Conservation of Coastal Sand Dune Systems: Social Perceptions of Prince Edward Island National Park Sand Dune Restoration Efforts

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Declaration

I hereby confirm that I am the sole author of this thesis and it is a product of my own academic research.

__Kirsten McCaffrey______________________________

Student’s name
Abstract

Cavendish Beach in Prince Edward Island National Park is characterized by red sandstone cliffs and cascading sand dunes. Tourism is heavy between June-September, as visitors want to explore the area, swim, sunbathe and relax. Dune systems are in close proximity to where tourists flock on the beach making the dunes susceptible to human interference such as walking and running up and down the dune systems. Human footsteps can uproot and destroy marram grass that is growing on dune systems, making it difficult for sand particles to build up and continue to build the dune systems along the coast. The Prince Edward Island National Park has conservation measures in place to help protect dunes from human traffic such as boardwalks, signs and various fences. This study will examine different social perceptions of various conservation strategies used at Cavendish beach by Prince Edward Island National park according to gender, age, and local versus out-out-province visitors. The results of this study will allow Prince Edward Island National park to re-evaluate what conservation measures are working and if they can be changed for future protection of Cavendish sand dunes. This study will also suggest recommendations for future conservation of the Cavendish beach area through various educational tools directed towards the preservation of Cavendish sand dune systems for future generations.
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Introduction

1 Background and Research

The aim of this thesis is to determine the level of awareness and perceptions of visitors of PEI National Park to the conservation, management and restoration efforts of sand dune systems. This chapter discusses the balance between the Park’s efforts to conserve natural ecosystems and the ability to allow people to visit the park for recreational and education purposes without disrupting or harming these natural systems. This is followed by the research problem, purpose and objectives of this research study. Finally, this section is followed by a description of how data was collected in the field and the structure of the thesis.

1.1 Prince Edward Island and its Coastal Environment

Sandy beaches along with over-arching coastal sand dunes, which provide protection against erosion and provide habitat for both plant and animal species, characterize Prince Edward Island (PEI) National Park, Canada. Sand dunes are a vital but fragile component of PEI National Park for stability of marram grass colonies, foxes and other plant and animal species (Parks Canada, 2011). In recent years, wind transportation has increased and vegetation has decreased allowing natural processes, specifically erosion, to further disturb foredune systems within PEI National Park. Increased tourism has also been a contributing factor in erosion. Tourism can negatively affect sand dunes within this area through the creation of unauthorized paths, the overstepping of boardwalks and the navigating on and through sand dunes – all of which destroy marram grass roots and allow blowouts to form and widen (Parks Canada, 2011). Due to the influx of tourism each year, the pressures of human demands are growing due to increased infrastructure needs including boardwalks, biking and walking trails, and road networks. By increasing human accessibility, through construction and expansion of these accommodating needs, it is creating a negative impact on sand dunes systems and on vegetation and wildlife that depend on these systems for survival. Monitoring tourism impacts on sand dunes by documenting perceptions and attitudes towards restoration efforts from people who visit Cavendish Beach is crucial for implementing the future of the sustainable tourism industry in PEI National Park.
1.2 Public and Private Beaches in Park Systems

Public access to PEI’s coastal waterfront is important to not only residents of PEI, but also for tourists who are attracted to the province for its coastal landscape which in turn, helps create local economic development within the province. Public access to PEI’s coastal landscape is also important for industries such as tourism, fishing, and harvesting of shellfish and leisure activities. Run by the provincial government, PEI has a total of 18 provincial beaches across the province, which are open to the public in supervised and unsupervised locations (Tourism PEI, n.d.). Provincial government employees maintain provincial beaches, and washroom and shower facilities are available along with food vendors and various hiking and biking trails. Provincial beaches are maintained by the government to allow visitor use while also protecting and conserving the environment for future generations. Private beaches in Parks Canada are not always common, but are reachable in the backcountry by canoe-camping which provides campers with a boat and a camping site and is located in an area that is not reachable by car. This gives campers access to their very own private beach away from the general public. For example, La Mauricie National Park in Shawinigan, Quebec National park has 150 canoe campsites with tent platforms and fire pits included (Parks Canada, 2016). Another example of a private beach is at Kejimkujik National Park in Maitland Bridge, Nova Scotia, which offers 46 campsites accessible by canoe or foot only and includes a picnic table, tent floats and bear cables along with the obvious, access to your own private beach area (Parks Canada, 2015). Private beaches appeal to park visitors because of the secluded and quiet feeling of having your own piece of nature to yourself, but a downside of this is that it is harder for park wardens to enforce regulations such as wildlife feeding, noise and use of unauthorized footpaths.

1.2.1 Managing a National Park

National Parks are the most heavily protected areas in Canada that are protected and enforced by the federal government. In PEI, the PEI National Park works to provide safe and secure hiking and bike trails, continuing research and protection of a vast majority of plants and animal species and provides the public with access to beautiful yet sustainable places now, and for the future. The main difference between a provincial park beach and a national park beach is that the provincial government runs provincial parks while the federal government runs national parks. Provincial parks around Canada have different mandates depending on what each individual park needs in order to conserve that particular environment. For example, the Thomas Raddall Provincial Park on the South shore of Nova Scotia covers 1,675 acres of
natural land and protects evidence of the first settlers along with endangered piping plover nests on the coast and a number of predatory birds and other animal species (Nova Scotia Provincial Parks, n.d.). In the northwest of Saskatchewan, the Athabasca Sand Dunes Provincial Park protects 100 kilometers of dune fields, which is accredited for being the most northern and active sand dune formations on the globe (Government of Saskatchewan, n.d.). As for PEI, Panmure Island Provincial Park located on the eastern shore protects white sandy beaches with moving sand dune systems.

Under federal government jurisdiction, Parks Canada “protects nationally significant examples of Canada’s natural and cultural heritage” (Parks Canada, 2011). In accordance with the law, team members help protect and enforce rules and regulations under the Canada National Parks Act. All National Parks in Canada follow the same rules and regulations under the Canada National Parks Act and Criminal Code of Conduct, which are executed by park wardens in all provinces (Parks Canada, n.d.). For example, area closures, off-road driving, wildlife viewing and hunting are rules that are enforced in all National Parks across Canada. Elk Island National Park in Fort Saskatchewan, Alberta prides itself in the protection of Bison along with over 250 species of birds which can be viewed safely by using the AdventureSmart national program that is supported by Parks Canada (Parks Canada, 2015). Like all other National Parks, Elk Island park staff are available at any time via phone for any emergency that may be at hand. In Churchill Manitoba, the Wapusk National Park covers 11,475 square kilometers in the subarctic and protects nearly 950 polar bears, which use this area for maternity denning (Parks Canada, 2016). Park wardens patrol and enforce regulations like hunting, disruption of flora and fauna and campfires which are not permitted in the Wapusk National Park. As regulations are enforced, research is also encouraged to allow National Parks to learn about the pros and cons of tourism and its impact on changing landscapes. Provincial and National Parks continue to protect Canada’s natural landscapes and coastal areas with regulations that are enforced by the provincial and federal government.

