can be done to stop environmental changes at the Outer Banks from occurring.
To what extent will environmental changes affect tourists' plans to return to the Outer Banks in the future?	Q21 How might the following changes affect your experience while at the Outer Banks?
	Q22 If current trends continue, how might the following affect your decision to return to the Outer Banks in the future?
	Q23 Are there any other environmental changes at the Outer Banks you feel are important? Please write them below.
	Q24 Based on your experience, how likely are you to do the following?
	Q26 Are there any measures that could be taken to improve your experience at the Outer Banks? Please write them below.
	Q25 For the following questions please write "A" for agree, "D" for disagree, or "NS" for not sure. <ul style="list-style-type: none"> I experience effects from environmental changes at the Outer Banks when visiting. Action(s) should be taken to mitigate the effects of environmental changes at the Outer Banks.

Data Analysis

i. Statistical Analyses

Data from the 23 closed response questions were coded and entered into IBM SPSS for further analysis. Descriptive statistical methods were used to analyze the data and draw conclusions about preferences, sensitivities, and environmental perceptions among respondents. Respondents' demographic information and visitation characteristic data were summarized and analyzed using the frequency analysis tools. Answers to Likert-scale questions were classified into a numeric scale from their qualitative descriptions (Table 4.2). Frequency analysis tools were used to summarize Likert data, with answers coded as one and two consolidated together, as were answers of four and five. Answers coded as three, or neutral, remained the same. Frequency analysis was also used to summarize and analyze responses to multiple choice and agree/disagree questions. To supplement the findings of frequency analysis, the mean values of responses to Likert-scale questions were calculated using the numeric scale (Table 4.2). For these purposes, similar answers were not consolidated. As such, the mean values are used to represent the respondents' overall viewpoint on Likert-scale questions regarding aspects of the Outer Banks that respondents find important and their attitudes towards environmental changes occurring there.

Table 4.2: Reclassification of Likert Answers into Numeric Values for Analysis

Very Important	Somewhat Important	Neither important nor unimportant	Not very important	Not at all important
5	4	3	2	1
To a very great extent	To a great extent	To some extent	To a little extent	Not at all
5	4	3	2	1
Very negatively	Somewhat negatively	Neither positively nor negatively	Somewhat positively	Very positively
5	4	3	2	1

Much less likely to return	Somewhat less likely to return	No effect on my decision to return	Somewhat more likely to return	Much more likely to return
5	4	3	2	1
Extremely likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Not at all likely
5	4	3	2	1

To better understand the association between demographic information and visitation characteristics pertaining to the respondents, Chi Square tests and (independent sample) one-way analysis of variance (ANOVA) tests were applied to variables. Chi square tests were used when survey answers were categorical and one-way ANOVA tests were used when these answers were continuous. Likert scale questions were designated as continuous. To simplify analyses and help meet the Chi Square test’s assumption of expected cells counts of at least 5, responses to some questions were consolidated and recoded in SPSS (Table 4.3).

Table 4.3: Example of Consolidation

	18-24 years old	25-34 years old	35-44 years old	45-54 years old	55-64 years old	65 and older
Previous Numerical Value	1	2	3	4	5	6
New Numerical Value	1	1	2	2	3	3

Additionally, ANOVA tests assume that the variances of the populations from which the different samples are drawn are equal. Therefore, Levene’s Test was used to determine if categories met the assumption of homogeneity of variance. The ANOVA tests results are questionable for categories with significant returns at the 0.05 level on Levene’s Test. Categories that fail the assumption of homogeneity of variance are still included in the tables of significant results, but are not discussed in further detail due to their questionable legitimacy. Further, while ANOVA tests reveal a significant difference between groups, one-way ANOVA tests do not identify the relationship of the statistical difference. As such, the Tukey HSD (honest significant

difference) test, a post hoc ANOVA test, was used to indicate a difference between specific groups. Cross tabulation analyses were also used to compare variables and respondent answers to reveal relationships.

ii. Content Coding

Data from the open-ended questions were entered into Microsoft Excel for further analysis. Open-ended survey questions supplemented closed-response survey questions and gave participants the opportunity to provide their own answers, with some writing just a few words or bullet points and others using full sentences or paragraphs. These written responses were analyzed for their content and coded into categories to establish main ideas, patterns, and themes. Categories were determined through identification of similar words and phrases among respondent answers. Initial categories were created and then consolidated upon identification of overlapping concepts. The analyses of survey results using quantitative statistical tests combined with qualitative content-coding of open-ended responses address the research questions for this study.

CHAPTER 5: ANALYSIS OF SURVEY RESULTS

This chapter presents the information provided by the survey responses. First, demographic information and visitation characteristics reported by respondents are introduced, followed by information from survey items that help to establish an understanding of respondents' preferences, sensitivities, and environmental perceptions. This information is used to address the study's research questions, as well as to explore the influence of demographic information and visitation characteristics on the results.

Characteristics of the Respondents

A total of 137 individuals participated in the survey, falling shy of the desired number of 200 respondents. The original goal was based on the notion that on a given summer week as many as 200,000 beachgoers could inhabit the Outer Banks' islands, with 200 encompassing 0.1% of this population. This goal was not met due to a combination of factors, including limited time between research approval and the conclusion of the high tourist season, limited researcher availability, and inclement weather during scheduled data collection trips. There were opportunities for additional data collection in late September and early October; however, having less respondents was seen to be more beneficial than acquiring additional responses that would then introduce the potentially complicating issue of seasonality.

Many of the respondents are between the ages of 35 and 64 (70.1%), while 20.4% are under the age of 35 and 8.7% were over the age of 64 (Table 5.1). The predominant race represented is white (90.5%), with no other single race accounting for more than 2.9% of respondents. The proportion of men and women who answered the survey is fairly even at 52.6% female and 46.0% male, with the other 1.4% electing not to specify their gender. A large

majority of the respondents holds some college degree (81.0%), with the remaining 19.0% possessing a high school diploma or GED, trade school certificate, or some college credits. Most respondents live in North Carolina and Virginia (66.4%), with others mainly traveling from the Mid-Atlantic States, as well as a few from the Southeast, the Midwest, and New England (Table 5.1). Of those surveyed, only one was visiting from a state south of North Carolina.

Table 5.1: Demographic Information of Respondents

Demographic Variable		Respondents	
		Frequency	Percentage
Age	18-24	11	8.0%
	25-34	17	12.4%
	35-44	26	19.0%
	45-54	33	24.1%
	55-64	37	27.0%
	65 and older	12	8.7%
	Prefer not to say	1	0.7%
Race	White	124	90.5%
	Black or African-American	1	0.7%
	Hispanic or Latino	4	2.9%
	Asian or Pacific Islander	3	2.2%
	Biracial	4	2.9%
	Other	1	0.7%
Gender	Male	63	46.0%
	Female	72	52.6%
	Prefer not to say	2	1.5%
Education	High School or GED	19	13.9%
	Trade School	6	4.4%
	Some College	1	0.7%
	Associate's Degree	19	13.9%
	Bachelor's Degree	54	39.4%
	Graduate Degree	38	27.7%
Home State	North Carolina	48	35.0%
	Virginia	43	31.4%
	Maryland	9	6.6%
	New York	5	3.6%
	Pennsylvania	4	2.9%
	West Virginia	4	2.9%
	Connecticut	3	2.2%
	Michigan	3	2.2%
	Tennessee	3	2.2%

	California	2	1.5%
	Delaware	2	1.5%
	New Jersey	2	1.5%
	Georgia	1	0.7%
	Illinois	1	0.7%
	Indiana	1	0.7%
	New Hampshire	1	0.7%
	Ohio	1	0.7%
	Oregon	1	0.7%
	International (Spain)	1	0.7%
	Prefer not to say	2	1.5%

Traditional tourists and local recreation users made up 93.4% of the total respondents surveyed, with permanent Outer Banks residents accounting for the rest (Table 5.2). A majority of respondents do not own property on the Outer Banks (86.1%). Of the 19 respondents who are Outer Banks property owners, eight are permanent residents and 11 have primary residences elsewhere but owned vacation homes on the Outer Banks. One respondent is a permanent Outer Banks resident but rented, not owned, property there. Eight of the nine permanent residents live in the communities north of CAHA. When surveyed, respondents were mostly there either with their families (with children) (45.3%) or with their partners (no children) (39.4%), showcasing the family-oriented nature and reputation of the destination. Further, 71.5% of respondents were surveyed at the northern part of CAHA, north of Oregon Inlet, while 28.5% were surveyed at a variety of other locations across southern CAHA. Lastly, 74.5% of respondents were surveyed at walkover beach access areas, compared with 19.0% at off-road vehicle (ORV) access areas and 6.6% at sound-side access areas.

Nearly half of respondents (44.5%) visit the Outer Banks multiple times a year, compared with 33.6% visiting once a year and 13.1% first time visitors (Table 5.2). Return visitors were asked approximately how many years they had been visiting the Outer Banks; however, only 52 supplied responses. Of those 52, 40.4% have been visiting the Outer Banks for less than ten

years, while the other 59.6% have been visiting for ten or more years, and as many as 50 years. Respondents' lengths of stay were fairly evenly distributed between day trips (24.1%), more than a day but less than a week trips (30.7%), and week-long trips (26.3%). Almost half of the visitors had accommodations at the communities north of CAHA or the northernmost campground within CAHA (47.7%), while 35.9% were staying at the communities alongside CAHA or the campgrounds farther south. The remaining 15.3% were day visitors returning home.

Table 5.2: Visitation Characteristics of Respondents

Visitation Characteristics		Respondents	
		Frequency	Percentage
Visitation Status	Traditional tourist or local recreation user	128	93.4%
	Permanent resident	9	6.6%
Property Ownership on the Outer Banks	No	118	86.1%
	Yes	19	13.9%
Visitation Group	Alone	2	1.5%
	With family (with children)	62	45.3%
	With partner (no children)	54	39.4%
	With a group (not family)	14	10.2%
	Multiple groups	2	1.5%
	Prefer not to say	3	2.2%
Frequency of Visit	Occasionally	3	2.2%
	First time visitor	18	13.1%
	Once a year	46	33.6%
	Multiple times a year	61	44.5%
	Live here	9	6.6%
Years Visiting	Less than 10	21	40.4%
	10 or more	31	59.6%
Length of Stay	A day	33	24.1%
	More than a day, but less than a week	42	30.7%
	A week	36	26.3%
	Several weeks, but less than a month	12	8.8%
	A month or longer	5	3.6%
	Live here	9	6.6%
	Southern Shores	1 (1)	0.7%

Accommodation Location (Permanent Residents in parentheses)	Kitty Hawk	4	2.9%
	Kill Devil Hills	32 (4)	23.4%
	Nags Head	19 (3)	13.9%
	Manteo	12	8.8%
	Wanchese	1	0.7%
	Rodanthe	2	1.5%
	Salvo	6	4.4%
	Avon	14	10.2%
	Buxton	5 (1)	3.6%
	Frisco	1	0.7%
	Ocracoke	13	9.5%
	Other	2	1.5%
	Multiple locations	4	2.9%
	Not staying/Returning home/Day trip	21	15.3%

Respondents participated in a variety of beach activities. Sunbathing (89.6%) and swimming (87.4%) were overwhelmingly the most popular (Figure 5.1). The only other activity participated in by over half of respondents was visiting lighthouses and historic sites (58.5%). Just over 16% of respondents selected “other” and indicated participating in activities such as reading on the beach, eating at local restaurants, and patronizing local businesses/shops. Surfing (11.1%) was the activity in which the fewest number of respondents indicated they participate.

