case study

Hatteras Island and Highway 12: A chain of complexity

by Cynthia S. Deale, Jennifer London

Introduction

In the book titled, *NC 12 Gateway to the Outer Banks*, author Dawson Carr (2016) alludes to the complex relationship between North Carolina's Outer Banks (OBX), a group of barrier islands along its coast, and Highway 12 (Hwy 12). Carr writes, "The story of Highway 12 on North Carolina's Outer Banks is the story of not just a road, but of a place. The Banks and the road are linked so intricately that it is difficult to consider one without the other. Their fates are bonded almost symbiotically, and their futures are bound together" (Carr, 2016, p.xi). Through Carr's words, it is implied that the development of a solution to protect one impacts the other. In the decades following the construction of Hwy 12, the social, environmental, and economic factors that led to the development and prosperity of this area, specifically Hatteras Island, define this symbiotic relationship. As a result, the difficulty of preserving both Hatteras Island and Hwy 12 with a solution that maintains the integrity of the people and the environment to ensure continued economic sustainability has emerged. Consequently, this ribbon of highway has literally become the island's lifeline, and preservation of the highway, a stable part of the island's infrastructure, means preservation of the island, a dynamic, always shifting land mass. However, as noted, the situation regarding the highway is complex.

Background

Hatteras Island, located off the southeastern coast of the United States (U.S.) in North Carolina (N.C.), is a simple barrier island segment, and its low, narrow structure subjects it to inlet and over wash dynamics (Riggs et al., 2008). The shoreline of Hatteras Island is approximately 50 miles long and, at most, 3.5 miles wide in Buxton (Hatteras, NC, n.d.). The majority of the island is less than that, and the areas of Hatteras Island most susceptible to over wash and breaches include the villages of Rodanthe, Waves, and Salvo; northern Buxton; Pea Island Refuge; and northern Hatteras Village, and as a result, have been dubbed the island's "hot spots" because of their vulnerability (Crist, 2018) (see Figure 1). These areas are extremely vulnerable because of their narrow width, and in some cases, the dune line stands less than 25 feet from the edge of the highway, which means the dune line and the shoreline sit closer to Hwy 12 than is recommended by the North Carolina Department of Transportation (NCDOT) (URS Corporation, 2015a; 2015b). Additionally, these narrow areas are vulnerable because normal tidal patterns cause erosion on both the ocean and sound sides of Hwy 12 (URS Corporation, 2015a; 2015b). The island's structure further complicates the issue of maintaining any permanent structure, such as Hwy 12.

Through the decades, local, state, and federal efforts to preserve Hwy 12 have faced challenges. They represent human beings' constant battle with natural coastal processes, rising sea levels, beach erosion, and storms, and raise many questions as to whether or not current and future efforts to preserve the barrier islands and Hwy 12 are cost effective across the triple bottom line of sustainability. Furthermore, they raise the question of whether the time has come to begin thinking outside the box regarding the future of Hwy 12 and the villages of Hatteras Island (see Figure 2).

Inception of Highway 12

Hwy 12 is often referred to as the lifeline of North Carolina's Outer Banks (OBX) and, more specifically, that of Hatteras Island because Hwy 12 quite literally saved the few, remote residents of Hatteras Island in the late 1940s from the United States military's "Project Nutmeg." The U.S. military had been seeking a more convenient location to test nuclear weapons, and the OBX, because of its remote location, seemed like the ideal spot (Carr, 2016). However, before the project received final approval, the director of the Atomic Energy Commission ordered aerial photographs to be taken. Those photographs revealed considerable development linked by a primitive road that eventually became N.C. Hwy 12 (Carr, 2016). Today, some people argue that the protection of the highway is detrimental to the protection of the island itself, but this road is the one factor that quite literally saved the people of Hatteras Island from nuclear destruction (Carr, 2016).

Cynthia S Deale and Jennifer London *are affiliated with East Carolina University.*

Figure 1

Highway 12 in Rodanthe, N.C.*

*Source: the authors

Figure 2

Map of the Outer Banks of North Carolina*

Source: The Outer Banks Chamber of Commerce (n.d.).