1.2.2 Managing National Historic Sites

Parks Canada’s aim is to protect wild and cultural areas that need to be maintained and protected for future generations to enjoy while also preserving and conserving Canada’s natural environment. Preservation methods are strict and balanced differently among national parks, national historic sites, and national marine conservation areas. Located in every province, National Parks balances the knowledge of vigorous and changing natural landscapes with
understanding and awareness of people whose footprints impact different landscapes across Canada. By understanding dynamic and ever-changing landscapes, conservation measures such as boardwalks, fences, signs, and rope can be and are implemented in most national parks to educate people who visit the parks while also directing foot traffic to safe and sustainable areas. National historic sites combine history and culture to provide visual and unforgettable experiences to people who visit these sites. National historic sites are preserved in ways to reduce fragility and to encourage people to respect cultural representations of Canada’s history. For example, Port-la-Joye—Fort Amherst is a National historic site near Charlottetown, PEI that is where the first permanent European settlement took place (Parks Canada, 2015). This national historic site is protected and defined as a designated place because of its location combined with harbor views and is protected against coastline erosion, future construction of housing and the views cannot be obstructed (Parks Canada, 2003). Port-la-Joye—Fort Amherst, along with other National historic sites across Canada, combines interpretive panels with trails and various special events that bring the Acadian culture to life to educate and inform visitors about the area’s importance.

1.2.3 Managing National Marine Conservation Areas

National Marine Conservation Areas (NMCAs) are defined as “marine areas managed for sustainable use and containing smaller zones of high protection” (Parks Canada, 2015). As national parks try to preserve natural environments that have not been reshaped by human use, NMCAs try to create an equal yet sustainable balance between sustainable preservation practices and human uses within the area (Parks Canada, 2014). NMCAs preserve these aquatic ecosystems by continuing to monitor visitor use through activities and by monitoring water quality and the various species that depend on a safe and sustainable aquatic environment for survival.

1.3 Providing Facilities in Fragile Environments

Parks Canada protects natural environments for people to enjoy now and in the future, but this means that visitors need a variety of facilities, from general tourist information to backcountry hiking shelters. Providing facilities to visitors is important to keep a constant flow of people learning and exploring new and natural places. For example, campgrounds are situated within National Parks, which means that bathroom facilities, running water and sheltered areas are constructed to allow campers to be comfortable while visiting a particular park. Bathrooms, boardwalks, trails, tourist information centers, and various other park buildings, such as staff
administration, are also available in most day-use parks, as well as National Historic Sites and NMCAs. As Parks Canada is dedicated to preserving and conserving natural environments in various dynamic ecosystems, the line between natural and man-made environments is a balancing act. Providing facilities for visitors to use is positive because it protects the surrounding environment from human activity that could be detrimental to its ecological integrity, but these facilities also take away from the natural feel of a preserved area. Parks Canada tries to create a sustainable medium between human use and natural, cultural, and historical protection.

1.4 Research Problem, Aims and Objectives

PEI National Park’s coastal areas consist of sand dunes which are created by natural processes through wind action, storms, and wave motions (Lajeunesse, et al., n.d.). Within PEI National Park is a popular coastal attraction known as Cavendish Beach. As tourism increases, the effects of human activity on the sand dunes increases, and this results in detrimental impacts. Uncontrolled access to the dunes has resulted in the killing of marram grass cover leading to the destabilization of sand dunes (Management Strategy Plan, 2000). Other negative impacts that human activity has had on sand dunes include the creation of unauthorized footpaths, which has decreased visitor experience and has put a strain on the ecological integrity of the park (Management Strategy Plan, 2000).

PEI National Park’s conservation measures towards sand dunes that have been successful in the past include restrictive wire fences along with T-bars and rope barriers (Davidson-Arnott, 2014). Various types of signage, boardwalks and designated trails have been used in the past, as well as today, to provide a visible but healthy path for visitor traffic to cross foredune systems. These signs vary from “area closed beyond this point” to “healthy dunes make healthy beaches” (Hawkins, personal communication, April 16, 2016). Through this research project, the objective is to measure visitors’ attitudes and perceptions towards park mitigation strategies to better understand how people visiting Cavendish Beach from all over the world perceive certain management strategies towards sand dunes and if these strategies should be changed or altered so that visitor behavior, such as trampling and the creation of unauthorized paths, can be changed for the survival of sand dunes in the future. Gauging how aware visitors are of conservation and management strategies in the park gives park staff answers as to what is working, what is not, and how efforts can be swayed one way or another to further educate visitors on why these strategies are initiated.
PEI National Park provides visitors with access to many protected areas under strict circumstances. To access these areas, visitors must obey various signs, fences and other precautionary materials to guarantee protection of the environment they are entering. Visitor access has been a priority to the park to allow the general public to enjoy a natural and protected environment, but visitors also pose a problem because increased foot traffic has long and short-term effects on different landscapes, especially environments such as foredune systems.

Due to increased tourism over the years, Cavendish Beach, dune systems have been impacted by human activities, resulting in eroding of frontal dunes due to foot traffic. Visitor interference combined with the changing parabolic dune systems on Cavendish Beach has proved to be unsustainable in the past. With increased and strategic placing of signs, boardwalks, fences and ropes along edges and on dune systems on Cavendish Beach, the natural landscape is being humanized to prevent visitors from damaging dune ecosystems. Limiting human access by using conservation measures such as fencing on dune systems can effectively restore plant vegetation and improve various plant communities over time, acting as a low cost measure for dune conservation (Silc et al., 2017, 2017; Acosta, et al., 2009).

This research paper answers two research questions: (1) do visitors perceive current conservation and restoration efforts towards sand dunes in PEI National Park as successful, and (2) how do these perceptions vary? These research questions are answered using semi-structured interviews with PEI National park staff and survey methods conducted with Cavendish Beach visitors between the dates of July 1 2016 - September 30 2016. The aim and objectives of this research paper are to determine if perceptions of current conservation efforts are positive or negative, if they differ between local residents versus non-residents and how these social perceptions can contribute to better management strategies that reflect concerns by visitors and can give Parks Canada feedback on current and future management strategies at Cavendish Beach.