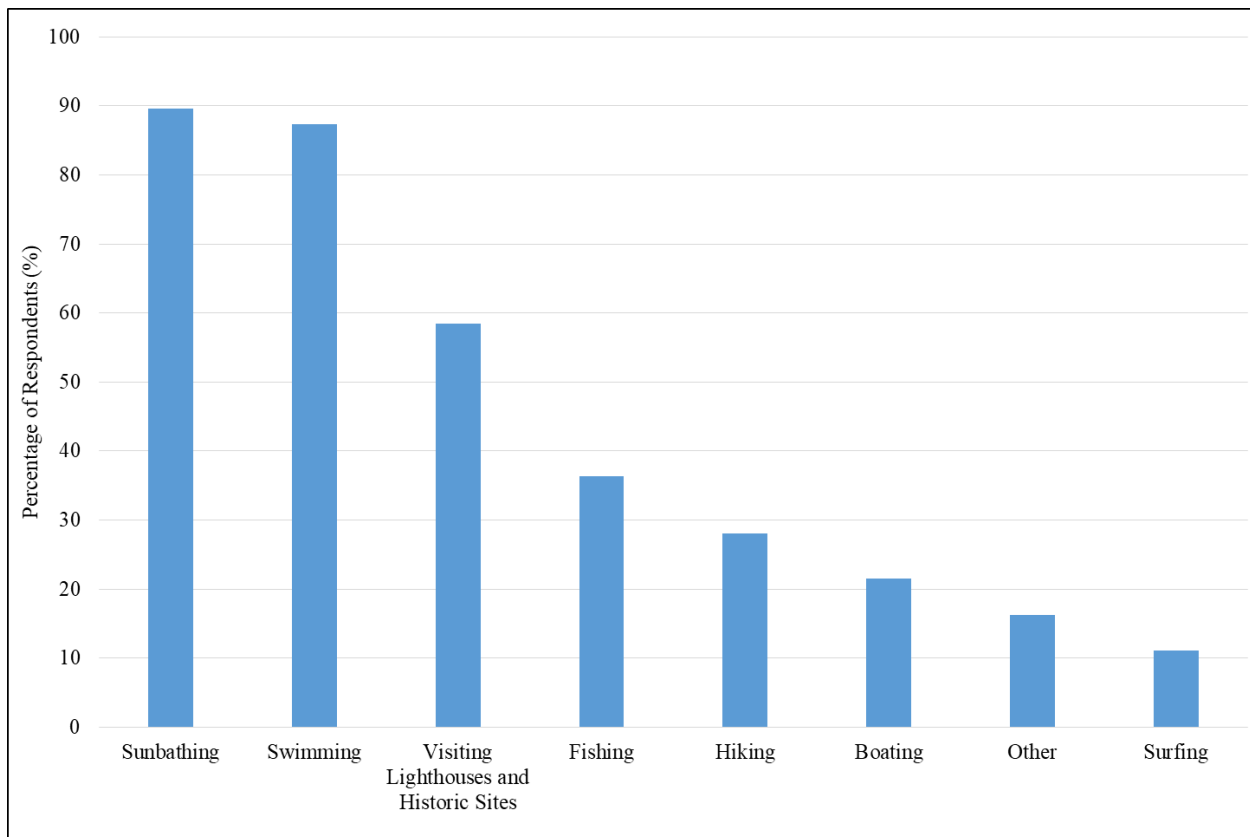


Figure 5.1: Respondents' Beach Activities

Research Question 1: Why do tourists choose to visit the Outer Banks as opposed to other beaches?

Two items from the survey address this research question: one Likert-scale question and one open-ended/written response question (Table 4.1). Eleven attributes were presented for respondents to rate on a 5-point Likert scale from very important to not all important in their choice to visit the Outer Banks. Attributes included price, accessibility, proximity (location), emotional attachment (tradition), scenery, beach width, historic sites, social activities, facilities, lack of development, and uncrowded beaches. Participants' answers were classified into a numeric scale from their qualitative descriptions (Table 4.2). Answers of 5 (very important) and 4 (somewhat important) were consolidated, as were answers of 2 (not very important) and 1 (not

at all important), at which point frequencies were calculated for each attribute. Scenery (96.3%) and uncrowded beaches (92.5%) were overwhelmingly the most important attributes of the Outer Banks among respondents (Figure 5.2). Location (79.1%) and accessibility (78.6%) also proved important, coinciding with the large proportion of visitors from North Carolina and nearby Virginia (66.4%). Social activities (45.4%) and historic sites (53.8%) were the least valued attributes among respondents though many still chose them.

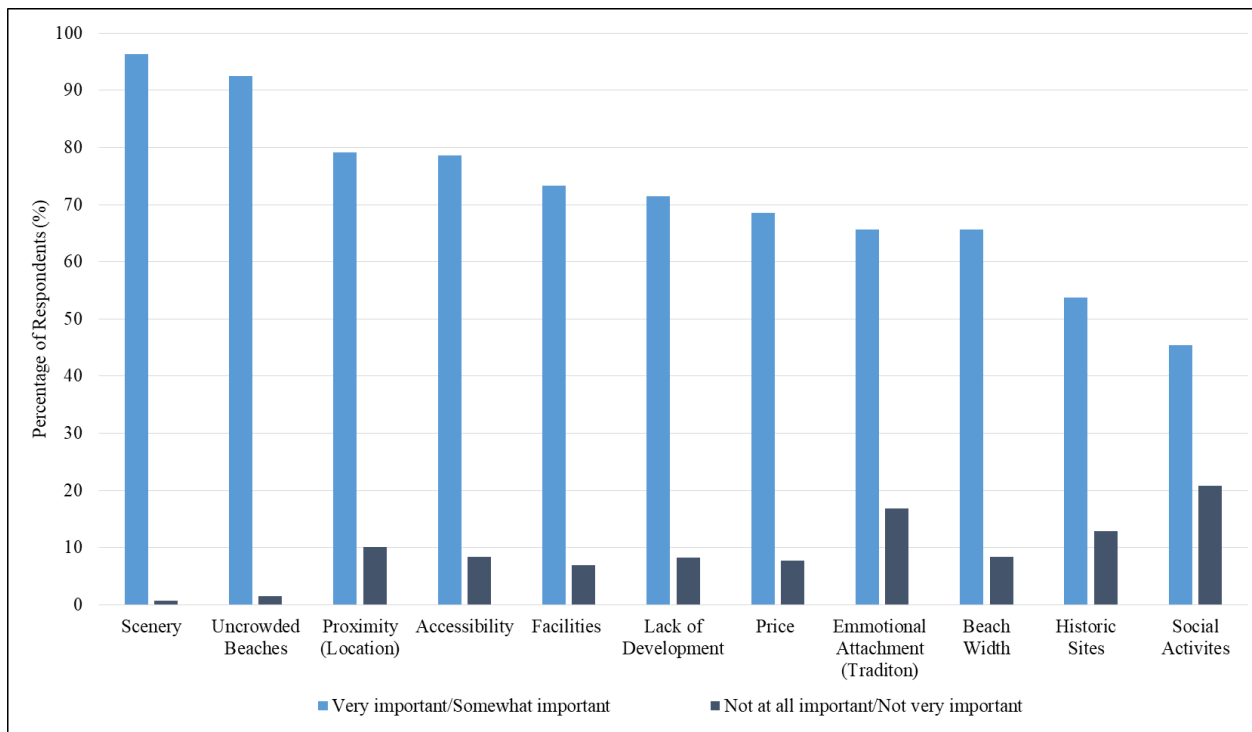


Figure 5.2: Attributes of the Outer Banks Respondents Find Important Based on Frequency Analysis

Using the numeric scale associated with their qualitative descriptions, the mean values of responses represent the attributes participants find important. The mean values are used to affirm the results of frequency analysis. Further, the mean values do not consolidate answers of 5 (very important) and 4 (somewhat important) and answers of 2 (not very important) and 1 (not at all important). Therefore, the mean values distinguish responses of very important versus somewhat important, and not very important versus not at all important, establishing a stronger distinction

among the attributes. The higher the mean value, the more heavily that attribute weighs on respondents' choices to visit the Outer Banks. The lower the standard deviation, the greater the consensus on the value of that attribute. The average mean score for the eleven attributes is 3.93 and the average standard deviation is 0.95. With the highest mean scores (M) and lowest standard deviations (SD), scenery ($M = 4.67$; $SD = 0.572$) and uncrowded beaches ($M = 4.51$; $SD = 0.680$) are the clear most important motivating factors in Outer Banks visitation (Table 5.3). Accessibility ($M = 4.08$; $SD = 1.016$) and proximity ($M = 4.05$; $SD = 1.074$) also proved important, but there was far less consensus, as evidenced by the high standard deviation among respondents. Social activities ($M = 3.22$; $SD = 0.909$) and historic sites ($M = 3.53$; $SD = 0.992$) were the least important to visitors.

Table 5.3: Attributes of the Outer Banks Respondents Find Important Based on Mean Comparison

Attribute	Respondents	
	M	SD
Scenery	4.67	0.572
Uncrowded Beaches	4.51	0.680
Accessibility	4.08	1.016
Proximity (Location)	4.05	1.074
Lack of Development	3.98	1.011
Facilities	3.88	0.851
Price	3.85	1.005
Beach Width	3.81	0.993
Emotional Attachment (Tradition)	3.70	1.362
Historic Sites	3.53	0.992
Social Activities	3.22	0.909

Frequency analysis and mean comparison analyses reveal similar results. The two attributes most valued by respondents according to both analyses are scenery and uncrowded beaches respectively. The two attributes least valued by respondents, historic sites and social activities, are also the same for both analyses. Other attributes rank similarly among both tests;

however, there are slight variations which can be attributed to the weighting of the mean comparison. In general, the combination of these analyses showcases the hierarchy of values among respondents in their choice to visit the Outer Banks.

In an open-ended follow-up question, respondents were encouraged to document any additional factors that are important in their choice of the Outer Banks, or to elaborate on an attribute already addressed in the previous question. Of the 137 respondents, 82 supplied responses, ranging from just a few words to full paragraphs. Content analysis revealed patterns, themes, and common ideas among responses, which allowed responses to be categorized. The overarching themes for characteristics that are important in respondents' choices of beach are beach quality, location, and amenities, with multiple subcategories prevailing to form these overarching themes (Table 5.4). In total, 59 responses fell under the beach quality theme. The most frequently identified attribute regarding beach quality was the Outer Banks' reputation as an authentic destination, not touristy or overcrowded. This was mentioned by 18 respondents, eight of whom made comparisons to other East Coast beach destinations. For many, the Outer Banks is the antithesis of Myrtle Beach, Virginia Beach, and other developed beaches in Maryland and Delaware. Another favorable beach quality is the laid back atmosphere of the Outer Banks, also cited by 18 respondents, with many finding the destination peaceful and relaxing. The natural beauty of the area was mentioned by 15 respondents, coinciding with the large proportion who indicated scenery as being important in the previous question. Likewise, 15 respondents remarked that the Outer Banks is a manageable distance from home, comprising the location theme and affirming the value of location as evidenced in the previous question. Notably, respondents who regarded the Outer Banks' location as being important were not just those who lived in nearby eastern North Carolina and southeastern Virginia, but respondents

from across the East Coast up to New England. The final theme, amenities, also garnered 59 total responses across multiple different subcategories, with participants highlighting a variety of entertainment options available on the Outer Banks.

Table 5.4: Attributes of the Outer Banks Respondents Find Important Based on Content Analysis

Theme	Attribute	Example	Number of Responses
Beach Quality/Condition	Not Touristy or Overcrowded	“Less crowds and development on oceanfront”	18
	Peaceful and Relaxing Atmosphere	“The outer banks is very relaxing”	18
	Natural Beauty	“North Carolina beaches are the most beautiful because they are so natural and pristine”	15
	Beach Quality	“We consider OBX one of the nicest beach areas on the East Coast”	8
Location	Manageable Distance from Home	“Away from home, but not too far at the same time”	15
Amenities	Other Amenities and Nearby Attractions	“Love to collect seashell specimens, visit historic places, climb lighthouses”	13
	Family Ties and Family-Friendly	“Good place to take family”	9
	National Park Service Protection	“Ability to camp/see national parks”	8
	Fishing	“GREAT fishing”	6
	Clean Beaches and Facilities	“The Outer Banks has very clean beaches. And the facilities are always clean”	5
	Local Restaurants	“Variety/great restaurants!”	5
	History	“We enjoy the history of the Outer Banks”	5
	Beach Driving	“Ability to drive on the beach”	4
	New Experience	“Never been here before. Wanted to experience it”	4

Research Question 2: To what extent are tourists aware of environmental changes occurring at the Outer Banks? From what sources do they obtain their information?

Four items from the survey address this research question: two traditional multiple choice questions, one “check all that apply” multiple choice question, and one agree/disagree question

(Table 4.1). First, respondents were asked if they had changed their choice of beach destination in the past because of beach conditions. Only 33.6% of the respondents reported having changed their choice of beach destination in the past because of beach conditions, suggesting a relatively low sensitivity to this among respondents. However, many respondents (85.1%) stated they had heard about environmental changes at the Outer Banks prior to being surveyed, while 7.5% said they had not and another 7.5% said they were not sure. Respondents were then introduced to the seven environmental changes addressed in this study: sea level rise, beach erosion, shoreline migration dune erosion, increasing temperatures, increasing storm frequency and severity, and larger waves than normally experienced. When asked specifically about their knowledge of these environmental changes at the Outer Banks, 90.4% said they have either very little (29.6%) or moderate (60.7%) knowledge. Few respondents reported possessing no knowledge (5.2%), while even fewer reported being experts on the subject (4.4%) (Figure 5.3).