Booming Tourism

Aside from saving Hatteras Island from a near demise at the hands of nuclear weapons testing, Hwy 12 has become important to the area for a variety of reasons. The highway, along with its bridges, allowed for accessibility to and from the mainland. With the establishment of the Cape Hatteras National Seashore and the pavement of Hwy 12 in the 1950s, tourism boomed on Hatteras Island (URS Corporation, 2015a). Since then, tourism has continued to grow, and in August of 2019, the Cape Hatteras National Seashore reported that as of July, 1.57 million people had visited the area, an increase of 2% from the same time the previous year. In fact, tourism spending has exceeded previous spending every year since 2009, where in all of Dare County, N.C., it topped $1.9 billion in 2018 (Hampton, 2019).

Preserving Hatteras Island and Highway 12

The completion of Hwy 12 brought challenges with regard to financing and government, but the challenges did not stop there. The people of the OBX fought state government to get their highway; and in the decades following the completion of Hwy 12, this road and the island still face challenges. However, current challenges stem from natural coastal processes, beach erosion, rising sea levels, and breaches from high energy storm damage. In fact, the very existence of the highway threatens the physical landscape of the island. The highway is a fixed structure that blocks the natural transport of sand. Rather than allowing the natural process of island migration to occur, which in effect adds width to the island, the island is actually shrinking (Tennant, 2013). A shrinking island means greater vulnerability to ocean over wash and breaches that lead to road closures which result in losses in tourism spending, environmental disruptions, and hardships for the island's residents. With Hatteras Island's heavy reliance on tourism made possible by Hwy 12, preserving accessibility means preserving the livelihood of the island's approximate 4,000 year-round residents, most of whom reside in the villages of Buxton and Frisco (Hatteras, NC, n.d.b). Essentially, without the highway there is no island, but without the island, there is no highway. Consequently, this symbiotic relationship dictates that N.C. and Hatteras Island must continue to be forward thinking with regard to preserving Hwy 12 and the island's accessibility.

Preservation Measures

Through the years, N.C. has sought and implemented a variety of measures to preserve Hatteras Island and the highway despite the barrier islands' natural tendency to drift because of storms and erosion. Protecting these delicate areas is important, especially to the people who live there. Populated coastal regions in the U.S. comprise less than 10% of the total land mass, while sustaining 39% of the population (Qui & Gopalakkrishnan, 2016). Additionally, these areas are a vital part of the U.S. economy in that they represent 45% of the U.S. Gross Domestic Product (Qui & Gopalakrishnan, 2016). N.C.'s coastal region is no exception. The state has 21 coastal counties, which comprise approximately 10% of the state's population (Riggs et al., 2008). In 2011, Hatteras Island contributed $204 million in tourism spending and $9.4 million in local taxes (URS Corporation, 2015a). With the importance

that these regions hold in the greater economic picture, it stands to reason that efforts would be undertaken to preserve what nature has created, people have erected, and the community has fostered. Over the years, various preservation methods have been implemented such as beach nourishment, hard structures like groins and jetties, and dune construction and maintenance in order to protect the natural resources and built structures of Hatteras Island (see Table 1). While these measures have offered some help, not one of them has served as a long-term solution for the problems encountered in trying to preserve Hwy 12.

Definitions

This case focuses on a major issue regarding sustainable tourism, specifically within coastal areas, and several factors need to be recognized before tackling the dilemma involved in the case. Given the complex nature of the situation regarding Hwy 12, the following terms are defined to provide the context and theoretical background for addressing the issues involved in the case: sustainable tourism, stakeholder theory, paradox perspective, and SWOT analysis:

Sustainable Tourism

The United Nations Environment Programme and the World Tourism Organization (UNEP, UNTWO, 2005, p.12), define sustainable tourism as, "Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities." Furthermore, the iconic Brundtland Report (World Commission on Environment and Development, 1987) describes sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." When this sustainability scheme is applied, it focuses on striking a balance between the economic, environmental, and socio-cultural aspects of sustainability's triple bottom line.