1.5 Conduct and Presentation of Research

Between July 1 2016-September 30 2016, research was conducted on Cavendish Beach, PEI between the times of 12:00pm-4:00pm by walking along the beach in both directions and asking visitors in a non-biased manner to fill out a survey. This double-sided survey contained various questions about the respondent such as age, gender, permanent residence status, and
how long they have been coming to Cavendish Beach. There were also questions on what management strategies they have seen on Cavendish Beach today or in the past such as wire fences, ropes and boardwalks. Once all surveys were completed, Microsoft Excel was used as a database where all survey information was stored. Interviews were also conducted with PEI National Park staff, including ecologists and resource conservationists, between July 1, 2016 and October 27, 2016. The interviewees were asked seven different questions ranging from staff availability to their views on visitor perceptions. The park staff interviewed also provided insight into past and current beach and foredune conservation and restoration strategies within PEI National park. These interviews each lasted around one hour or less and were recorded for future transcription. Throughout the three-month research permit at Cavendish Beach, observations were conducted at Oceanview, where visitors were stopped and asked what conservation efforts they saw that day off the top of their head and where they were from. All information from interviews were typed and saved in Microsoft Word and saved on a personal computer along with all applicable Microsoft Excel documents. Analysis of data and write-up of results was completed between early October and end of December 2016. This thesis is presented in five chapters. Following Chapter One, Chapter Two describes the study area and its background and Chapter Three describes the methodology in detail. Chapter Four contains a description of results and Chapter Five is where results are combined with the research problem and relevant literature. The data collected is presented in this research paper in written form, graphs, and qualitative assessment.
2 Study Area and Conservation Efforts

PEI is a unique and small province of Canada and preserving its natural components has posed a challenge for PEI National Park. This chapter will describe PEI’s physical geography and history and how climate change is significantly affecting the coastline’s natural components. This is then followed by a more detailed description of PEI National Park and the Cavendish Beach area. Finally, this chapter will discuss different management, conservation, preservation and restoration efforts undertaken by Park staff in PEI National Park with a focus on sand dune systems. This chapter will conclude with a brief description on why public perception testing using a survey method was used to gauge public understanding of various management strategies in PEI National Park.

2.1 Location

Located on the eastern coast of Canada, (Figure 2.0) PEI is Canada’s smallest province, known for its rich farmland producing famous potatoes, popular fishing opportunities, and a unique landscape that attracts tourists from around the world. PEI is 280 kilometers long, 7-50 kilometers wide (Figure 2.0), and is a maritime province and an Atlantic province due to its location in the Gulf of St. Lawrence (PEI Provincial Government, 2016) (Figure 2.0). Having the smallest population in Canada of around 150,000 residents, two cities, seven towns and a total land area of 5,656 square kilometers, PEI has become a top-destination for travelers from around the around to explore and discover (Tourism PEI, n.d.). Access to PEI is via ferry from Nova Scotia taking approximately 75 minutes to cross or via Canada’s longest bridge, the Confederation Bridge, connecting the province of New Brunswick to PEI. The Charlottetown airport has direct flights to a number of cities in Atlantic Canada, Quebec and Ontario. As access to PEI has become easier year-around, tourists have been flocking to PEI to not only shop and eat, but to also see the unique red soil landscapes and cliffs.
Bedrock geology of the island consists of nearly horizontal sedimentary units of sandstone and some siltstone and mudstones deposited in a shallow, deltaic area about 220-300 million years ago (van de Pol, 1983). Many of the beds have a bright red colour due to a coating of iron oxide and this colour is also found in a superficial layer generally < 3 m thick of sandy clay till that overlies the bedrock in most locations. Similar rocks are found in Nova Scotia and New Brunswick on the other side of the Northumberland Strait. Much of the island is <50 m in elevation and consists of broad, gently sloping valleys that usually end in shallow estuaries. The sandstones and mudstones are relatively weak and break down readily due to weathering and erosion. The north and north-east coasts are characterised by low cliffs and headlands cut in sandstone and extensive sections characterised by barrier islands and barrier spits which enclose lagoons and shallow estuaries with extensive saltmarsh development.

The only known source of igneous rock is in Malpeque Bay, PEI (Van De Poll, 1988, p. 25). Above ground, PEI is covered in rich farmland and forested areas. PEI has protected its culture and wildlife by designating and protecting two Canadian Heritage River systems, 60 ecological sites, and almost 100 wetlands (Tourism PEI, n.d.). Due to PEI’s geographical location being surrounded by the Gulf of St. Lawrence, PEI has milder summers and winters due to marine...
regulation. Winter temperatures average between -3 to -11 degrees Celsius and summer temperatures average around the 20-degree mark (Figure 2.1) (PEI Provincial Government, 2014). Between November-early May, snowfall amounts average between 19 cm-73 cm and rainfall amounts average around 90 cm in the spring and summer months (Figure 2.2) (PEI Provincial Government, 2014). With cool summers, little fog, and the occasional hurricane that brings strong winds and tidal surges, PEI’s weather can change rapidly day-to-day and season-to-season, especially with changing ice conditions.

Wind and ocean currents heavily influence the Gulf of St. Lawrence. As ice moves from higher latitudes through the Labrador shelf and into the Gulf of St. Lawrence, the ice is trapped and is unable to move south creating high amounts of ice that continues to grow in thickness, which also limits wave generation. The introduction of ice along with generation of ice in small bays and inlets such as on the North shore of PEI begin in late fall peaks in mid-late winter. Cold wind temperatures are one of the main generators of ice thickness within the Gulf of St. Lawrence accounting for 57% of inter-annual change of the seasonal thickness of ice cover (Benoit, et al., 2012, pg. 24). Air temperature mixed with moving north-easterly winds has a large impact on ice cover area, especially in the Gulf of St. Lawrence which has contributed to the formation of new ice (Figure 2.3). As cold temperatures contribute to the distribution and growth of sea ice in the gulf, the ice also has secondary effects of coastal protection acting as a shield lessening wave action, storm surges, and coastal erosion. PEI depends on the ice in the Gulf of St. Lawrence, for coastal protection in the winter months and thus reduced cliff erosion. Increased winter temperatures due to global warming are leading to reduced winter ice cover and thus a greater probability of storm wave action and coastal erosion during the winter months (Benoit, 2012; Manson et al., 2016).

Sea level around PEI has been rising at 0.25-0.3 metres per century for the past 5-6000 years (Grant, 1970; Forbes et al., 2004) and modern tide gauge records from Charlottetown show that it is still rising at about the same rate. This rise in sea level has led to the formation of the numerous lagoons and estuaries around the coast and to the ongoing average retreat of the shoreline of about 0.3 metres per year (Forbes et al., 2004; Webster, 2012.)
Figure 2-2: Mean Maximum and Minimum Temperatures in PEI (PEI Provincial Government, 2014).

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<tr>
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<td>DECEMBER</td>
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<td>33</td>
<td>-7</td>
<td>19</td>
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Figure 2-3 Average Rainfall and Snowfall in PEI (PEI Provincial Government, 2014).

<table>
<thead>
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<th>Avg. Snowfall</th>
<th>Avg. Rainfall</th>
</tr>
</thead>
<tbody>
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<td>93</td>
</tr>
<tr>
<td>DECEMBER</td>
<td>66</td>
<td>59</td>
</tr>
</tbody>
</table>
Figure 2.4 Effect of Winter Air Temperatures on Seasonal Ice Cover Area in the Gulf of St. Lawrence (Benoit, et al., 2012).