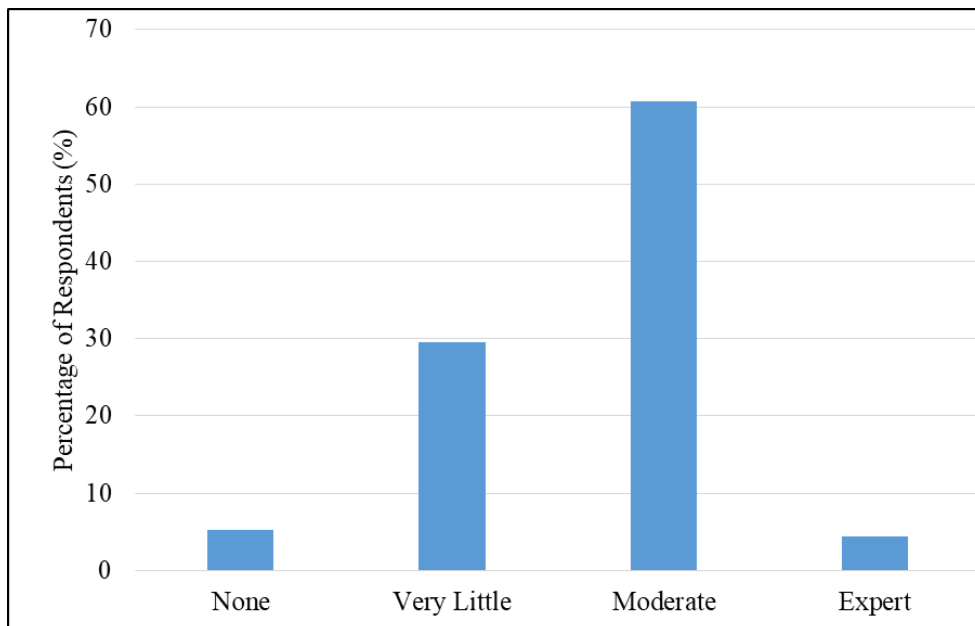


Figure 5.3: Respondents' Reported Knowledge Level Regarding Environmental Changes at the Outer Banks

In a follow-up question, respondents were asked to select all the sources from which they acquire their knowledge of environmental changes. Respondents were presented with eight sources from which to choose, and were encouraged to check all sources that applied. Further, they were provided the option to select “other” and asked to specify. Personal experience or observation was the most common source of knowledge, indicated by 73.1% of respondents. Almost 47% reported learning about environmental changes through television, radio, or other media coverage, while 35.4% reported acquiring knowledge from newspapers or magazines. It is important to note that of the 61 respondents who marked television, radio, or other media coverage and the 46 who marked newspapers or magazines, a majority, 45 and 39 respectively, also marked personal experience. The remaining sources were reported less frequently, with none topping 30%. Just over 9% of respondents selected “other” and indicated learning about environmental changes from sources such as NPS interpretive signs, ferry personnel, and museums (Figure 5.4).

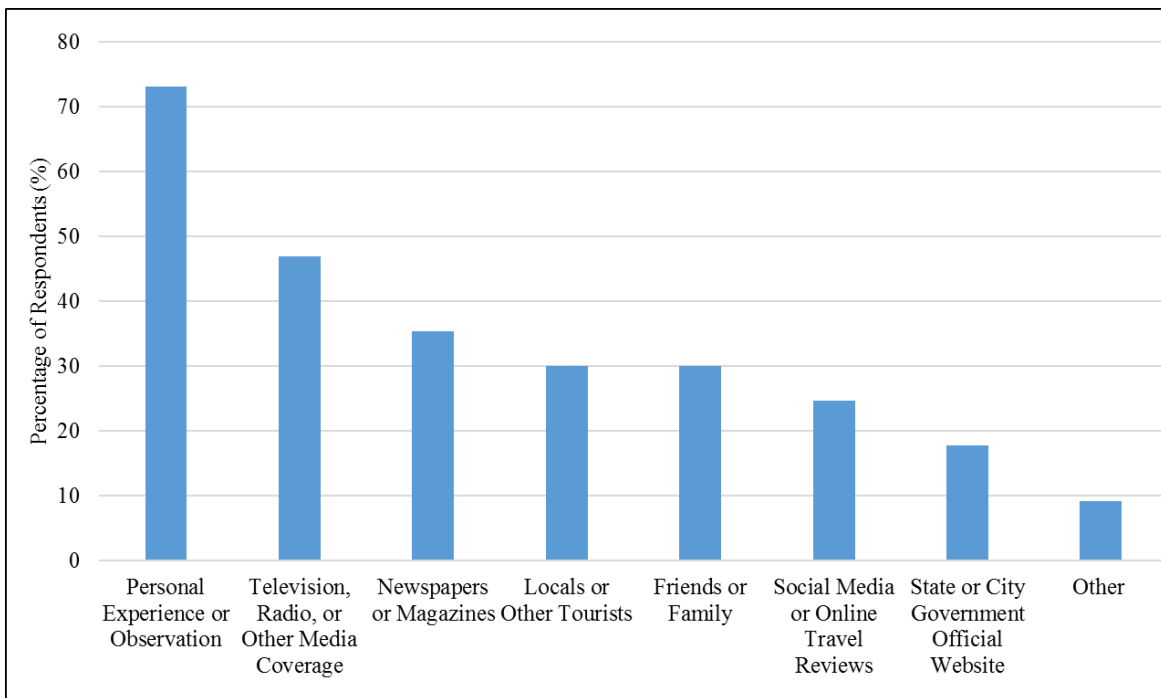


Figure 5.4: Respondents’ Sources of Knowledge on Environmental Changes

In comparing respondents' reported knowledge levels with their knowledge sources, only two categories show significance at the 0.05 level (Appendix C). Respondents who cited personal experience or observation as a knowledge source had significantly higher reported knowledge levels ($M = 2.81$), compared to those who did not ($M = 2.29$). In other words, respondents who believed they had observed environmental changes firsthand unsurprisingly felt more knowledgeable on the subject. However, this finding is limited by the fact it fails to address which experiences gave them this knowledge and what specific changes they observed. Further, respondents who obtained knowledge from locals or other tourists had higher reported knowledge levels ($M = 2.81$) compared to those who did not ($M = 2.60$). However, these ANOVA tests results may be unreliable since both fail the assumption of homogeneity of variance as evidenced by their statistical significance on Levene's Test.

Research Question 3: To what extent are environmental changes of concern to tourists? Which changes are they most concerned about?

Seven items from the survey address this research question: two multiple choice questions, one Likert-scale question, and four agree/disagree questions (Table 4.1). First, respondents were asked how worried they are about environmental changes at the Outer Banks. Just over 88% stated they are either somewhat worried (65.2%) or very worried (23.0%), while 10.2% of respondents said they are not very worried, with only 1.5% saying they are not all worried (Figure 5.5).

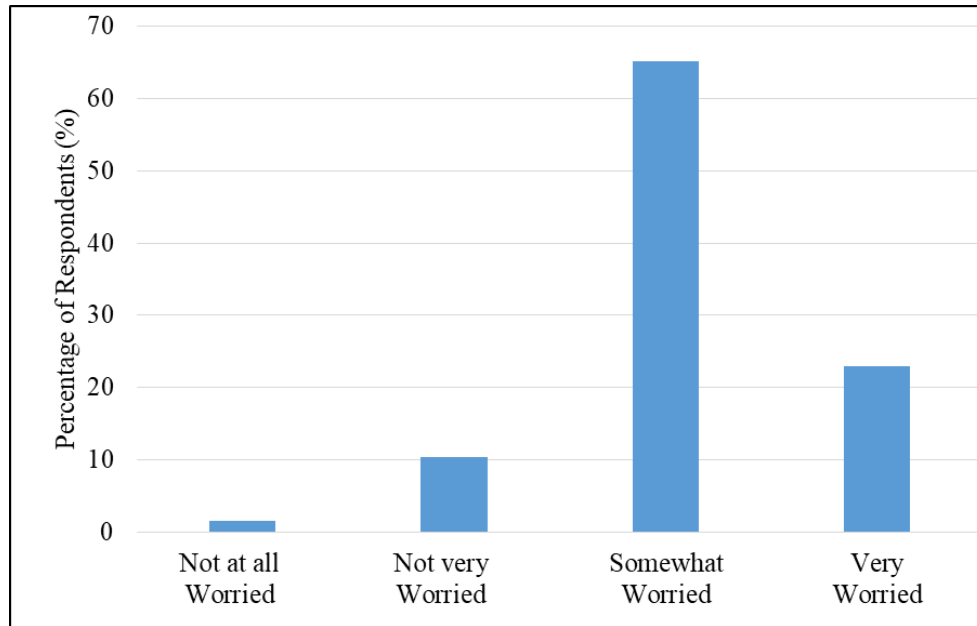


Figure 5.5: Respondents’ Levels of Concern for Environmental Changes at the Outer Banks

While no relationship was found between respondents’ reported knowledge and concern levels, four categories show significance in comparing their concern levels with their knowledge sources (Table 5.5). Respondents who cited personal experience as a knowledge source were more concerned ($M = 3.19$) than those who did not ($M = 2.94$). That is, respondents who felt they had observed environmental changes firsthand were more concerned. However, this finding is again limited by the fact it fails to address which experiences gave them this knowledge and what specific changes they observed. Further, this ANOVA test result may be unreliable since it fails the assumption of homogeneity of variance. The three remaining categories passed Levene’s Test. Respondents who cited newspapers or magazines as sources reported greater concern ($M = 3.27$) than those who did not ($M = 3.05$). Additionally, respondents who used social media were more concerned ($M = 3.39$) than those who did not ($M = 3.04$). Lastly, respondents who used government websites reported greater concern ($M = 3.35$) than those who did not ($M = 3.08$). However, of the 46 respondents who used newspapers or magazines, 39 also

indicated personal experience and observation as a knowledge source. Further, of the 32 respondents who used social media, 23 also marked personal experience. Finally, of the 23 respondents who used social media, 19 also marked personal experience. Therefore, it is difficult to attribute their greater concern to their use of newspapers and magazines, social media, and government websites as information sources. That being said, it is unsurprising that individuals who obtained information from any combination of these sources are more concerned than those who obtained information from none of these sources.

Table 5.5: Statistically Significant ANOVA Test Differences in Concern Levels by Knowledge Sources

Knowledge Source	ANOVA Test Result	Degrees of Freedom	ANOVA Significance
Personal Experience	4.984	1	0.027*
Newspapers or Magazines	4.322	1	0.040
Social Media	9.035	1	0.003
Government Official Websites	4.320	1	0.040
*Levene's Test statistic returns as significant at 0.05 significance level; the ANOVA tests results may be unreliable.			

A series of agree/disagree questions supplemented the initial multiple choice question to better understand the extent to which respondents are concerned about environmental changes. Just over 93% of respondents indicated they are concerned about environmental changes occurring at the Outer Banks (Table 5.6). However, 41.7% also said more research is needed for them to accept these environmental changes as problems at the Outer Banks, with only slightly more, 44.7%, not calling for more research before accepting these changes as problems. Despite this nearly even split between those needing more research before accepting these environmental changes as problems and those not, a staggering 97.0% believe environmental changes should be taken into account when policymakers are developing plans for current and future development

at the Outer Banks. Further, 72.0% disagreed that nothing can be done to stop environmental changes at the Outer Banks from occurring.

Table 5.6: Respondents' Answers to Agree/Disagree Questions

Statement	Agree	Disagree	Not Sure
I believe that environmental changes should be taken into account when policymakers are developing plans for current and future development at the Outer Banks.	97.0%	0.7%	2.2%
More research is needed for me to accept these environmental changes at the Outer Banks.	41.7%	44.7%	13.6%
I am concerned about environmental changes at the Outer Banks.	93.1%	4.6%	2.3%
Nothing can be done to stop environmental changes at the Outer Banks from occurring.	12.9%	72.0%	15.2%

Next, the seven environmental changes from before were presented one by one for respondents to rate on a 5-point Likert scale to evaluate the extent to which respondents believe each is a problem at the Outer Banks. Responses were classified into a numeric scale from their qualitative descriptions (Table 4.2). Answers of 5 (to a very great extent) and 4 (to a great extent) were consolidated, as were answers of 2 (to a little extent) and 1 (not at all). Beach erosion (67.4%) and dune erosion (65.9%) were indicated as the greatest problems by respondents (Figure 5.6). Shoreline migration ranked third among problems, indicated by 50.8% of respondents. Of the 86 respondents who marked beach erosion and 65 who marked shoreline migration as a 4 or 5, 59 marked both variables as a 4 or 5. Therefore, most individuals who indicated shoreline migration as a problem also indicated beach erosion as a problem, but a lesser proportion of those who indicated beach erosion as a problem also indicated shoreline migration as a problem despite the similarity of the processes. Larger waves (34.1%) and increasing temperatures (33.8%) were the least prevalent problems, as perceived by respondents.