Stakeholder Theory and Stakeholder Involvement in Sustainable Tourism

The stakeholder approach and theory emphasize that the management of resources needs to take into account the interests of all parties involved (Bryson, 2004; Freeman, 1984; Freeman, 1994; Freeman, Wicks, & Parmar, 2004), and trace their foundations to the business arena in association with the management of companies. Hospitality and tourism stakeholders can be classified into six broad categories: tourists, industry, local community, government, special interest groups, and educational institutions (Waligo, Clarke, & Hawkins, 2013). Stakeholder groups can also encompass hospitality and tourism developers and entrepreneurs, non-tourism businesses, indigenous people, and local residents (Brokaj, 2014). In addition, stakeholders in sustainable hospitality and tourism may comprise present visitors, future visitors, the present host community, and the future host community (Byrd, 2007), and within those four categories, one can view tourists and others, such as "investors, legislators, government agencies, environmentalists, the media, the scientific community, competitors, special interest groups, the general public, and local communities" (Manwa, 2003, p. 46). It has been observed that input from various stakeholders is needed at destinations, and in communities, to guarantee community buy-in connected to comprehending the following six principle factors: resource preservation, environmental education, stakeholder inclusion, economic planning, cultural awareness, and community resource identification (Cardenas, Byrd, & Duffy, 2015). Moreover, the National Oceanic and Atmospheric Administration (NOAA) urges community and stakeholder collaboration in decisions about development to ensure that public interests in and rights of access to the waterfront and coastal waters are maintained (US Department of Commerce, NOAA, 2009). In coastal settings, NOAA believes that all-encompassing planning processes are indispensable, for what happens on and near the water can increase property values, strengthen businesses, enhance community hardiness in connection with natural hazards, and enrich a community's overall quality of life (NOAA, 2009).

Ethical Paradox and Paradoxical Perspective

A paradox can be defined as "contradictory yet interrelated elements that exist simultaneously and persist over time" (Smith & Lewis, 2011, p.382). Paradoxes involve the interplay between complicated, complex, dynamic, ambiguous systems, such as those comprised of people, teams, organizations, environmental elements, and society (Lewis, 2000). A paradox can occur when stakeholders try to polarize elements, while ignoring the interdependence of elements involved in the situation, and those involved can try to avoid the negative actions of tensions between parties (Lewis & Smith, 2014). However, management tactics that embrace the tensions and accept the paradox as an ongoing process to promote sustainability are desirable from a paradoxical perspective, to meet end goals without compromising the means, such as socio-cultural and/or environmental resources (Elkington, 1998). For accepting the paradox can help to enhance creativity in terms of solutions, allowing for synergies to develop and for stakeholders to strive toward multiple goals (Lewis & Smith, 2014). Rather than resolving an issue by deciding that solution X works better than solution Y, the paradox approach considers how solution X and solution Y can be considered simultaneously (Bartunek, 1988; Lewis & Smith, 2014). An ethical paradox can be depicted as a model or conception concept that draws attention to the paradoxical nature of sustainable development and management. Sustainability implies that a resource is supported interminably, whereas development gives rise to environmental change, which can bring about depletion. Sustainable development changes the focus from the environment to society because meeting the needs of people takes precedence over other

Table 1

Current Preservation Measures

Preservation Measure	The Process
Beach Nourishment	The process of dredging sand from one area and relocating it to another, dates back as early as the 1920s (Qui & Gopalakrishnan, 2016). It mimics the natural processes of protecting the dunes while generating minimal negative impacts on adjacent areas (Campbell & Benedet, 2006). However, it is costly. Over the past fifty years, beach nourishment has largely been a federal expenditure that has exceeded $2.9 billion. The costs associated with nourishment sand is estimated to be between $1- $3 million per mile of shoreline (Qui & Gopalakrishnan, 2016).
Dune Construction and Replenishment	Sand dunes are constructed and replenished to serve as protective barriers between the ocean and the roadway's pavement, and presently, the NCDOT maintains that 25 feet is the recommended distance between dune and roadway pavement. Dune construction and maintenance require both moving dune lines and fortifying existing ones (URS Corporation, 2015a; 2015b).
Inlet Closures	Efforts to maintain the highway have often involved closing newly formed inlets that wash away sections of the highway so that those sections can be restored relatively quickly (Carr, 2016). When an inlet is opened due to a high energy storm event like a hurricane, Hwy 12 remains closed, and tourism dollars are lost. Residents dependent on a highway that is essential for maintaining their own safety and livelihood will not wait 15 years for an inlet to close.
Highway Realignment	Over the decades, as the ocean shoreline has moved west so has Hwy 12. The NCDOT has moved the highway four times since 1955. Hwy 12 was moved in 1974, 1999, and again in 2003. In the area between Avon and Buxton, analysis of historical surveys and aerial photographs has demonstrated that the island has receded 2500 feet in the span of about 150 years. That is a rate of approximately 17 feet per year (Hatteras Island, n.d.; URS Corporation, 2015b).

needs. Ultimately, considering the paradox situation leads to a discussion focused on what is the best course of action (Jabareen, 2008).