2.3 Cavendish History

The Cavendish area is relatively new in terms of having human population. In the 1720s, French and Acadian settlers came to PEI (previously a French colony known as Isle Saint Jean) and by the 1770s when PEI was deemed its own colony, the population continued to grow with immigrants from the British Isles ([billboard for Parks Canada], personal communication, n.d.). When settlers first settled in the Cavendish area, they were greeted with red sandstone cliffs, vast sand dune systems, and wooded areas. Settlers cleared forests to create farmlands, which proved to be rich in nutrients producing high quality potatoes and grain products ([billboard for Parks Canada], personal communication, n.d.). Not only did Cavendish provide settlers with high grade soil, lumber and small harbours for fishing, it also had, and still has, the protection of large sand dune systems that create a natural protective barrier against storms, erosion and rising sea levels.

2.4 Natural Features of PEI National Park

Sand dune systems are prominent in and around Cavendish Beach and appeal to tourists because of their beauty but also because of how vast this dynamic ecosystem which can be found rolling around the Cavendish area as well as Brackley-Dalvay, Greenwich and much of the PEI shoreline. Cavendish sand dunes and management schemes have changed greatly over
the years. Until the mid 1990s, a road was heavily in use, which ran along the edge of Macneil’s Pond just behind large and established foredune systems ([billboard for Parks Canada], personal communication, n.d.) (Figure 2.4). This road was later removed in 1995 by Parks Canada to allow the area to reestablish naturally and to restrict further damage to the surrounding foredune systems ([billboard for Parks Canada, personal communication, n.d.). Sand dunes are and have been constantly changing as are PEI National Park management strategies.

![Location of old road that was removed in 1995 by PEI National Park](image)

*Figure 2-5* Location of old road that was removed in 1995 by PEI National Park (Google Maps, 2017).

Other natural features that are found in PEI National Park are of course sandy beaches which can be found around almost every corner of the park. On these beaches, an internationally endangered shore bird, the Piping Plover, builds nests and tends to its young. Other natural components of the park include look-off points accessible by foot and car that look out on the horizon of the Gulf of St. Lawrence and there are also cultural heritage sites that represent human history. It is important to note that PEI National Park has been working to ensure dune systems are protected from human impacts by implementing conservation measures to educate people on the fragility of vegetation on the dunes and to refrain from disrupting them at all.

### 2.4.1 Cavendish Sand Dunes

PEI is known for its color, but also for its ever-changing landscapes. Cavendish sand dunes were created by strong winds over a period of time blowing sand particles inland from the beach where they were deposited within pioneer vegetation leading to the formation of a foredune. The sand in Cavendish is made up primarily of quartz and feldspar, with small amounts of mica, and magnetite. The foredunes at Cavendish, as is the case for dunes
throughout PEI, are subject to the development of natural blowouts, which in some case may develop into landward migrating parabolic dunes with a crescentic slip face. The instability due to sand transport within blowouts and parabolic dunes makes it difficult for vegetation to re-establish and thus stabilize the dunes once more. Cavendish sand dunes are characterized as parabolic dunes because the dune is shaped like a crescent and the inward side has a slip face. Over the last three centuries since the first settlers arrived, Cavendish sand dunes were not only subject to natural weather conditions, but also to trampling and other human activities, which disturbed the vegetation and is now recognized as detrimental because of the large increase in blowout development. Due to the Cavendish area having a large amount of beach access, the ever-growing pressure of tourism is affecting the natural value of dune systems as well as undercutting the other ecosystem services they give (Acosta, Jucker, Prisco, Santoro, n.d., Andersen, 1995).

2.4.2 Dune Systems Around PEI

Sand dunes are prominent in other areas of PEI. In the East for example, Basin Head Provincial Park is bordered by sand dune systems, which provide visitors with a unique treat, “singing” sand. Although this phenomenon is due to sand particle sizes, it attracts visitors to the park. The Greenwich area at the northeast end of the island, which is also within PEI National Park, has rolling white beaches and is PEI’s biggest parabolic dune systems (Tourism PEI, n.d.). In the Northwest area of PEI in Prince County, Conway Sandhills is part of 50-kilometre sand dune system that is now protected under the Nature Conservancy of Canada (Nature Conservancy of Canada, n.d.). PEI’s sand dunes stretch over most of the Island’s coastline and act as a natural barrier while also providing habitat for many plant and animal species to grow and thrive.

2.5 Social Aspect

Founded in 1790, the Cavendish area transformed from a small, rural populated area to a hotspot destination for tourists around the world in the first half of the 20th century (Welcome PEI, n.d.). The Cavendish area has transformed into a destination suitable for all ages including tours of the fictional yet blockbuster hit, Anne of Green Gables house with an adjacent golf course (Tourism PEI, n.d.). The Cavendish area also includes various amusement parks, restaurants, shopping opportunities, hotels and motels. As most people flock to the seaside during Canada’s hot summer months, Cavendish provides the perfect getaway with the introduction and continued protection of the PEI National Park.
2.6 Coastal Erosion Endangering Facilities Along PEI’s Coastline

As noted in Section 2.1, reduced winter ice cover and ongoing sea level rise results in erosion of coastal cliffs and recession of the shoreline at a rate of about 0.28 meters per year (Webster, 2012). Dr. Adam Fenech who is the director of the Climate Research Lab at the University of PEI has helped develop and use CLIVE (Coastal Impacts Visualization Environment) which is a visualization video game allowing users to fly over PEI using different levels of sea level rise to give a visual representation of how much land will be lost in the future (Taber, 2016). Dr. Fenech (as cited in Taber, 2016) explains “over those years, more than 20 square kilometers of coastline had eroded away. Over the next 90 years, at least 1,000 homes and cottages are at risk of disappearing into the ocean, along with 17 lighthouses, 10 footbridges and 146 commercial buildings. About $45 million in road infrastructure is also at risk”. Although resilient to coastal erosion, the impact has secondary effects on the plants and animals that depend on these ecosystems for survival along with sand dunes that are being subject to continuous erosion.

2.6.1 Sea Level Rise and Human Impacts: Erosion of Sandy Beach Systems

Coastal and aeolian action combined with sea level rise pose a great threat to sandy beaches such as Cavendish Beach in PEI National Park. As increased storms create more aggressive wind patterns and wave action, sandy beaches are prone to longshore sediment transport and movement of sediment onshore into the lagoons and estuaries. Human intervention has also become a problem due to the large number of people using the sandy beach systems of people on the beach, which disrupts the accretion of sediments in the dunes. Beaches are of value to both human uses such as tourism and the natural environment which tourism can base itself around in areas such as Cavendish Beach. Cavendish Beach is a hot tourist area with infrastructure to allow visitors safe access, but there is also Cavendish Spit, which is just south of Cavendish Beach, which is a result of swash currents removing sediment and being transported by longshore drift. According to Norton 2000; Savard et al. 2000; Conway and Nordstrom 2003 (as cited in Nordstrom, 2008) “Maintaining natural environments in developed areas can help familiarize people with nature, instill the importance of restoring or preserving it, and enhance the image of a developed coast” (p. 7). By protecting beach systems using various management strategies, beach erosion can be maintained and sediment transport can continue on the aeolian transport cycle between beach and foredune systems.