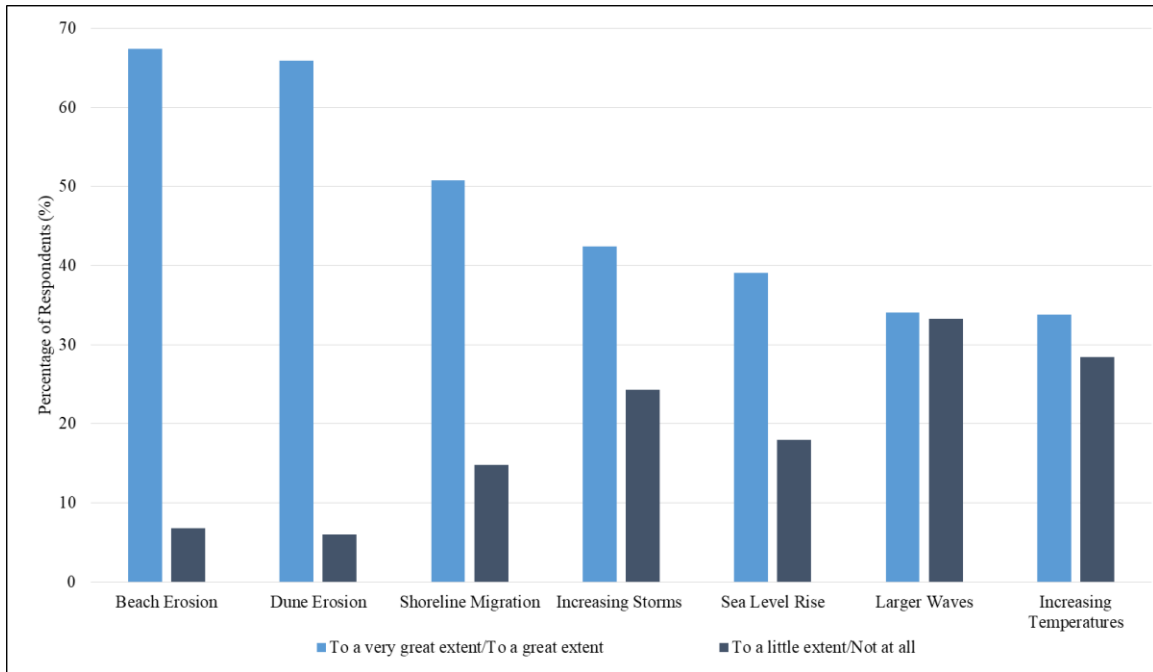


Figure 5.6: Extent to Which Environmental Changes are Problems at the Outer Banks Based on Frequency Analysis

Again, mean value comparison was used to affirm the results of the frequency analysis. The average mean score for the seven variables is 3.43 and the average standard deviation is 1.11. With the highest mean scores, beach erosion ($M = 3.92$) and dune erosion ($M = 3.89$) were identified as the largest environmental problems at the Outer Banks (Table 5.7). Larger waves ($M = 2.99$) and increased temperatures ($M = 3.10$) were identified as the least prevalent problems. However, standard deviations were high for all of the variables.

Table 5.7: Extent to Which Environmental Changes are Problems at the Outer Banks Based on Mean Comparison

Environmental Variable	Respondents	
	<i>M</i>	<i>SD</i>
Beach Erosion	3.92	1.012
Dune Erosion	3.89	0.998
Shoreline Migration	3.48	1.011
Sea Level Rise	3.34	1.082
Increased Storms	3.28	1.256
Increased Temperatures	3.10	1.206
Larger Waves	2.99	1.176

The frequency analysis and mean comparison tests show similar results. The two environmental changes most cited as the largest problems by respondents according to both analyses are beach erosion and dune erosion respectively. Larger waves and increased temperatures are the two changes least perceived as problems by respondents for both tests, however their order is reversed. Other attributes rank similarly among both tests; however, there are slight variations which can be attributed to the weighting of the mean comparison. In general, the combination of these tests showcases the hierarchy of problems related to environmental changes at the Outer Banks as perceived by respondents.

Although frequency analysis and mean comparison suggest beach erosion is seen to be the most significant change, a follow-up question directly inquired which change respondents thought was most significant. Although this question was not intended to be a “check all that apply” question, 29 respondents selected multiple answers; therefore, the frequencies do not add up to 100 percent. Beach erosion was overwhelmingly identified as the most significant concern by respondents at 48.1% (Figure 5.7). By comparison, dune erosion was the second most significant at 24.8% and sea level rise was third at 21.1%. No other environmental change was regarded as the most significant by more than 12% of respondents. Shoreline migration was

deemed the most significant concern by only 10.5% of respondents, a sharp contrast from beach erosion despite the similarity of the processes.

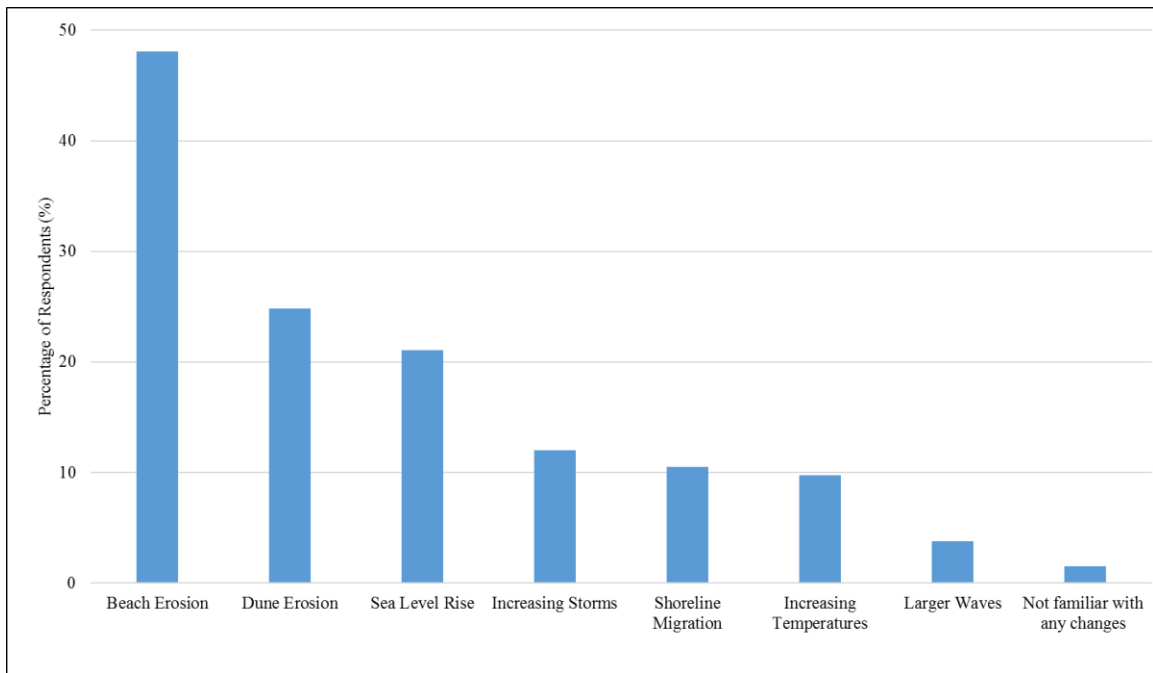


Figure 5.7: Most Significant Environmental Change Based on Frequency Analysis

Research Question 4: To what extent will environmental changes affect tourists' plans to return to the Outer Banks in the future?

Seven items from the survey address this research question: three Likert-scale questions, two agree/disagree questions, and two open-ended questions (Table 4.1). Despite the large numbers of respondents who said they are concerned about environmental changes and cited personal experience as a source of knowledge, only 46.5% of respondents agreed that they experience effects from environmental changes at the Outer Banks. However, a majority of respondents (82.4%) said action(s) should be taken to mitigate the effects of environmental changes at the Outer Banks.

Next, the seven environmental changes tested earlier were presented one by one for respondents to rate on the 5-point Likert scale to evaluate which changes most affect respondents' experiences while at the Outer Banks. Responses were classified into a numeric scale from their qualitative descriptions (Table 4.2). Again, answers of 5 (very negatively) and 4 (somewhat negatively) were consolidated, as well as answers of 2 (somewhat positively) and 1 (very positively). Answers of 3 (neither positively nor negatively) represent neutrality. Answers of 2 and 1 were rare, and are not included in Figure 5.8. Beach erosion was most frequently regarded as having a negative effect on visitor experience, identified by 65.1% of respondents (Figure 5.8). Dune erosion (58.5%), shoreline migration (54.8%), and increasing storms (54.3%) were also regarded as detrimental to visitor experience by over half of respondents. Larger waves had the least negative effect; in fact, 14.2% of respondents said larger waves weighed positively on their experience.

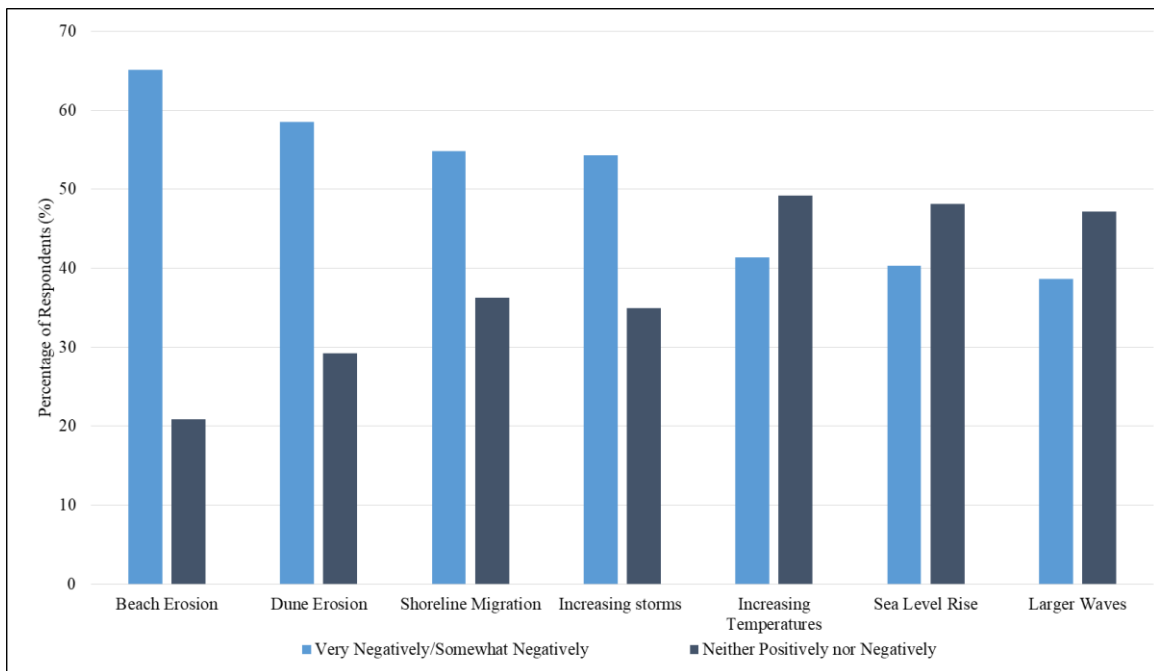


Figure 5.8: Extent to Which Environmental Changes Affect Respondents' Experience at the Outer Banks Based on Frequency Analysis

Notably, while beach erosion was identified as the change with the most negative effect on respondents' experience overall, increasing storms received the most answers of 5, or very negatively. This relationship is highlighted by the mean value comparison, where increasing storms ranks second ($M = 3.61$) behind beach erosion (3.65) (Table 5.8). The average mean score for the seven variables is 3.49 and the average standard deviation is 1.01. While the overall hierarchy is similar for the frequency analysis and mean comparison, the mean comparison highlights how little separation there is between the different environmental changes.

Table 5.8: Extent to Which Environmental Changes Affect Respondents' Experience at the Outer Banks Based on Mean Comparison

Environmental Variable	Respondents	
	<i>M</i>	<i>SD</i>
Beach Erosion	3.65	1.164
Increasing Storms	3.61	1.134
Dune Erosion	3.58	1.098
Shoreline Migration	3.55	0.868
Increasing Temperatures	3.37	0.895
Sea Level Rise	3.36	0.976
Larger Waves	3.33	0.935

In a follow-up question, the seven environmental changes were again presented one by one for respondents to rate on a 5-point Likert scale, but this time the emphasis was on which changes most affect respondents' decision to return to the Outer Banks. Responses were classified into a numeric scale from their qualitative descriptions (Table 4.2). Beach erosion was most frequently identified as having a negative effect on respondents' decision to return (43.8%), followed closely by increasing storms (43.7%) (Figure 5.9). No other change was regarded as detrimental to decisions to return by more than 40% respondents, and for five of the seven changes, more than 50% of respondents said they would have no effect on their decision. Again,

larger waves were perceived as having the least negative effect, with 18.4% of respondents saying larger waves weighed positively on their decision to return.