SWOT analysis

A SWOT analysis is a tool applied to assist in attending to the varied needs of an organization, business, or destination. When a SWOT analysis is conducted, internal factors connected to the strengths and weaknesses of a destination are characterized, as are external factors, opportunities, and threats connected to attaining the objectives associated with an organization's goals (United States Department of Agriculture, 2011), including those connected with tourism and hospitality. A SWOT analysis creates awareness of the internal and external factors that can influence the success and considers strategies that a destination can engage in to make the most of competitive advantages and effectively plan to alleviate weaknesses or threats. Furthermore, with regard to tourism, a SWOT analysis can apprise destination managers of ways to transform weaknesses and threats into strengths and opportunities.

The Dilemma

The preservation of Hwy 12 continues to be an issue for the OBX and Hatteras Island, in particular. A feasibility study published in 2016 sought to address the preservation of Hwy 12, specifically in a narrow stretch of Hatteras Island between the unincorporated areas of Frisco and northern Hatteras Village, one of the top three villages in terms of businesses supported by tourism. In the study, four short-term and four long-term alternatives were presented, which could potentially provide stability to this transportation corridor and reduce its vulnerability to storms, erosion, and natural coastal processes (Crisp, 2018). In the report, short term is defined as a five-year period, and the intent behind the short-term alternatives is to provide a means of quickly restoring the highway following a storm event in any of the identified "hot spot" areas. The biggest short-term threat stems from storm damage to the protective dune line and the structural integrity of Hwy 12. Long term is defined as a 50-year period where the intent is to protect the reliability and stability of the highway well into the foreseeable future (URS Corporation, 2015a). While the study specifically addressed the area between Frisco and Hatteras Village, the considerations presented could potentially be applied to the other aforementioned "hot spot" areas as well.

Each short- and long-term option offers a combination of road relocation, dune replenishment, beach nourishment, and/or the construction of a concrete bridge. Alternatives were developed after considering historical shoreline position data over a 45- year span, as well as the projected future shoreline position. The average erosion rate of this particular area is one to five feet per year which was calculated with a 95% confidence rating. Short term alternatives were based on an average shoreline erosion whereas the long-term alternatives were based on the higher rate of shoreline erosion (see Table 2). This was done as a means of accounting for erosion due to storm dam-

age and minimizing impacts to private property. Furthermore, NCDOT recommends a buffer of 230 feet from the ocean shoreline which was calculated using the average high-water line. In areas where the shoreline was projected to be inside the 230 feet buffer zone, bridge construction was recommended as part of the alternative (URS Corporation, 2015a; 2015b). However, the dilemma lies in what action steps to take. Which solution(s) will work best and why? Which solution(s) should be selected and why? Additionally, what are the implications of these solutions for the island and the highway? This dilemma can be seen from the context of an ethical paradox, involving interactions between complicated, complex, dynamic and ambiguous systems. Thus, determining what the best solution is (or solutions are) to the problems facing the island truly calls for a paradoxical perspective regarding the issues.

Future of Hatteras Island and Hwy 12

The future of Hatteras Island and subsequently Hwy 12 hangs in the balance. Recent reminders reiterate the undeniable message that creating a feasible, long-term solution is critical. In November of 2019, Dare County Commissioners approved $250,000 to conduct a feasibility study for possible beach nourishment along Ocean View Drive in Avon (Crist, 2019a). Another reminder can be found in two storms that merged in the Atlantic that prompted NCDOT's October 11, 2019 closing of Hwy 12 between the Marc Basnight Bridge (Oregon Inlet) and northern Rodanthe due to ocean over wash (Associated Press, 2019). Road closures and reduced beach accessibility, regardless of time closed, impact the economy (NC 12, 2019). Hwy 12 was reopened just a day later, but traveling with caution was encouraged due to lingering water and sand, which potentially deters would-be travelers. Furthermore, Hatteras Island's neighbor to the south, Ocracoke Island, anticipated having Hwy 12 closed until November 22, 2019 (Vankevich, 2019). After continued delays and despite many businesses remaining closed, Ocracoke Island reopened to visitors on December 2 (Crist, 2019b). If the viability and sustainability of such measures as beach nourishment and highway realignment have run their course, it certainly raises questions concerning more sustainable solutions for maintaining the barrier islands and Hwy 12. In fact, a recent Washington Post article addresses this very issue (Sellers, 2019). Ocracoke residents, still reeling from the destruction of Hurricane Dorian that hit the island on September 6 and the task of rebuilding, are now faced with exploring their own sustainability and asking the very difficult question of whether even rebuilding is cost effective for an island that is situated only three feet above sea level. In fact, the Federal Emergency Management Agency provided financial assistance for rebuilding infrastructure, but denied individual assistance. Such a decision reflects a larger issue regarding the sustainability of coastal areas such as Hatteras and Ocracoke as well as the cost effectiveness of spending taxpayer money to rebuild (Sellers, 2019). In fact, Dare County manager Bobby Outen echoes the economic feasibility and sustainability of beach nourishment in response to Avon's long-standing request for beach nourishment funding: "'As you know, down in Avon, they've been asking us for a long time for some kind of funds to do a study to figure out what it would cost to do a beach nourishment project. We said we didn't want to do that just yet, because we didn't know when or if we would have money to do a project'" (Crist, 2019a). With an anticipated price tag of $20 million, concerns are raised as to whether or not Avon could contribute to their share of the cost which in turn raises even greater questions regarding the sustainability of traditional preservation measures such as beach nourishment.