Dune systems in PEI depend heavily on beach sediment in terms of transport and deposition.
Human uses that have a negative effect on dune systems include a wide range of activities, such as running up and down the dunes, using the dunes as a wind shelter or even just to lay your towel down, which all have an impact on the natural vegetation. However, these recreational uses can create erosion of sediment leading to instability of the dune system. As sea levels rise and storms increase, sediment is suspended, and transported offshore or down shore through longshore transport processes. Phillips and Jones (2006) describe “the point of issue is how to protect and manage our coastal resources whilst accommodating growing pressures for tourism development” (p. 518). This relates closely to the problems PEI National Park has been encountering at Cavendish Beach because Parks Canada has management and conservation strategies put in place on and around dune systems due to growing tourist populations in recent years combined with increased storms, requiring changing management strategies in response to dune system changes on Cavendish Beach.

Erosion is occurring around the coastline of PEI from natural processes due to the fragility of sandstone cliffs. Sea level rise has been an ongoing process from glacial melt, but worldwide sea level rise due to global warming has been accelerating which has been a contributing factor to increased coastal erosion on PEI. Dickson et al., 2007; Walkden and Dickson, 2008 (as cited by Davidson-Arnott and Ollerhead, 2011) describes that “Sea level rise over the next century or more may lead to an increase in the recession rate for weak cliffs because deeper water over the platform close to the cliff toe will permit more wave energy to reach the cliff toe” (p. 10). Cliffs are affected by sea level rise, but sandy beach systems are also affected due to sand deposits being swept away by the constantly increasing high water mark. Doody (2013) describes that the detrimental impacts of global warming on beach systems can push sediments landwards ‘locking it up’ and taking it out of the system that would normally contribute to the replenishment of sediment to the beach (p. 140). An important component of sandy beach systems are sand dunes, which act as a natural barrier against storms and sea level rise. Doody (2013) explains that sand dunes are dynamic ecosystems that rely on wind and waves to deposit sediment particles onto upper shore areas but human actions along with climate change interfere with these developments causing a sediment budget deficit (p. 85). Because of erosion of the bedrock headlands and ongoing sea level rise, dune systems will continue to be at risk from wave action, intense storms and tidal surges furthering onshore migration and shore transgression (Davidson-Arnott, 2005). Preserving the dune form while allowing it to migrate with the shoreline is enhanced through management activities designed to reduce human impact on the stabilizing vegetation and this now an important part of the park management.
Since sandy beach and dune systems are constantly moving and sea level rise is increasing due to global warming in recent years and reduced ice cover in winter months, dune systems will continue to be at risk of detrimental storms and tidal surges furthering the sediment deficit and furthering onshore migration which accelerates the erosion process on the coastline of PEI. Focusing on the north shore of PEI, exposed sandstone cliffs are not hard to find, as they are prominent around almost every turn on a coastal road. These cliffs are composed of red colored sedimentary bedrock, which is not very resistant to weathering, wave action, and erosion by wind. Macneil’s Brook which is just east of Cavendish Beach is an accessible beach area within PEI National Park and has eroding sandstone cliffs where the cliff face is eroding faster than the toe of the cliff creating a natural but not permanent barrier towards the ocean (Figure 2.5). As cliff erosion poses a threat to PEI and its landmasses, erosion of sandstone cliffs can help replenish sandy beaches and dune systems with sediments traveling with wind and wave patterns through longshore transport.

Figure 2-6 Cliff erosion at Macneil’s Brook, PEI National Park (Kirsten McCaffrey-July, 2016).

2.7 PEI National Park: Its History and what it offers to Visitors

During the early 19th century, the economy in Cavendish was changing rapidly from a farming community to a tourist hotspot with the introduction of the PEI National Park. According to
Simpson (1973) the PEI National Park was officially designated as a National Park on April 24th 1937 as land was exchanged from the provincial to federal governmental authorities (p. 212). Ever since the National Park was formed, visitors have continued to visit the protected area year after year and with growing numbers.

National Parks not only protect the natural landscapes and wildlife, they also provide learning opportunities, supervised swimming areas, cultural experiences, and hiking and biking trails. PEI National Park attracts visitors not only because of its coastal geographical location, but also because of the many different activities that it provides to its visitors each season in both English and French. PEI National Park has more than 50 kilometers of hiking and biking trails, daily learning opportunities for children including hands-on problem-solving and interpretive activities such as sand castle competitions, story-telling, beach combing and Mi’kmaq cultural heritage experiences (Parks Canada, 2016). PEI National Park also includes seven supervised beaches which also pose as a stage for many Park activities while also being readily accessible with the use of parking, boardwalks and special wheelchairs for those with have restricted mobility (Parks Canada, 2016). With a focus on learning, exercising and various camping and day-pass opportunities, PEI National Park continues to be the center of attraction in the province of PEI.

2.7.1 Cavendish Area

The Cavendish region of PEI National Park is known for its pristine and arguably most popular beach in PEI. Stretching eight kilometers from New London Bay to the easterly sandstone cliffs in the East, it isn’t hard to tell why visitors are attracted to this area because of its pristine, clean and memorable white sand beaches with overlooking red sandstone cliffs (Marco Polo Land, n.d.). Cavendish Beach provides day-use visitors with bathroom and changing facilities, a canteen, and easily accessible boardwalks from the parking lot to the beach and various trail and bike networks. The Cavendish area of PEI National Park also includes a campground that is operational from the beginning of June to mid-September and offers campers facilities such as flush toilets, showers and kitchen facilities along with access to various trail networks and access to beaches (Parks Canada, 2016). Along the coastal Gulf Shore Parkway West drive between the Cavendish area and North Rustico, there are many places to stop and enjoy the scenery of the Gulf of Saint Lawrence and picturesque views of the sunset along red sandstone cliffs. PEI National Park attracts visitors of all ages from around the world appealing to those seeking adventure and an unforgettable experience.
2.8 Dune Management Efforts at Cavendish Beach

PEI National Park is constantly improving management strategies towards vital forests, important animal and plant habitats and various strategies to improve the awareness of visitors and to reduce their impact on the natural landscape. Park staff are heavily involved in sand dune management at Cavendish Beach in order to preserve the functioning of the natural ecosystem and to prevent human impacts which might threaten the natural resiliency of the dunes to erosion and sea level rise. Boardwalks, rope barriers, wire fences, and conservation signs are the main management strategies put in place on and around Cavendish Beach dune systems to help protect them for the future.