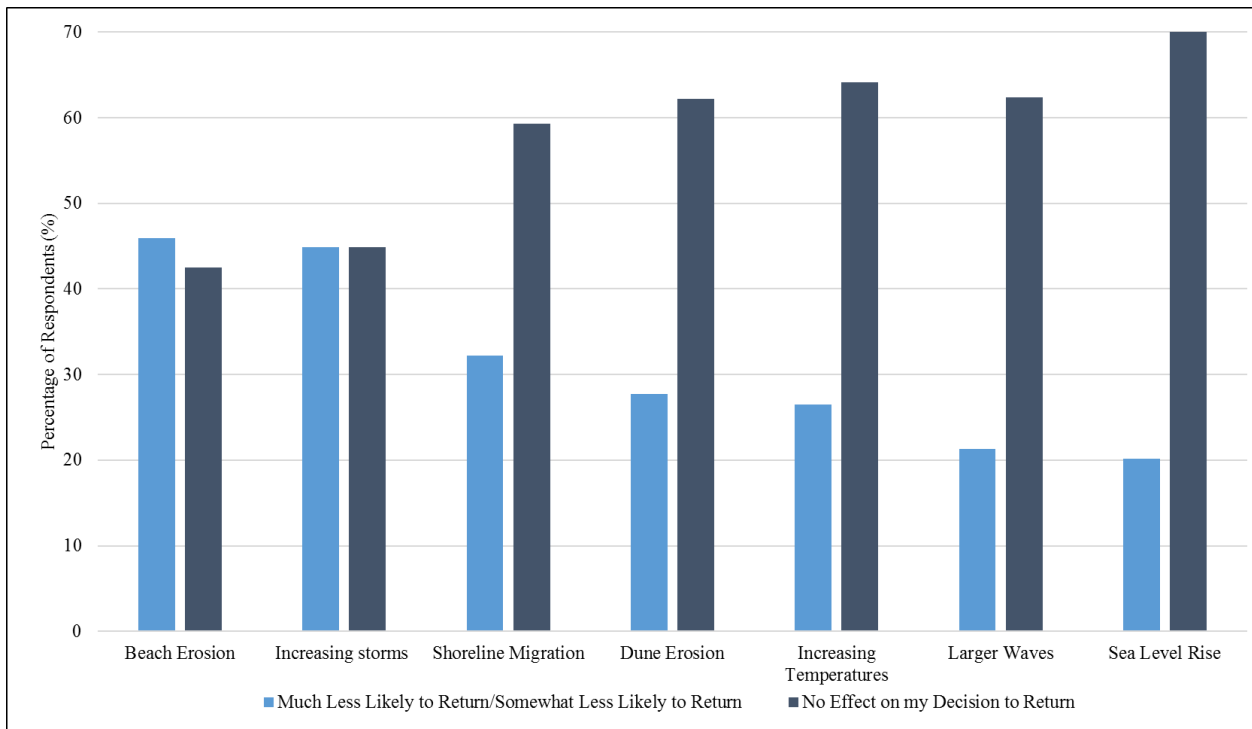


Figure 5.9: Extent to Which Environmental Changes Affect Respondents’ Desire to Return to the Outer Banks Based on Frequency Analysis

Due to the large number of respondents who said they were much less likely to return in light of increasing storms, this change ($M = 3.42$) ranks ahead of beach erosion (3.35) in the mean value comparison (Table 5.9). However, the close proximity of the mean values to 3 indicates that environmental changes as a whole have little effect on respondents’ decisions to return.

Table 5.9: Extent to Which Environmental Changes Affect Respondents' Desire to Return to the Outer Banks Based on Mean Comparison

Environmental Variable	Respondents (Tourists only)	
	<i>M</i>	<i>SD</i>
Increasing Storms	3.42	0.972
Beach Erosion	3.35	0.913
Shoreline Migration	3.23	0.767
Dune Erosion	3.15	0.830
Increasing Temperatures	3.13	0.760
Sea Level Rise	3.07	0.722
Larger Waves	3.01	0.846

To affirm these results using a 5-point Likert scale from extremely likely to not all likely, respondents were then asked to rate the likelihood that they will recommend and revisit the Outer Banks. This was based on their overall environmental perception, not specific environmental changes. Responses were classified into a numeric scale from their qualitative descriptions (Table 4.2). Nearly all respondents (96.3%) said they would recommend the Outer Banks to others. Perhaps more importantly, 98.4% said they would revisit the Outer Banks in the future, with 91.9% saying it is extremely likely they will return. Once again, the mean values support the findings of the frequency analysis. The mean values for both likelihood to recommend the Outer Banks ($M = 4.80$) and likelihood to revisit the Outer Banks ($M = 4.90$) are extremely high.

In open-ended follow-up questions, respondents were encouraged to document any other environmental changes that they feel are important, or to elaborate on a change already addressed in the previous question. A total of 42 participants supplied responses. Content analysis revealed patterns, themes, and common ideas among responses, which allowed responses to be categorized. The overarching themes for important changes are environment, use, and development (Table 5.10). In total, 16 responses fell under the environment related theme, comprised of visitor concerns relating to various environmental challenges facing the

island chain including habitat loss, general climate change, and overwash and flooding. The use related theme, comprised of visitor concerns regarding how others treat and use the destination including littering, overcrowding, and beach driving, featured 15 responses. Finally, the development related theme includes only the subcategory of overdevelopment and commercialization, which was the most frequently identified individual problem in addition to pollution, indicated by ten respondents.

Table 5.10: Additional Environmental Considerations Based on Content Analysis

Theme	Problem	Example(s)	Number of Responses
Environment	Habitat Loss	“Corporate invasion, loss of natural environment”	9
	General Climate Change	“I believe climate change is real and not being addressed by the current administration. All these changes affect OBX”	4
	Overwash and Flooding	“Erosion of beach affecting the highways. Washouts of road after storms”	3
Use	Trash and Pollution	“Pollution via trash, people here need to be as ‘leave no trace’ as the mountains” “Pollution (no recycling at national park sites)”	10
	Overuse and Overcrowding	“Acceleration of change due to things [like] excessive use and or man induced climate change should most definitely be managed and reduced”	3
	Beach Driving	“Cars tearing up beach habitat”	2
Development	Overdevelopment and Commercialization	“Overdevelopment of the area has negatively impacted beach structure- i.e., human encroachment on dunes, dredging, possible oil rigs offshore”	10

Respondents were then asked if there were any measures that could be taken to improve their experience at the Outer Banks. A total of 58 participants supplied responses. The overarching themes relate to preservation, use, and maintenance (Table 5.11). The preservation theme garnered 27 responses, including calls for natural areas to be preserved, development to be restricted, and dunes to be better protected. A total of 25 responses fell into the use theme, including educating visitors, better regulating beach driving, limiting the number of people, and increasing beach driving access. Finally, thirteen responses were categorized into the maintenance theme, including improving cleanliness, keeping up with beach restoration and maintenance, and upgrading facilities. Preserving natural areas and educating visitors were the most common individual measures identified, with 12 respondents in support of each. Again, development was a concern, as evidenced by the ten respondents calling for restricted development, going hand in hand with the desire for natural areas to be preserved.

Table 5.11: Measures Respondents Hope to Be Taken Based on Content Analysis

Category	Measure	Example(s)	Number of Responses
Preservation/ Development	Preserve Natural Areas	“Less commercial properties [and] more natural environment”	12
	Restrict Development	“Restrict commercial development”	9
	Protect Dunes	“Keeping the dunes safe (people off them)”	6
Use	Educate Visitors	“Protect this special place through education and natural resources”	12
	Ban or Better Regulate Beach Driving	“No vehicles permitted on beach (I think it's crazy!)”	5
	Limit Number of People	“Less people!”	4
	Increase Beach Driving Access	“Allow more freedom to drive on beach, esp. at Cape Point” “Keep beaches open to 4x4 travel/fishing”	2

	Reduce Costs	“Reduce prices”	2
Maintenance	Improve Cleanliness	“Addition of trash/recycling cans to help clean up the beaches”	5
	Beach Maintenance	“Continued beach nourishment”	4
	Upgrade Facilities	“More facilities at entry points” “Improvements in campgrounds”	4

The Influence of Demographic Information and Visitation Characteristics on Respondents’ Answers

With the research questions for this study addressed, comparisons can be made between respondent answers and patterns identified based on their demographic and visitation characteristics. Age, gender, education, home state, frequency of visit, length of stay, accommodation location, location surveyed, and access area were all analyzed as independent variables. The independent variables and their categories after consolidation are shown in Table 5.12. Since the respondents were not evenly distributed according to race, visitation status (traditional tourist or local recreation user versus permanent residents), and property ownership, these variables were not analyzed. For the age, gender, and home state-related analyses, the “prefer not to say” option was omitted due to few responses, as was the “other” option for accommodation location.

Table 5.12: Independent Variables in Analysis after Consolidation

Independent Variable	
Age	18-34
	35-54
	55 and older
Gender	Male
	Female
Education	Less than a Bachelor’s Degree
	Bachelor’s Degree
	Graduate Degree

Home State	North Carolina
	Virginia
	Other
Frequency of Visit	First time visitor
	Once a year
	Multiple times a year or Live here
Length of Stay	A day
	More than a day, but less than a week
	A week
	More than a week or Live here
Years Visiting	Less than 10
	10 or more
Accommodation Location	Northern CAHA (north of Oregon Inlet)
	Southern CAHA (south of Oregon Inlet)
	Not staying/Return Home/Day trip
Location Surveyed	Northern CAHA
	Southern CAHA
Access Area	Walkover beach
	Off-road vehicle (ORV)
	Sound-side

Respondents' demographic and visitation characteristics are compared against their answers to survey questions that correspond with the overall research questions (Table 4.1). Responses to some questions were consolidated and recoded in SPSS to simplify analyses and meet the minimum assumptions of the statistical tests being applied. The dependent variables and their categories after consolidation are shown in Table 5.13. Again, Chi square tests were used when survey answers were categorical and one-way ANOVA tests were used when these answers were continuous, with Likert scale questions being designated as continuous.

Table 5.13: Dependent Variables in Analysis after Consolidation

Dependent Variable	
Attributes of Outer Banks valued	Price
	Accessibility
	Proximity (Location)
	Emotional attachment (Tradition)
	Scenery
	Beach width
	Historic sites
	Social Activities
	Facilities
	Lack of development
	Uncrowded beaches
Changed beach destination?	Yes
	No
Reported knowledge level on environmental changes	Very little or None
	Moderate or Expert
Knowledge sources on environmental changes	Personal experience
	Friends and/or family
	Newspaper or magazines
	Television, radio, or other media coverage
	Locals and/or other tourists
	Social media
<ul style="list-style-type: none"> • Environmental changes that are problems • Changes that affect visitor experience • Changes that affect visitor desire to return 	Government official website
	Sea level rise
	Beach erosion
	Shoreline migration
	Dune erosion
	Increasing temperatures
I believe that environmental changes should be taken into account when policymakers are developing plans for current and future development at the Outer Banks.	Increasing storms
	Larger waves
More research is needed for me to accept these environmental changes at the Outer Banks.	Agree
	Disagree
I am concerned about environmental changes at the Outer Banks.	Agree
	Disagree
Nothing can be done to stop environmental changes at the Outer Banks from occurring.	Agree
	Disagree

In comparing respondents' demographic information with the attributes they value in the Outer Banks, several categories show significance at the 0.05 level (Table 5.14). Formal education appears to have the greatest influence on respondents' values, with significant returns on four of the eleven attributes. That is, the value of accessibility, beach width, historic sites, and facilities varies based on respondents' education levels. More specifically, respondents with less than a bachelor's degree value accessibility ($M = 4.40$), beach width ($M = 3.88$), historic sites ($M = 3.79$), and facilities ($M = 4.17$) significantly more than respondents with graduate degrees (M accessibility = 3.79, M beach width = 3.35, M historic sites = 3.24, M facilities = 3.70). While most differences in values were between visitors with less than a bachelor's degree and visitors with a graduate degree, the value of beach width also varied between those with a bachelor's degree ($M = 4.08$) versus a graduate degree ($M = 3.35$). All told, visitors with a bachelor's degree value beach width the most, followed by those with less than a bachelor's degree and, lastly, those with a graduate degree. Age also shows significance, with respondents ages 55 and older placing greater value on the Outer Banks' wide ($M = 4.02$) and undeveloped beaches ($M = 4.28$) compared to respondents ages 18 to 34 (M beach width = 3.43, M lack of development = 3.44). Lastly, visitors local to North Carolina place more value on facilities ($M = 4.07$) than do visitors from nearby Virginia ($M = 3.60$).