The projected shoreline position in 2063 was used to calculate long term alternatives, and like their short-term counterparts, long term alternatives offer combinations of highway relocation, beach nourishment, dune construction and replenishment, and bridge construction (see Table 3).

In addition to the short- and long-term solutions offered, the following possibilities have been mentioned:

- **A Highway on Stilts.**

  In order to preserve Hwy 12, some argue that the literal landscape of the highway must change. NCDOT has proposed that Hwy 12 be moved from land to bridge in areas that are the most prone to flooding. In an article published in the Virginian-Pilot, Commissioner Allen Burrus agreed that this could be a viable long-term solution as long as the bridge deck is at least 30 feet up and the support pilings are properly secured (Tennant, 2013). NCDOT is moving in this direction with the newly opened Marc Basnight Bridge, which replaced Oregon Inlet's former Herbert C. Bonner bridge. The second phase of this plan involves the construction of the NC 12 Rodanthe Bridge, otherwise known as the "Jug Handle" Bridge. Currently under construction, this bridge will extend from the southern end of the Pea Island National Refuge to the northern end of Rodanthe. Prompted by major breaches that occurred in 2011 during Hurricane Irene and 2012 during Hurricane Sandy, this is NCDOT's long term solution for dealing with the issue. The completed bridge will extend out into the Pamlico Sound 2.4 miles and is believed to be environmentally friendly for the Pea Island Refuge, as well as the ocean shoreline. Once the bridge is completed, Hwy 12 inside the refuge will not be maintained while the highway inside Rodanthe would be maintained for the purpose of accessing private property (NCDOT, 2018). Bridges such as the "jug-handle" bridge may provide an alternative model for dealing with other "hot spots" on the island and provide a feasible long-term solution to protect the stability and reliability of Hwy 12 and minimize disruption to tourism

Table 2

Proposed Short Term Solutions*

Alternative 1 – Road Relocation A	*1.5 miles of new highway alignment *Shift 100 to 120 feet *7500 feet of dune construction *National Park Service (NPS) retains right-of-way
Alternative 2 - Road Relocation B *Costliest in both price and amount of sand needed	*1.8 miles of new highway alignment *Shift 200 feet for ½ mile *2900 feet concrete bridge *2700 feet of dune construction *NPS retains right-of-way
Alternative 3 –Beach Nourishment	*highway remains in current location *1.5 miles of nourishment *provides 230 feet buffer between highway and the mean high-water level *dune maintenance for 7500 that includes one cycle of nourishment and maintenance *NPS retains right-of-way
Alternative 4 – Beach Nourishment & Road Relocation	*3000 feet of beach nourishment with 1700 feet located along realigned highway *1.3 miles of new alignment *4000 feet of new dune construction *3000 feet of dune maintenance *NPS retains right-of-way

*Source: North Carolina Department of Transportation (NCDOT) (2016).