2.8.1 Boardwalks

Cavendish Beach provides visitors with a main boardwalk that connects the parking lot to the bathroom and changing facilities, canteen and picnic area, and to a long stretch of boardwalk that connects to the sandy beach and ocean (Figure 2.6). Visitors who drive to Cavendish Beach for beach access only, never touch vegetated ground due to the boardwalk length connecting to the beach. The boardwalk concentrates on crossing of the dune in one location, which greatly reduces the potential human impact. This strategy has allowed vegetation along and around the Cavendish Beach area to grow and has given the dune systems bordering the boardwalks room to move and grow with different weather patterns. The boardwalk is moved every 30-40 years to allow the dune to reestablish in the area where the boardwalk was previous built. This boardwalk has also allowed public accessibility over this sensitive landscape, which has prevented further disruptions to the dune systems.
2.8.2 Rope Barriers

Rope fences are used on Cavendish beach act as soft barriers to keep visitors away from the dunes. These rope fences are used on the bottom of the boardwalk entering Cavendish Beach to funnel beach away from the dunes on the edges of the boardwalk (Figure 2.7). Rope barriers are also along the edges of the dunes in the most heavily used part of Cavendish Beach by visitors and here they keep people away from the location of potential embryo dune establishment as well as from walking over the foredune itself. Rope barriers blend into the natural environment more than hard barriers such as wire fences. They do not interfere with sand transport in the way that wooden ‘snow fencing’ does and they can be removed over the fall and winter months when there are few visitors.
2.8.3 Wire Fences

Wire fences are used as a hard barrier prominently in areas such as Oceanview, which is east of Cavendish Beach, providing views of red sandstone cliffs, dune systems and the busy Cavendish Beach. Wire fences are situated in front of visitor footpaths on the dune systems at Oceanview to deter people from using these unauthorized dune paths in the future (Figure 2.8). Visitors were and still are walking and running through dunes to catch a better glimpse of the view and to just enjoy the novelty of sand dunes, but these activities have proven to be detrimental to the growth of the dunes, destroying marram grass roots allowing sand to blow away, creating blowouts. This is why wire fences, which are an obvious and hard obstacle to jump over, have been put in place to stop visitors from doing such activities. These wire fences are grouped with conservation signs to tell visitors why these wire fences are in place and why they are important for the growth of the environment. They are used especially to protect areas where there is ongoing sand dune restoration and areas away from the view of park staff.
2.8.4 Conservation Signs

Various conservation signs are apparent around Cavendish Beach on the sand dunes, on park billboards and on posters in entrances to trails, Cavendish Beach and information pamphlets available at tourist information centers. These signs vary from “Area closed beyond this point” to an explanation stating why dunes are important and how foot traffic can be detrimental (Figure 2.9) (Figure 2.10). As described by the Arcata field office (2004) “providing informational and regulatory signs at major use areas will reinforce the rules necessary to minimize impacts from an anticipated higher level of visitor use” (p. 114). Conservation signs are a learning mechanism that educates visitors on why a certain area is closed and why they cannot enter, which protects the dune and surrounding environments when park staff are not present.

Figure 2-9: Wire fences at Cavendish main beach (Robin Davidson-Arnott, March 27, 2017)
2.9 Dune Restoration Efforts at Cavendish Beach

Dune Restoration at Cavendish Beach has been an ongoing process that has been monitored for years due to the constantly moving dune systems and the heavy flow of visitors who use the beach primarily in the spring and summer months. PEI National Park analyzes the changes in the dunes from stabilized dunes to severe blowouts to see what management strategies can be implemented to help restore and maintain these ever-changing environments. Christmas tree placement in the dunes and transplanting nursery-grown marram grass has proven to be successful in regenerating healthy dune systems while area closures become a last resort when dune restoration has been negatively impacted and is at high risk of permanent and irreversible damage. Dune restoration is important for the future of Cavendish sand dunes in PEI National
Park and has become a challenge in recent years due to repeated storms and an increase of visitor traffic.

2.9.1 Dune Restoration Efforts at Cavendish Beach: Christmas Trees

Various forms of vegetation can help stabilize dune systems to prevent sediment transport. PEI National Park has introduced a program where recycling of dead Christmas trees are placed in the dunes sideways to act as a catchment and stabilization barrier for sand particles. A Coastal Resource officer stationed in Brackley-Dalvay explains that PEI National Park works closely with Island Waste Management (IWM) to recycle Christmas trees. As Christmas comes to an end, trees are gathered by IWM and dropped off at the long-term storage facility where they are stored until spring and then are placed in the sand dunes in areas where restoration of the vegetation is being promoted [personal communication, August 2016]. The dead Christmas trees are used instead of wooden snow fences because they trap sand naturally and the dead tree decomposes after it is buried. Marram grass is planted in the area to be restored and the dead Christmas trees stabilize the sand long enough for the marram to become established and effective at trapping sand.

PEI National Parks’s main focus is to preserve the natural environment, but to also educate the public on why conservation and preservation is important for the future of the park. PEI National Park seeks volunteers from the community as well as working with student groups from around the province. A Coastal Resource Officer explains that student groups from the rural high school in Charlottetown help with the planting of Christmas trees because it is part of their school course and PEI National Park works with the external relations team to try and accommodate community volunteer group efforts [personal communication, August 2016]. Christmas tree placement is done in the spring and is monitored regularly with stakes to see if sediment is building up and contributing to healthy dune systems (Figure 3.0). Christmas tree placement is an organic method used to stabilize dunes while marram grass helps to prevent sand movement on and around the surface of dunes.

2.9.2 Dune Restoration Efforts at Cavendish Beach: *Ammophila breviligulata*

*Ammophila breviligulata* commonly known as marram grass is a perennial type of beach grass that grows in dry, sandy areas and continues to spread and build roots in sandy environments helping stabilize important sand dune systems. Marram grass can grow up to over 1 metre in height and flower and seeds between July and September each year where the seeds are carried
away by wind currents (Plants for the Future, n.d.). Marram grass is a vegetative species due to its roots that helps stabilize sand sediments in dune systems and act as a wind barrier against the movement of sand to other areas. PEI National Park has been planting marram grass in the dunes with the help of volunteer groups. A Coastal Resource Officer at PEI National Park stationed in Brackley-Dalvay explains, “we are more concerned about the marram grass [in reference to Christmas trees] because we need the moisture in the sand which is available in the spring, and in summer its so hot and dry so we usually try and do smaller things in the spring months and in the fall we do larger dune restorations” [personal communication, August 2016]. As with Christmas tree restoration projects in the dunes, PEI National Park uses volunteers, school groups and members from different departments of the National Park to help with planting nursery-raised marram grass each year before the windy and cold winter months approach (Figure 2.11) (Figure 2.12). Storms, windy weather, and human intervention on marram grass colonies disrupts roots of the grass which is eventually uprooted leading to secondary effects of sand deposition. The North Carolina State Extension Publications website (2015) explains that “although it grows quickly [in reference to Amophila breviligulata] where sand accumulates on the seaward dune edge, it tends to die out behind the dune crest after only a few years”. Human intervention especially with the high volume of foot traffic on Cavendish Beach also poses a problem because it takes only ten footsteps to dismantle a marram grass area allowing sand to blow away from the dunes resulting in dune blowouts (Parks Canada, 2011). Dune systems help support vegetation while vegetation helps stabilize dunes. Sand dunes are a highlight for people visiting Cavendish beach and without the planting of marram grass, the dunes would be in danger of bigger and a higher number of blowouts resulting in an ever-changing beach landscape.