Table 5.14: Statistically Significant ANOVA Test Differences in Outer Banks Attributes by Demographic Information

Independent Variable	Dependent Variable	ANOVA Test Result	Degrees of Freedom	ANOVA Significance	Tukey HSD Test
Age	Beach Width	F = 3.206	2	0.044	18 to 34-55 or older: $p = 0.035$
Age	Lack of Development	F = 6.226	2	0.003	18 to 34-55 or older: $p = 0.002$
Gender	Uncrowded Beaches	F = 4.207	1	0.042*	N/A
Education	Accessibility	F = 3.788	2	0.025	Less than a Bachelor's- Graduate Degree: $p = 0.019$
Education	Beach Width	F = 6.364	2	0.002	Less than a Bachelor's- Graduate Degree: $p = 0.044$ Bachelor's- Graduate Degree: $p = 0.002$
Education	Historic Sites	F = 3.122	2	0.047	Less than a Bachelor's- Graduate Degree: $p = 0.037$
Education	Social Activities	F = 5.899	2	0.004*	Less than a Bachelor's- Bachelor's Degree: $p = 0.037$ Less than a Bachelor's- Graduate Degree: $p = 0.004$
Education	Facilities	F = 3.657	2	0.029	Less than a Bachelor's- Graduate Degree: $p = 0.039$
Home State	Facilities	F = 3.605	2	0.030	North Carolina-Virginia: $p = 0.030$
*Levene's Test statistic returns as significant at 0.05 significance level; the ANOVA tests results may be unreliable.					

In comparing respondents' visitation characteristics with the attributes they value in the Outer Banks, a few categories show significance at the 0.05 level (Table 5.15). However, many of the categories that show significance fail the assumption of homogeneity of variance as indicated by their significant returns on Levene's Test, making their ANOVA significance questionable and perhaps unreliable. These categories are shown in Table 5.15, but not discussed further. However, some categories do have sufficiently equal variances and show significant

results. For instance, respondents who visit the Outer Banks more frequently (once a year $M = 3.98$; multiple times a year or live here $M = 4.11$) unsurprisingly value tradition more than first time visitors ($M = 1.56$). Interestingly, respondents staying more than one week or living at the Outer Banks ($M = 3.39$) value prices less than respondents with shorter stays ($M = 4.17$). This is likely because of the 26 respondents staying more than a week or living there, 12 were property owners. However, historic sites are more important to respondents visiting long term or living there ($M = 4.00$) than their counterparts ($M = 3.27$). This suggests a greater awareness and appreciation for the Outer Banks' rich history among those with longer stays. Again, this can likely be attributed to the large proportion of property owners that fall into this category. There was also a significant difference in importance of lack of development between those surveyed in northern CAHA compared to southern CAHA, with respondents surveyed in southern CAHA valuing lack of development more. This makes sense, as the northern Outer Banks, while still relatively undeveloped when compared with some other East Coast beach destinations, is more developed than the Southern Outer Banks.

Table 5.15: Statistically Significant ANOVA Test Differences in Outer Banks Attributes by Travel Characteristics

Independent Variable	Dependent Variable	ANOVA Test Result	Degrees of Freedom	ANOVA Significance	Tukey HSD Test
Frequency of Visit	Tradition	F = 44.046	2	0.000	First time visitor-Once a year: $p = 0.000$ First time visitor-Multiple times a year or Live here $p = 0.000$
Frequency of Visit	Scenery	F = 3.819	2	0.024*	First time visitor-Once a year: $p = 0.020$
Frequency of Visit	Social Activities	F = 4.833	2	0.010*	First time visitor-Multiple times a year or Live here: $p = 0.015$

Frequency of Visit	Uncrowded Beaches	F = 4.882	2	0.009*	First time visitor-Once a year: $p = 0.016$ Once a year-Multiple times a year or Live here $p = 0.046$
Length of Stay	Price	F = 3.064	3	0.031	A week-More than a week or Live here: $p = 0.019$
Length of Stay	Tradition	F = 5.642	3	0.001*	More than a day, but less than a week-More than a week or Live here: $p = 0.001$ A week-More than a week or Live here: $p = 0.009$
Length of Stay	Historic Sites	F = 2.976	3	0.034	More than a day, but less than a week-More than a week or Live here: $p = 0.020$
Accommodation Location	Accessibility	F = 8.048	2	0.001*	Northern CAHA-Not staying: $p = 0.037$ Southern CAHA-Not staying: $p = 0.000$
Accommodation Location	Location	F = 3.855	2	0.024*	Southern CAHA-Not staying: $p = 0.018$
Location Surveyed	Accessibility	F = 7.639	1	0.007*	N/A
Location Surveyed	Lack of Development	F = 5.229	1	0.024	N/A
Access Area	Price	F = 4.214	2	0.017*	Walkover beach-ORV: $p = 0.039$ ORV-Sound side: $p = 0.036$
*Levene's Test statistic returns as significant at 0.05 significance level; the ANOVA tests results may be unreliable.					

Next, respondents' demographic and visitation characteristics are compared with their reported knowledge levels and information sources. Frequency of visit is the only category that shows a significant influence on whether or not participants ever changed their choice of beach destination in the past because of beach conditions. The proportion of those who visit the Outer

Banks multiple times a year who have changed their choice of beach destination is significantly lower compared to the proportion of those who visit less often (Table 5.16). The table of values used to compute this Chi square test is available in Appendix D.

Table 5.16: Chi Square Analysis of Changed Beach Destination by Frequency of Visit

Independent Variable	Result	Degrees of Freedom	Significance	Cramer's V Association
Frequency of Visit	$\chi^2 = 8.131$	2	0.017	0.249

Four categories show significance at the 0.05 level when respondents' demographic information and travel characteristics are compared with their reported knowledge levels. However, all four categories that show significance fail the assumption of homogeneity of variance as indicated by their significant returns on Levene's Test, making their ANOVA significance questionable and perhaps unreliable (Appendix C). Furthermore, in comparing respondents' agreement or disagreement with the statement "I had heard about environmental changes at the Outer Banks prior to this survey," frequency of visit was the only variable that showed significance. That being said, 5 cells (55.6%) have expected counts less than 5, again, making the significance unreliable (Appendix D).

Some sources of knowledge varied among respondents based on certain demographics and travel characteristics. Gender was clearly a factor, as significantly more women than men used social media to obtain knowledge on environmental changes (Table 5.17) Alternatively, significantly more men used government official websites than did women. Length of stay also came into play, with more of those staying longer claiming to have learned about environmental changes from personal experience and observation. Further, respondents staying in the communities in southern CAHA reported friends, family, locals, and other tourists as knowledge sources significantly more than those staying in the communities north of CAHA, perhaps

suggesting tighter knit communities in the smaller villages to the south. The table of values used to compute these Chi square tests is available in Appendix D.

Table 5.17: Chi Square Analyses of Sources of Knowledge by Demographic Information and Travel Characteristics

Independent Variable	Knowledge Source	Result	Degrees of Freedom	Significance	Cramer's V Association
Gender	Social Media	$\chi^2 = 8.816$	1	0.003	0.261
Gender	Government Official Websites	$\chi^2 = 4.280$	1	0.039	0.182
Frequency of Visit	Personal Experience	$\chi^2 = 17.136$	2	0.000*	0.367
Length of Stay	Personal Experience	$\chi^2 = 9.048$	3	0.029	0.264
Accommodation Location	Friends or Family	$\chi^2 = 13.073$	2	0.001	0.323
Accommodation Location	Locals or Other Tourists	$\chi^2 = 14.994$	2	0.001	0.346
Location Surveyed	Friends or Family	$\chi^2 = 11.228$	1	0.001	0.294
Location Surveyed	Locals or Other Tourists	$\chi^2 = 11.228$	1	0.001	0.294
Access Area	Friends or Family	$\chi^2 = 8.165$	2	0.017*	0.251
* One or more cells have expected count less than 5.					

Next, respondents' demographic and visitation characteristics are compared with their concern levels for environmental changes occurring at the Outer Banks. No significant relationships are found between demographics and visitation characteristics of respondents and their overall levels of concern for environmental changes. Despite this, age appears to affect the extent to which two specific changes are seen as problems. A significant relationship is found between respondents' age and the extent to which they believe beach erosion and shoreline migration are problems at the Outer Banks, with older respondents regarding both changes as greater problems (M beach erosion = 4.02, M shoreline migration = 3.71) than their 18 to 34 year old counterparts (M beach erosion = 3.50, M shoreline migration = 3.04) (Table 5.18).

Table 5.18: Statistically Significant ANOVA Test Differences in Extent to Which Environmental Changes are Problems by Demographic Information and Travel Characteristics

Independent Variable	Dependent Variable	ANOVA Test Result	Degrees of Freedom	ANOVA Significance	Tukey HSD Test
Age	Beach Erosion	F = 3.458	2	0.034	18 to 34-35 to 44: $p = 0.035$
Age	Shoreline Migration	F = 4.041	2	0.020	18 to 34-55 or older: $p = 0.016$
Frequency of Visit	Beach Erosion	F = 5.155	2	0.007*	First time visitor- Multiple times a year or Live here: $p = 0.008$
*Levene's Test statistic returns as significant at 0.05 significance level; the ANOVA tests results may be unreliable.					

In comparing respondents' demographic and visitation information with the environmental changes they regard as "the most important," only one category, frequency of visit, proves significant. However, 18 cells (66.7%) have expected counts less than 5, making the significance questionable (Appendix D). A similar problem arose when comparing respondents' backgrounds with their answers to additional agree/disagree questions. Three categories, length of stay, access area, and education, show significance. However, despite consolidation, a large proportion of cells for each category have expected counts less than 5, making their significance unreliable (Appendix D).

Finally, respondents' demographic and visitation characteristics are compared with their perspectives on the effects of environmental changes on their experiences at and decisions to return to the Outer Banks. No comparisons were made between participants on their likelihood to recommend or revisit the Outer Banks due to the near unanimity of their responses, with almost all participants planning to both recommend and revisit in the future. That being said, formal education shows significance in comparing changes respondents perceive as affecting their

experience at the Outer Banks (Table 5.19). Respondents with more formal education report dune erosion as having a more negative effect on their experience (graduate degree $M = 3.83$, bachelor's degree $M = 3.73$) than respondents with less formal education ($M = 3.19$).

Additionally, respondents holding graduate degrees indicate increasing storms as having a more negative effect on their experience ($M = 3.97$) than respondents who do not hold a bachelor's degree ($M = 3.17$).

Table 5.19: Statistically Significant ANOVA Test Differences in Changes that Affect Visitor Experience by Demographic Information and Travel Characteristics

Independent Variable	Dependent Variable	ANOVA Test Result	Degrees of Freedom	ANOVA Significance	Tukey HSD Test
Gender	Larger Waves	F = 10.115	1	0.002*	N/A
Education	Dune Erosion	F = 4.202	2	0.017	Less than a Bachelor's- Bachelor's: $p = 0.044$ Less than a Bachelor's- Graduate degree: $p = 0.028$
Education	Increasing Storms	F = 5.373	2	0.006	Less than a Bachelor's- Graduate degree: $p = 0.006$
Length of Stay	Larger Waves	F = 2.886	3	0.038*	A day-More than a day, but less than a week: $p = 0.028$
*Levene's Test statistic returns as significant at 0.05 significance level; the ANOVA tests results may be unreliable.					

Several categories show significance in comparing respondents' demographics and travel characteristics with changes they claim affect their desire to return to the Outer Banks (Table 5.20). Male respondents describe larger waves as having a positive impact, albeit marginally, on their decision to return ($M = 2.74$). Alternatively, females suggest larger waves have a marginally negative impact ($M = 3.24$). Additionally, more educated respondents identify dune

erosion as having a more negative effect on their decision to return (bachelor's degree $M = 3.28$, graduate degree $M = 3.34$) than less educated respondents ($M = 2.83$). In fact, those with less than a bachelor's degree indicated dune erosion has a slightly positive influence on their decision to return. Lastly, first time visitors cite increasing storms as having a more negative effect on their decision to return ($M = 3.88$) than respondents who visit multiple times a year ($M = 3.20$).

Table 5.20: Statistically Significant ANOVA Test Differences in Changes that Affect Visitor Desire to Return by Demographic Information and Travel Characteristics

Independent Variable	Dependent Variable	ANOVA Test Result	Degrees of Freedom	ANOVA Significance	Tukey HSD Test
Gender	Larger Waves	F = 11.411	1	0.001	N/A
Education	Dune Erosion	F = 3.957	2	0.010	Less than a bachelor's- Bachelor's: $p = 0.026$ Less than a bachelor's- Graduate degree: $p = 0.020$
Frequency of Visit	Increasing Storms	F = 3.500	2	0.034	First time visitor- Multiple times a year: $p = 0.037$

CHAPTER 6: DISCUSSION AND CONCLUSIONS

The tourism industry, and other industries that are closely linked to the natural environment, will always rely on certain climatic and environmental conditions. In the face of a changing climate, and the various environmental impacts associated with that, the need to understand both the physical changes and their effects on society has never been greater. Using North Carolina's Outer Banks as a case study, this research aimed to determine what attributes of the destination visitors value, if they feel the destination is threatened by environmental changes, and if environmental changes compromise their experiences and their desire to return. Understanding tourist behavior not only has large economic implications and practical uses for businesses in the tourism industry, but fills a gap in climate change perception, environmental hazards, and natural resource management research.