Table 3

Proposed Long Term Solutions*

Alternative 1 – Road Relocation with Bridge *Minimizes impact to private property	*average shoreline forecast *1/2 mile of relocated highway *3/4-mile bridge *5000 feet of dune construction
Alternative 2 - Road Relocation with Bridge	*high erosion shoreline forecast *1/2 mile of relocated highway 450 feet north of existing highway *1-mile bridge *4000 feet of dune construction
Alternative 3 – Existing Alignment with Beach Nourishment *Costliest in the amount of sand needed	*1.5 miles of beach nourishment *highway remains in current location *beach nourishment in 5-year cycles *8500 feet of dune maintenance
Alternative 4 –Bridge in Existing Easement & Beach Nourishment *Least costly in the amount of sand needed, but is the most expensive. *Least impact on private property	*1800 feet of new highway alignment *1.5-mile bridge within existing easement *2200 feet of dune maintenance

*Source: North Carolina Department of Transportation (NCDOT) (2016).

Table 4

Summary of the Future Possibilities of Hwy 12*

Solutions:	Pros	Cons
Beach Nourishment	*Protects the natural integrity of nourished beach *Increases property values *Increases recreational amenities *Resident preferred option – most likely to produce the least amount of resistance	*Costly *Sustainability *Ability to locate suitable sand *Must be performed in cycles *Temporary beach closures during construction
Building a Series of Bridges	*Reduces road closures and lessens impacts on travel *Constructed with minimal disturbance to Ecosystems and natural habitats	*Costs associated with construction *Traffic issues associated with construction
Individual Villages	*Development of Ecotourism *Natural process of barrier island rebuilding allowed *Improved marine productivity, fishing sites, and natural habitats *Improved water quality as a result of water transfer between Pamlico sound and Atlantic Ocean *Fewer emissions if no cars on islands *Increased education of residents and visitors	*Displacement of individuals *Potential overcrowding in villages *Changing people's mindsets about NC Hwy 12 preservation efforts *Feasibility of evacuation efforts
Inner Banks Development	*Economically advantageous partnerships with the newly formed individual villages *Ecotourism – camping, fishing, kayaking, wildlife viewing, bird watching, Eco-tours *Increased education of residents & visitors	*Residents' resistance to increased development *Potential lack of infrastructure to deal with influx of individuals *Disturbance of natural habitats due to construction of ferry terminals, park & ride lots, and other tourism-related construction

*Sources: North Carolina Department of Transportation (NCDOT) (2016) and Riggs et al. (2008).

and the day-to-day lives of the island's residents.

- **Chain of Islands.**

  The publication, *North Carolina Coast in Crisis: A Vision for the Future*, presents a more radical option for the future that involves letting natural coastal processes take their course, which potentially results in Hatteras Island's seven villages eventually becoming their own islands, something akin to Ocracoke Island (Riggs, et al., 2008). It is suggested that current efforts such as that of building barrier dune ridges to protect Hwy 12 be withdrawn, and instead, natural coastal processes be allowed to begin the process of rebuilding the barrier islands. In pursuing this course of action, Riggs et al. (2008) argue that this new system of islands and inlets would open up new economic opportunities in ecotourism that would maintain the economic viability and sustainability of the area. To further argue this point, Riggs et al. (2008) suggested that not only would this open the door for additional economic opportunities, but would also produce numerous positive environmental impacts. Aside from allowing inlets to form that result in island "growth", increased water flow between the Pamlico Sound and the Atlantic Ocean would improve overall water quality, increase productivity in estuarine and marine ecosystems, increase the number of viable fishing sites, and expand the natural habitats of endangered species.

- **Increased Development of the Inner Banks.**

  If efforts to preserve Hwy 12 are halted and nature is allowed to pursue its own course in shaping Hatteras Island, a new door of opportunity for North Carolina's Inner Banks (the inland coastal region of eastern N.C. known for spacious river estuaries, inlets, bays, and slow moving rivers) potentially opens whereby this area is able to create partnerships that are economically, environmentally, and socially viable with the OBX, as well as focus on the area's own tourism development. According to a 2016 study conducted by North Carolina State University's Department of Parks, Recreation, and Tourism Management, any tourism dollars that might be lost due to the creation of "Ocracoke-style" villages would be retained through the tourism development of the Inner Banks. The Inner Banks are an area loaded with ecotourism opportunities such as camping, kayaking, bird watching, and wildlife viewing, as well as their associated businesses. However, there is a large discrepancy in the tourism tax base between Dare County (at the OBX) and an inner banks area such as Tyrell County. In 2016, the personal tax savings in Dare County due to tourism was $2800, and in Tyrell County, it was $122 (Seekamp, Jurjones, & Bitsura-Mesazaros, 2016). Among many reasons, this large discrepancy in tourism

tax base could be an indicator that shifting focus from the preservation efforts of Hwy 12 to that of the tourism development of the Inner Banks is not entirely feasible. When Dare County is responsible for generating such a significant amount of money through tourism, it raises the question whether, despite the exorbitant costs associated with protecting, repairing, and maintaining Hwy 12, the state can afford not to do so.