2.9.3 Dune Restoration Efforts at Cavendish Beach: Area Closures

Activities in the park are monitored regularly to see if they are endangering the natural and cultural environment including the landscape, plants and animal habitats. The superintendent of the National Park can order area closures at any time due to poor conditions of any area of the park. According to the National Parks General Regulations (2016) “The superintendent may, on request, issue an authorization and may prescribe terms and conditions in any such authorization, taking into account the natural and cultural resources of the park; the safety, health and enjoyment of persons visiting or resident in the park; and the preservation, control and management of the park”. In early August of 2016, the superintendent of PEI National Park issued an area closure for dune restoration management. The dune area closure stated by
the superintendent explains “the dune immediately east and west of Cavendish Beach access, excluding the boardwalk structure, between the coordinates from 46.500147,-63.400821 in the west and 46.49899,-63.39087 in the east and bordered in the south by the Lake of Shining Waters outflow and Clarke’s Pond” (Figure 2.13). This area closure strictly prohibited all uses and closed area signs were placed every few meters on the entire closed area on August 4th 2016 (Figure 2.14). People who disobey this area closure, dismiss signage, and do not have permission by the superintendent to access the area could be fined hundreds of dollars. An ecologist from PEI National Park based in Brackley-Dalvay explains that “area closures are used in areas to restore places which is why the east side of Cavendish was closed but it gives that added protection by making it officially closed. The rest of the closure was a reaction to people up in the dunes to the point where people complained” [personal communication, September 2016]. Cavendish main beach is subject to high visitor traffic making the dunes vulnerable to human interaction creating unauthorized footpaths and dune blowouts. Area closures paired with signage and the threat of fines make it clear to beach visitors that preservation and conservation of dune systems in PEI National Park is important and is to be taken seriously.

Figure 2-12 Christmas trees lay sideways beside Cavendish main boardwalk as part of the restoration of a blowout. Note the planted marram grass, which is becoming established. (Kirsten McCaffrey, October 11, 2016).
Figure 2-13 Environmental Studies class from the University of PEI volunteering to plant marram grass in dune systems at Brackley Beach (Kirsten McCaffrey, October 24 2016).

Figure 2-14 PEI National Park Dune Area Closure on Cavendish Main Beach (Parks Canada, August 2016).
Figure 2-15 Area Closure by order of the superintendent at Cavendish Main Beach (Kirsten McCaffrey, October, 2016).
Methods

3 Data Collection

The focus of this research was to determine visitors’ perceptions of dune management strategies being carried out at Cavendish beach in PEI National Park and how educated they are about dune systems and the importance of conserving them for future generations. This objective was achieved by administering a survey to 70 visitors in the Park in July and August 2016. Interviews were also administered to four key Park personnel to collect information on what management strategies were being carried out by the Park and supplemented by information collected from a variety of printed sources. This Chapter provides details of the survey administered to park visitors and the methodology used to interpret their responses, and it also provides details of the interviews conducted with park staff.

3.1 Background on Public Perception Testing

Using a survey approach has many advantages including little cost, dependability, flexibility, and the ability to characterize details about a broad population. A survey approach for this research was used because surveys can be easily replicated for future studies and results can be generalized and are simple to execute and compare results for analysis (Marshall and Rossman, 2006, p. 126). A survey method was the most appropriate method to use on a natural beach setting because the researcher was approaching the visitor rather than the visitor approaching the researcher, allowing surveys to be administered to visitors walking, sun-bathing or simply relaxing on the beach, resulting in time-efficient data collection. Approaching the visitor and asking them to fill out the survey by themselves while the researcher was a distance away allowed the visitor to feel comfortable answering questions not under a watchful eye, allowed the visitor to feel at ease and under no pressure answering the questions, and gave the researcher time to distribute surveys to other visitors on Cavendish Beach. A survey method was used in this research because of the high response rate and people’s attitudes and body language could be examined allowing the researcher to make personal observations about how visitors feel about sand dune management strategies. The questions asked in the survey were created using information from PEI National Park and their concern for sand dune management with the interaction of visitors on Cavendish Beach. Questions were asked to obtain personal
information about the visitor and also how they feel about certain management strategies visible on and throughout Cavendish beach. Names were not collected as part of this research because it was important to distribute surveys and collect information on the perspectives of individuals rather than personal information allowing this research to be non-biased. Surveys were available in English and in French to allow bilingual visitors to participate and to reduce bias even further. The researcher greeted visitors in both English and French and surveys were distributed depending on the visitor’s choice of language. Under the Official Languages Act of Canada (2017) “every federal institution that provides services or makes them available to the traveling public has the duty to ensure that any member of the traveling public can communicate with and obtain those services in either official language from any office or facility of the institution in Canada or elsewhere where there is significant demand for those services in that language”. By law, any interaction with the public affiliated with Parks Canada must be available in English and in French, which is why every aspect of communication affiliated with this research paper was made available in both languages. To be granted permission to do any type of research in PEI National Park, a Research and Collections Permit was submitted to Parks Canada online to be reviewed. On May 31 2016, once all information including surveys and interview questions were approved, the research permit was granted and research was allowed to be conducted between July 1 2016 and September 30 2016. A survey method was chosen for this research paper to gain insight into the various perspectives of visitors at Cavendish Beach because the amount of completed surveys needed to have statistically significant data was low enough that a survey method was the most cost-efficient and extensive approach to use.

3.2 Methods

This research conducted 70 personal surveys by visitors on Cavendish Beach and four interviews with PEI National Park staff in Brackley-Dalvay. The information obtained from both the surveys and interviews was analyzed to see what management strategies are working and which are not working. The interviews were also used to determine if there are any gaps in staff availability, seasonal employment and volunteer opportunities for further education of sand dune management strategies. Both surveys and interview questions were available in English and French. This research thesis is based on perceptions from visitors and opinions from park staff, which is why data is shown in a narrative format. This study was initiated because of the need for preservation, conservation and increased protection of sand dune
systems at Cavendish Beach in PEI National Park. PEI National Park has been facing increased tourism, which has caused secondary effects of human foot-traffic in and throughout dune systems creating damage to marram grass cover creating blowouts and destroying the dunes. PEI National Park has signs, wire fences, boardwalks and rope barriers placed on Cavendish Beach to educate and deter visitors away from fragile areas, but not all management strategies are working to their full potential. This research thesis could not have been performed without a research and collection permit, which was granted by Parks Canada on May 31 2016. This research permit allowed access to Cavendish Beach for the purpose of interviews and personal observation data collection.