Summary of Results

Demographic information about respondents suggests the Outer Banks attracts a certain audience. A majority of respondents are between the ages of 35 and 64, and the younger generation is less represented. Over 90% of respondents are white, while men and women are fairly equally represented. Most respondents hold some college degree, and many live in North Carolina or Virginia. An overwhelming majority of respondents do not own property on the Outer Banks. Only one respondent was visiting from a state south of North Carolina. Sunbathing and swimming are the most popular tourist activities.

The first research question revealed which attributes of the Outer Banks tourists value and the reasons they prefer it to other beaches. Visitors primarily choose the Outer Banks for its scenery and uncrowded beaches, followed closely by location and accessibility. Participants' written responses affirm the value of these attributes, as well as revealing other aspects visitors

find important. Responses that fell into the categories of “natural beauty” and “manageable distance from home” support the notion that scenery, location, and accessibility are important to visitors. Further, responses categorized as “not touristy or overcrowded” and “peaceful and relaxing atmosphere” expand upon the idea that visitors enjoy the Outer Banks’ uncrowded beaches, offering additional characteristics related to uncrowded beaches that visitors value. The fifth most commonly cited written response was “other amenities and nearby attractions,” an attribute that was not accounted for previously, but proved important to visitors. For the most part, tourists visit the Outer Banks for the very attributes that are used to market the destination.

When asked about their awareness of environmental changes in research question two, the vast majority of visitors reported that they knew about environmental changes occurring at the Outer Banks prior to being surveyed. Not surprisingly, personal experience and observation were the most common sources of knowledge, reported by almost three-quarters of respondents. No other source was reported by more than half of respondents, but television, radio or other media coverage and newspapers or magazines were also commonly reported knowledge sources.

The third research question focused on visitors’ risk perception of environmental changes. The majority of respondents said they are concerned about environmental changes at the Outer Banks. Many stated they are either somewhat worried or very worried, while few respondents said they are not very worried or not at all worried. When asked about specific changes, beach erosion and dune erosion were indicated as the greatest problems by respondents. Larger waves and increasing temperatures were the least prevalent problems among respondent answers.

The final research question addresses the impact of environmental changes on visitor experience and the influence of environmental changes on their decision to return. Despite the

large number of respondents who said they are concerned about environmental changes, less than half of respondents agreed that they experience effects from environmental changes at the Outer Banks. Beach erosion is the change most frequently regarded as having a negative effect on visitor experience and decision to return. Although increasing storms are not viewed as one of the most significant environmental changes at the Outer Banks, they were reported as having the second most negative effect on visitors' decisions to return. Nearly all respondents said they will recommend the Outer Banks to others and they will continue to visit in the future, suggesting environmental changes have little to no effect on visitors' decisions to return. For many, the fact that the Outer Banks remains relatively undeveloped compared to other East Coast beaches constitutes enough reason to return in spite of other changes. Written responses point to the fact that visitors are sensitive to overdevelopment and commercialization of the area, trash and pollution, and habitat loss. While visitors show no signs of changing their preferred choice of beach destination, they did suggest measures that could be taken to improve their Outer Banks experience. These measures include continued preservation of natural areas, restricted development, and heightened education of visitors.

While this study exhibits a rather homogenous sample, the final step sought to analyze respondents' demographics with the many variables analyzed in the survey. Age appears to be a significant factor in visitors' values and preferences and their evaluations of which environmental changes are most significant. There is a stark contrast in values between respondents under the age of 35 and over the age of 55. Further, respondents over 55 express greater importance to beach erosion. This could possibly be accounted for by the years visiting variable, although few respondents indicated how many years they have been visiting the Outer Banks. Based on those who did answer, respondents who have been visiting 10 or more years

report greater concern levels than those who have not been visiting as long, perhaps because the former have had longer to observe and experience changes. While concern levels for beach erosion varied by demographics, it is still the most significant change indicated overall. Despite the nearly even split of men and women who participated in the survey, relatively few significant gender related differences were observed. One notable exception is their sources of information. Whereas men are more likely to use government official websites, women are more likely to use social media. Education displays the greatest influence on visitors' values and preferences as well as shows significance in comparing changes respondents perceive as affecting their experience at the Outer Banks. In particular, differing values are observed between those with graduate degrees and those without a bachelor's degree. Interestingly, respondents staying and surveyed at Southern CAHA are privy to information from locals, friends, family, and other tourists, perhaps suggesting a greater sense of community in the southern villages compared to the northern villages. All told, visitors' values vary based on their demographics (e.g. age, education, home state), but their environmental perceptions seem to vary based on their travel characteristics (e.g. frequency of visit).

Implications

The data derived from the questionnaire surveys uncover a significant amount of information about the Outer Banks tourist landscape, as well as their destination image, preferences, sensitivities, and environmental perceptions. The findings of this study highlight marketing opportunities for the Outer Banks, identify measures that could be taken to improve the destination, and showcase the need for improved environmental education. Many of the attributes that visitors identified as important are the very attributes that are used to market the destination, and many visitors are return visitors. Both pieces of information are encouraging

from a marketing perspective; however, they also present opportunities. Just over 13% of respondents are first time visitors, with most visitors returning annually or more often. The “cult following” of tourists that frequent the Outer Banks suggests that many visit the Outer Banks not because of marketing, but because of their past experiences. Therefore, it can be argued that marketing efforts should, in part, be focused on attracting new visitors and currently underrepresented populations. The distribution of respondents by race and the clear lack of visitors traveling from states south of the Outer Banks highlight the disproportionate visitation of the Outer Banks and present opportunities for growth.

The discovery that Outer Banks tourists are generally aware of environmental changes, but not particularly sensitive to them is also important. This is consistent with previous studies by Lucas (1979) and Marion and Lime (1986), who found that tourists are perceptive of direct environmental impacts but have limited understanding of wear and tear impacts on the environment. Tourists are more aware of environmental changes that affect them directly; however, only half of respondents in this study believed environmental changes affected them directly. CAHA has a platform to further educate visitors. In fact, visitors suggested various educational opportunities including more informative signs on the beach, speakers at visitor centers and informative signs with a recorded message advising good practices, updates through local news or reports on the current and annual changes, and greater ranger presence. Such measures could engage visitors, bolster the identity of the park, and keep the community informed.

Outer Banks visitors’ concern for erosion and destruction behaviors such as littering are in line with Hammitt et al.’s (1996) findings regarding environmental impacts to parks of most concern to tourists, despite the fact their research was not in a coastal park. As a result, this study

fills a gap in research pertaining specifically to tourists' perceptions of coastal environmental change. It is also consistent with Hall and Staimer's (1995) research that demonstrated that beach erosion is the number one concern that tourists have about beaches, despite the fact their research took place in a less chaotic time of environmental change than we are currently experiencing due to accelerations in climate change. The fact that concern for beach erosion does not appear to vary over space and time can likely be attributed to the fact that tourists are more aware of direct impacts, as demonstrated by Lucas (1979) and Marion and Lime (1986). While beach erosion is not a direct impact in the sense that the beach does not usually erode significantly during the course of a tourist's stay, temporal changes in beach profile can be observed by annual visitors. This is in contrast to changes such as sea level rise. In this study, sea level rise is not highly regarded by visitors as a significant change or an effect on their experience or desire to return despite the fact that sea level rise is well studied, widely reported, and ultimately, can accelerate beach erosion. That said, it can be hard for the general public to understand the connectivity and causal continuum of environmental changes. For reasons such as this, Outer Banks visitors are more aware of and concerned about beach erosion, dune erosion, and increasing storms, changes that are more visible. Again, this highlights the opportunity for increased environmental education.

From an economic standpoint, the most important finding of this study is that environmental changes are not a threat to the Outer Banks' tourism economy from a visitor interest perspective. While there is undoubtedly a large financial burden when it comes to beach maintenance projects that compensate for problems such as beach erosion, environmental changes are not at risk of jeopardizing visitors' satisfaction and affection for the destination. Development, overcrowding, and other changes that compromise the nature of this authentic

getaway are more likely to turn off visitors. In fact, among many visitors, there seems to be an understanding and acceptance that environmental changes are just part of life at the Outer Banks.

Limitations of the Research

While the data collected from the analyses of the survey provide a wealth of information, this study has several limitations. First, the applicability of the information to other tourism destinations and difficulty in generalizing the conclusions must be addressed. This study recruited participants solely from CAHA. While this was deliberate, it can be argued these individuals have increased environmental sensitivity compared to those visiting other Outer Banks beaches north of the national seashore. Moreover, the information may not be consistent with other beach destinations across the U.S. Outer Banks visitors are fiercely loyal, so their loyalty to the destination could cloud their sensitivity to environmental changes. However, it can also be argued this makes them more aware of environmental changes occurring there. Regardless, values and perceptions may differ at other beach destinations.

Additionally, the survey was conducted in the summer months, which could impact survey results. Again, this was intentional, as summer is the high tourist season at the beach and draws the largest crowds. However, the shoulder seasons also attract visitors. There is often greater climate variability in the shoulder seasons, which perhaps could affect respondents' answers to questions. While several surveys were conducted in September following a hurricane that passed offshore and no variations were found between these respondents' answers and those surveyed prior, more surveys during the fall could affect responses in association with the dynamic changes that can occur later in the hurricane season.

Furthermore, the survey asked respondents to self-report their knowledge of environmental changes, but did not test their knowledge. Therefore, it is likely some respondents

inaccurately reported their knowledge. While this study is interested in perceptions, making reported knowledge levels useful and important, it would also be valuable to know how knowledgeable the visitors really are. Perhaps more importantly, the survey asked respondents to speculate on their decision to return. Given a longer time period to conduct the study, it would be helpful to determine how many respondents follow through on their decisions either to return or not. Finally, respondents' similar demographics also limit the predictive power of demographic information on respondents' values and perceptions and does not allow for broad conclusions.

Contributions to Knowledge and Future Work

With the vulnerability of the coast to climate change juxtaposed with the concentration of wealth and resources near the coast, it is critical to understand physical changes, societal impacts, and the public's perceptions. Beaches are an ideal site to study coupled human and natural systems due to their volatile and dynamic nature and their appeal to tourists. For North Carolina's Outer Banks, there are efforts to preserve the fragile environment while still accommodating the large tourist population it attracts. Building on existing literature, this study lays the groundwork to better understand how tourists perceive the destination and the challenges it faces, as well as assesses the degree to which environmental challenges compromise visitor experience.

Future research can be broadened both spatially and temporally and address limitations of this original research. Because the study was limited in time and demographic scope, the study can be expanded to include more participants over a longer time period. Expanding the study to include the shoulder seasons would be beneficial, but expanding it over multiple years with some of the same key informants would be ideal. Along those lines, expanding the survey to include interviews in addition to the written responses could provide critical insights. Humans and the

environment are inextricably tied, and this study draws on many disciplines to understand how this relationship manifests itself in the nature-based tourism industry in the face of a changing climate.

While the findings of this research may be specific to the Outer Banks, they may also provide valuable information applicable to similar tourism destinations throughout the world. This research can be compared to research at other coastal locales to develop broader understandings and a more holistic view of perceptions of environmental changes and their influence on tourism and recreation decision making. Millions of people live on and travel to the coast, domestically and internationally, making coastal management one of the premier concerns of our time.

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APPENDIX A: IRB APPROVAL



EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office 252-744-2914 · Fax 252-744-2284 · www.ecu.edu/ORIC/irb

Notification of Exempt Certification

From: Social/Behavioral IRB
To: [Logan McSherry](#)
CC: [Burrell Montz Covey](#)
Date: 7/10/2017
Re: [UMCIRB 17-000137](#)
Tourists' Perceptions of Environmental Changes on North Carolina's Outer Banks: A Case Study of Cape Hatteras National Seashore

I am pleased to inform you that your research submission has been certified as exempt on 7/10/2017. This study is eligible for Exempt Certification under category #2.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

APPENDIX B: THE SURVEY

Dear Participant,

I am a Graduate Student at East Carolina University in the Department of Geography. You are being invited to participate in a study titled, “**Tourists’ Perceptions of Environmental Changes on North Carolina’s Outer Banks: A Case Study of Cape Hatteras National Seashore.**” This location was selected as a sample site to gather data from tourists in the area. The goal is to distribute surveys to 200 individuals in multiple sites within Cape Hatteras National Seashore including off-road-vehicle beach access areas, walkover beach access areas, visitor centers/lighthouses, and sound-side access areas.

The purpose of this research is to gain a better understanding of how seasonal visitors perceive environmental changes, and how it will affect their choice of recreation and leisure destination in the future. In this study, you will be asked to discuss your knowledge, opinions, and feelings about environmental changes occurring at the Outer Banks by completing a 26-question survey. The findings of this research will fulfill the critical need for research regarding human understandings and perceptions of environmental change and degradation. A deeper understanding of the problems related to environmental change holds useful information that can be used to promote sustainability, reduce vulnerability, increase awareness, and develop practical adaptations.