Analysis

Preserving Hwy 12 and Hatteras Island is a complex problem with no easy solution (s) (see Table 4). No matter the preservation efforts or solution(s) presented, there is a price to be paid that can be felt throughout the triple bottom line of sustainability. Presently, much remains uncertain regarding the future of Hatteras Island and Hwy 12. If efforts to preserve Hwy 12 continue, those efforts will continue to be met with challenges related to costs, logistics, and taxpayer support. Beach nourishment is expensive and requires cycles to replace the sand lost due to natural coastal processes, storms, and erosion. Given that tourism is closely linked with beach nourishment through recreational amenities and increased property values, this might be a difficult cycle to break. Furthermore, convincing people to abandon traditional preservation efforts for those that are more radical will be no easy task.

While abandoning preservation efforts and focusing on developing ecotourism along a chain of "Ocracoke-like" villages and within the Inner Banks may present a feasible solution and guarantee a greater degree of sustainability, implementing such a solution requires a huge leap of faith and additionally, requires the ability to change one's thinking regarding the importance of Hwy 12. Even greater still may be the challenge of convincing taxpayers outside of Hatteras Island that their money is being spent wisely to preserve a highway situated in an area that is shrinking despite efforts to stop it. While embarking on an unknown future poses great risks, as Riggs et al. (2008) suggested, there is potential for great reward in the development of ecotourism and natural resource-based businesses.

Conclusion

Questions remain about the future of Hwy 12 and the OBX of N.C (Peach, 2014). N.C. Hwy 12 is an integral part of the state's barrier island region, especially to those that reside on and visit Hatteras Island. It is the only vehicular point of access, so sustaining the highway in some capacity is inarguably crucial. The island's accessibility is important to the economic viability of the area, but its preservation efforts have an impact on the environment and the people who live and vacation there. Implementing measures to maintain the highway and thus a way of life for the island's residents gives them a sense of pride, purpose, and control against forces like natural coastal processes, high energy storms, and erosion that would otherwise render them powerless. Still, others would argue that clinging to this highway is environmentally detrimental to its existence. To preserve the structural integrity of N.C. Hwy 12 means taking action that negates nature's way of repairing and rebuilding the barrier islands. Striking balance between maintaining a stable structure on a dynamic land mass that is subject to frequent beach erosion, ocean over wash, sound side flooding, and high energy storm damage is a difficult, unique, and expensive challenge. The barrier islands continue to shrink due to these factors as well as rising sea levels, and with no room left to continue moving the highway, nontraditional alternatives may need further consideration. Previous methods of preservation including beach nourishment and highway realignment have produced counterproductive results and raise the question regarding their cost effectiveness in terms of the economy, the environment, and the people that reside on and visit the OBX. Some would argue that Hatteras Island should "…allow this natural process [island migration] to occur and give up the infrastructure at the water's edge" (Tennant, 2013). To the residents of Hatteras Island, this sounds akin to being told to give up the good fight. In the 1940s, this highway quite literally saved the sparsely populated residents of Hatteras Island from complete nuclear destruction and in the decades since has provided generations of visitors with access to an area that would have otherwise remained virtually unknown. As the lifeline of Hatteras Island, both literally and figuratively, it is impossible to conceive that those same people, generations later, would give up the fight now to save their highway.

Discussion Points and Questions

1. Define sustainable tourism in your own words.
2. Define the following terms: stakeholder, stakeholder theory and explain why stakeholders are important.
3. Briefly summarize the issues facing Hatteras Island in connection with Hwy 12.
4. Discuss the Hwy 12 situation with regard to its connection to the triple bottom line of sustainability that includes the environmental, economic, and socio-cultural aspects of sustainability.
5. Discuss the pros and cons of each alternative short- and long-term solution.
6. Briefly describe the sustainable development concept of ethical paradox, and discuss how this situation presents a paradoxical perspective.
7. Provide your thoughts on the future of this situation regarding Hwy 12 and Hatteras Island. Use evidence from the case and other reliable sources to support your thoughts.
8. Additional question:
9. How do you think that the corona virus (COVID-19) situation will impact the issues presented in this case study?

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