You are being invited to take part in this research because you are currently at Cape Hatteras National Seashore and identify as a tourist. Your participation is completely voluntary. The study should last between 5 – 10 minutes.

The ECU Institutional Review Board will oversee this research, so some of the IRB members or staff may need to review my research data. However, the information you provide will remain anonymous and not be linked to you. All of your answers will be saved in computer files and no individuals will be identified. Only I will have access to these records. When the research project is finished and results are reported, the survey questions will be erased confidentially.

If you have any questions or concerns about the research, please feel free to contact Logan McSherry at mcsberry116@students.ecu.edu. If you have questions regarding your rights as a research participant, you may contact East Carolina University Office of Research Integrity & Compliance (ORIC) at 252-744-2914. If you would like to report a complaint or concern about this research study, call the Director of ORIC, at 252-744-1971.

Your participation is completely voluntary, so please do not write your name. You do not have to take part in this research and you may stop at any time. If you decide to take part in this study, you can continue with the questions below.

Thank you for taking the time to participate in my research.

Sincerely,
Logan McSherry, Principal Investigator

Q1 What is your age?

- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75-84 years old
- 85 years or older

Q2 With what racial or ethnic group do you most identify?

- White
- Black or African-American
- Hispanic or Latino
- Native American or American Indian
- Asian or Pacific Islander
- Biracial
- Other _____

Q3 What is your gender?

- Male
- Female
- Prefer not to say

Q4 What is the highest level of education you have completed? If you are currently enrolled, what is the highest degree you have received?

- Less than High School
- High School or GED
- Trade School
- Associate's Degree
- Bachelor's Degree
- Graduate Degree

Q5 In what zip code do you consider your permanent home to be located? If not in the United States, in what country do you consider your permanent home to be located? _____

Q6 Do you own property on the Outer Banks?

- Yes
- No

Q7 Who are you visiting with?

- Alone
- With family (with children)
- With partner (no children)
- With a group (not family)

Q8 How often do you visit the Outer Banks?

- I live here
- Multiple times a year
- Once a year
- First time visitor

Q9 If once a year, for approximately how many years? _____

Q10 How long are you planning to stay at the Outer Banks?

- A day
 More than a day, but less than a week
 A week
 Several weeks, but less than a month
 A month or longer

Q11 Where are you staying while at the Outer Banks?

- | | |
|--|-----------------------------------|
| <input type="radio"/> Corolla | <input type="radio"/> Waves |
| <input type="radio"/> Duck | <input type="radio"/> Salvo |
| <input type="radio"/> Southern Shores | <input type="radio"/> Avon |
| <input type="radio"/> Kitty Hawk | <input type="radio"/> Buxton |
| <input type="radio"/> Kill Devil Hills | <input type="radio"/> Frisco |
| <input type="radio"/> Nags Head | <input type="radio"/> Hatteras |
| <input type="radio"/> Manteo | <input type="radio"/> Ocracoke |
| <input type="radio"/> Wanchese | <input type="radio"/> Other _____ |
| <input type="radio"/> Rodanthe | |

Q12 Please indicate how important the following are in your decision to visit the Outer Banks.

	Very important	Somewhat important	Neither important nor unimportant	Not very important	Not at all important
Price	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accessibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Proximity (Location)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Emotional attachment (Tradition)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Scenery	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beach width	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Historic sites	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social activities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lack of development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Uncrowded beaches	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13 Are there any other important reasons you chose to visit the Outer Banks? Please write them below.

Q14 What activities do you participate in at the beach? Check all that apply.

- | | |
|-------------------------------------|--|
| <input type="checkbox"/> Sunbathing | <input type="checkbox"/> Hiking |
| <input type="checkbox"/> Swimming | <input type="checkbox"/> Boating |
| <input type="checkbox"/> Surfing | <input type="checkbox"/> Visiting lighthouses and historic sites |
| <input type="checkbox"/> Fishing | <input type="checkbox"/> Other_____ |

Q15 Have you ever changed your choice of beach destination in the past because of beach conditions?

- Yes No

For the following questions, environmental changes are defined as sea level rise, beach erosion, shoreline migration, dune erosion, increasing temperatures, increasing storm frequency and severity, and larger waves than normally expected.

Q16 How would you rate your current knowledge of environmental changes at the Outer Banks?

- None Very Little Moderate Expert

Q17 How worried are you about environmental changes at the Outer Banks?

- Not at all worried Not very worried Somewhat worried Very worried

Q18 To what extent do you believe the following are problems at the Outer Banks?

	To a very great extent	To a great extent	To some extent	To a little extent	Not at all
Sea level rise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beach erosion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shoreline migration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dune erosion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing temperatures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing storms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Larger waves	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19 Of these changes, which do you think is most significant?

- | | |
|---|---|
| <input type="radio"/> Sea level rise | <input type="radio"/> Increasing temperatures |
| <input type="radio"/> Beach erosion | <input type="radio"/> Increasing storms |
| <input type="radio"/> Shoreline migration | <input type="radio"/> Larger waves |
| <input type="radio"/> Dune erosion | <input type="radio"/> Other_____ |

Q20 Of the changes you are familiar with, where/how did you learn about them? Check all that apply.

- | | |
|---|--|
| <input type="checkbox"/> Personal experience or observation | <input type="checkbox"/> Locals and/or other tourists |
| <input type="checkbox"/> Friends and/or family | <input type="checkbox"/> Social media and/or online travel reviews |
| <input type="checkbox"/> Newspapers or magazines | <input type="checkbox"/> State or city government official website |
| <input type="checkbox"/> Television, radio, or other media coverage | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> Travel agents and/or travel guides | |

Q21 How might the following changes affect **your experience** while at the Outer Banks?

	Very positively	Somewhat positively	Neither positively nor negatively	Somewhat negatively	Very negatively
Sea level rise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beach erosion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shoreline migration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dune erosion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing temperatures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing storms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Larger waves	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q22 If current trends continue, how might the following affect **your decision to return** to the Outer Banks in the future?

	Much more likely to return	Somewhat more likely to return	No effect on my decision to return	Somewhat less likely to return	Much less likely to return
Sea level rise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Beach erosion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Shoreline migration	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dune erosion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing temperatures	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing storms	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Larger waves	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q23 Are there any other environmental changes at the Outer Banks you feel are important? Please write them below.

Q24 Based on your experience, how likely are you to do the following?

	Extremely likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Not at all likely
Recommend the Outer Banks to others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Revisit the Outer Banks in the future	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q25 For the following questions please write "A" for agree, "D" for disagree, or "NS" for not sure.

- ___ I had heard about environmental changes at the Outer Banks prior to this survey.
- ___ I believe that environmental changes should be taken into account when policymakers are developing plans for current and future development at the Outer Banks.
- ___ More research is needed for me to accept these environmental changes at the Outer Banks.
- ___ I am concerned about environmental changes at the Outer Banks.
- ___ I experience effects from environmental changes at the Outer Banks when visiting.
- ___ Nothing can be done to stop environmental changes at the Outer Banks from occurring.
- ___ Action(s) should be taken to mitigate the effects of environmental changes at the Outer Banks.

Q26 Are there any measures that could be taken to improve your experience at the Outer Banks? Please write them below.

Thank you for your time spent taking this survey.

APPENDIX C: STATISTICALLY SIGNIFICANT ANOVA TEST DIFFERENCES

Statistically Significant ANOVA Test Differences in Reported Knowledge Levels by Knowledge Sources				
Knowledge Source	ANOVA Test Result	Degrees of Freedom	ANOVA Significance	Tukey HSD Test
Personal Experience	40.115	1	0.000*	N/A
Locals or Other Tourists	5.148	1	0.025*	N/A
*Levene's Test statistic returns as significant at 0.05 significance level; the ANOVA tests results may be unreliable.				

Statistically Significant ANOVA Test Differences in Knowledge Levels by Demographic Information and Travel Characteristics				
Independent Variable	ANOVA Test Result	Degrees of Freedom	ANOVA Significance	Tukey HSD Test
Age	F = 4.490	2	0.013*	18 to 34-35 to 54 $p = 0.042$ 18 to 34-55 or older: $p = 0.012$
Home State	F = 4.501	2	0.013*	North Carolina-Other $p = 0.030$ Virginia-Other $p = 0.024$
Frequency of Visit	F = 18.765	2	0.000*	First time visitor-Once a year: $p = 0.000$ First time visitor-Multiple times a year or Live here: $p = 0.000$
Length of Stay	F = 4.768	3	0.003*	More than a day, but less than week-More than a week or Live here: $p = 0.000$ A week-More than a week or Live here
*Levene's Test statistic returns as significant at 0.05 significance level; the ANOVA tests results may be unreliable.				

APPENDIX D: CHI SQUARE ANALYSES AND TABLE OF VALUES USED TO COMPUTE
CHI SQUARE ANALYSES

Table of Values Used to Compute Chi Square Analysis of Changed Beach Destination by Frequency of Visit			
Frequency of Visit	Changed beach destination?		
	Yes	No	Total
First time visitor	8	10	18
Once a year	20	24	44
Multiple times a year or Live here	15	54	69
Total	43	88	131

Chi Square Analyses of Awareness of Environmental Changes by Frequency of Visit				
I had heard about environmental changes at the Outer Banks prior to this survey.				
Independent Variable	Result	Degrees of Freedom	Significance	Cramer's V Association
Frequency of Visit	$\chi^2 = 8.816$	1	0.003*	0.261
Table of Values				
Frequency of Visit	I had heard about environmental changes at the Outer Banks prior to this survey.			
	Yes	No	Total	
First time visitor	9	4	13	
Once a year	41	2	43	
Multiple times a year or Live here	63	4	67	
Total	113	10	123	
*One or more cells have expected count less than 5.				

Table of Values Used to Compute Chi Square Analyses of Sources of Knowledge by Demographic Information and Travel Characteristics			
Table of Values			
Gender	Learned about environmental changes from social media		
	Yes	No	Total
Male	7	52	59
Female	24	46	70
Total	31	98	129

Table of Values			
Gender	Learned about environmental changes from government official websites		
	Yes	No	Total
Male	15	44	59

Female	8	62	70
Total	23	106	129

Table of Values			
Frequency of Visit	Learned about environmental changes from personal experience		
	Yes	No	Total
First time visitor	5	11	16
Once a year	33	11	44
Multiple times a year or Live here	55	12	67
Total	93	34	127

Table of Values			
Length of Stay	Learned about environmental changes from personal experience		
	Yes	No	Total
A day	20	11	31
More than a day, but less than a week	31	9	40
A week	20	13	33
More than a week or Live here	24	2	26
Total	95	35	130

Table of Values			
Accommodation Location	Learned about environmental changes from friends or family		
	Yes	No	Total
Northern CAHA	14	52	66
Southern CAHA	20	19	39
Not staying	3	17	20
Total	37	88	125

Table of Values			
Accommodation Location	Learned about environmental changes from locals or other tourists		
	Yes	No	Total
Northern CAHA	16	50	66
Southern CAHA	21	18	39
Not staying	2	18	20
Total	39	86	125

Table of Values			
Location Surveyed	Learned about environmental changes from friends or family		
	Yes	No	Total
Northern CAHA	20	73	93
Southern CAHA	19	18	37
Total	39	91	130

Table of Values			
Location Surveyed	Learned about environmental changes from locals or other tourists		
	Yes	No	Total
Walkover beach	26	69	95
ORV	11	15	26
Sound-side	2	7	9
Total	39	91	130

Table of Values			
Access Area	Learned about environmental changes from friends or family		
	Yes	No	Total
Walkover beach	23	72	95
ORV	10	16	26
Sound-side	6	3	9
Total	39	91	130

Chi Square Analyses of Most Significant Environmental Change by Frequency of Visit				
Independent Variable	Result	Degrees of Freedom	Significance	Cramer's V Association
Frequency of Visit	$\chi^2 = 43.657$	16	0.000*	0.410
*One or more cells have expected count less than 5.				

Chi Square Analyses of Agree/Disagree Questions by Demographic Information and Travel Characteristics				
I believe that environmental changes should be taken into account when policymakers are developing plans for current and future development at the Outer Banks.				
Independent Variable	Result	Degrees of Freedom	Significance	Cramer's V Association
Length of Stay	$\chi^2 = 15.543$	6	0.016*	0.241
More research is needed for me to accept these environmental changes at the Outer Banks.				
Independent Variable	Result	Degrees of Freedom	Significance	Cramer's V Association
Access Area	$\chi^2 = 17.872$	4	0.001*	0.260
I am concerned about environmental changes at the Outer Banks.				
Independent Variable	Result	Degrees of Freedom	Significance	Cramer's V Association
Education	$\chi^2 = 9.494$	4	0.050*	0.190
Nothing can be done to stop environmental changes at the Outer Banks from occurring.				
Independent Variable	Result	Degrees of Freedom	Significance	Cramer's V Association
None	N/A	N/A	N/A	N/A
*One or more cells have expected count less than 5.				