3.3 Survey

Starting July 1st 2016, surveys were distributed to visitors on Cavendish Beach between the times of 1:00pm-4:00pm on both weekdays and weekends. Surveys were handed to four different visitors at one time and collected after completion. When a survey was completed and passed in to the researcher, the visitor was given a sheet of paper containing information about the research being conducted and contact information for the purpose of a follow-up (see Appendix one (B), Project Description and Contact Information). By September 30th, 70 visitors completed surveys. This survey contained three sections, was made up of 13 individual questions and was created using existing knowledge of PEI National Park (see Appendix one (A)). The first section of this double-sided survey asked questions about age, gender, and reasons for visiting the park to see age ranges and to see why people are coming to Cavendish Beach. The second section of the survey asked questions about sand dune conservation including what conservation measures has the visitor witnessed today, and how much they agree with statements pertaining to wire fences, rope barriers and other sources of management strategies implemented on Cavendish Beach. The third section of the survey incorporated visual pictures of three different signs that are in place on Cavendish Beach and asked visitors to circle which sign they would most likely obey by.

3.3.1 Why a Survey Method was Chosen

Obtaining information via public perception about dune conservation is important because it identifies the public’s concerns and the gaps in knowledge that Parks Canada needs to know to change management strategies to better fit a heavily used area. Measuring visitors perceptions has been used in recent years by Parks Canada through the Visitor Experience Assessment tool which uses questionnaires to better understand how satisfied visitors are with their visit and use
of Parks Canada designated areas (Parks Canada, 2012). Another example of using public perception for data purposes with a focus on coastal management is Friesinger and Bernatchez (2010) who evaluated the resilience of residents living on the coast in relation to coastal erosion in five different areas in eastern Canada using a questionnaire to conduct semi-structured interviews (p. 2). This questionnaire allowed the researchers to compare resident’s perceptions with geoscience data to determine which region is affected by coastal erosion. One of the five areas evaluated was the Magdalen Islands, which is just over 100 kilometers north from Souris, PEI. Parks Canada, along with Friesinger and Bernatchez (2010) demonstrate that using a survey method to gather information on public perceptions of coastal environments has proved to be a valuable technique in obtaining credible data, which is why a survey method was chosen as a data collection method for this research paper. Using a survey method can also gauge how educated the public is on different conservation methods within the park. As Parks Canada’s main goal is to preserve the environment for generations to come, education of visitors and public understanding of why management and conservation efforts are in effect is an important aspect of protecting the fragile natural and cultural environments across Canada.

3.3.2 Why and How Survey Questions were Created

The survey handed out to visitors to complete on Cavendish Beach was created to see how people feel about sand dune management in PEI National Park and if this differs between age groups or place of origin. Hesse-Biber and Leavy (2011) describe, “surveys are an effective method for generating large amounts of “flat” data from many respondents” (p. 173). The “flat” data in the survey administered to Cavendish Beach visitors were questions about age and gender (See Appendix one (A), questions 1.1 and 1.2). Obtaining this information is crucial to evaluate if differences in age or sex change the response results for each survey. All questions asked were created due to PEI National Park’s current sand dune management issues including continued dune meandering and marram grass trampling. Questions such as how many times a visitor has come to Cavendish Beach gives the researcher an idea of how observant a visitor is to different management strategies in the park and if this correlates with the age and gender of this individual compared to other completed surveys (see Appendix one (A), question 2). Survey questions about what management strategies were observed and how much visitors agree or disagree of rope barriers, fences and signs placed on and around dune systems was asked to see how observant visitors are, how they feel about these management strategies and if these strategies are observed in a positive or negative way (see Appendix one (A), question 2.1 and 2.2). Three visuals were also used on the backside of the survey to see
which sign visitors would most likely obey by (see Appendix one (A), question 3.1). Pictures were used to appeal to the visual learner and to also get an understanding of what signs are working and which signs are not getting the message across. Questions that were directly asked to visitors verbally were about how long the visitor plans on staying in the Cavendish Beach area, if they are camping in the PEI National Park campground, and if they make use of the bike and walking trails. All questions in the visitor survey were asked to gain insight into how accepting the public is of signs, rope barriers, boardwalks and wire fences in a natural area and how educated and observant visitors are.

3.3.3 Survey Approach and Process

Surveys were administered to visitors on Cavendish Beach through random selection. The days in which surveys were carried out depended on weather conditions and time of day. Sunny/cloudy weather and between 1:00pm-4:00pm were the days that most people were visiting Cavendish Beach. The researcher walked up and down the length of Cavendish Beach asking visitors if they would like to participate in this survey, and explain how long it would take to complete, and why this research was being conducted. Four surveys were handed out at one time to different visitors and following that the researcher would walk away allowing the four visitors to complete the survey privately. When the survey was completed, a sheet of paper containing the project and contact information was given to the visitor (see Appendix one (B), Project Description and Contact Information). Out of all visitors asked to complete this survey, only one individual refused to participate. Initially, this research paper wanted to find out if visitors from out-of-country think differently about PEI National Park sand dune management strategies compared to in-province and in-country participants but after 55 surveys were completed, there was not a statistically significant amount of completed surveys by out-of-country visitors to compare to in-country visitors. This research paper changed its focus to comparing in-province visitor’s perspectives to out-of-province perspectives towards dune management in PEI National Park, which meant that surveys completed, by in-province visitors were needed to make comparisons. The researcher then focused on administering surveys to only in-province residents of PEI who were visiting Cavendish Beach. Once there were enough surveys completed by in-province residents to compare to out-of-province Canadian residents, all survey data was inputted into a Microsoft Excel document for further analysis.
3.4 Interview Methods

Four PEI National Park staff were contacted and individual interviews were conducted between July 1st 2016- October 30th 2016. A set of seven interview questions was created using existing knowledge from PEI National Park. Questions were created based on personal knowledge regarding physical management strategies for dune conservation as well as knowledge provided by park staff. Questions regarding the timing of management strategies being installed on Cavendish Beach each year was asked because this research project wanted to see if there were any gaps in between high visitor numbers on the beach and when these management strategies are in place (see Appendix 2, question 3). Other questions regarding staff availability were asked to see if management strategies are facing low staff numbers creating the inability of installation, inspection and reassessment (see Appendix 2, questions 4 and 5). The interviewees were also asked about changes in the dunes and visitors awareness to conservation efforts within PEI National Park because the dunes are constantly changing and park staff who work in and around Cavendish Beach would see how different management strategies impacted visitors through education (see Appendix 2, question 6). Interviewees were also asked how they felt about current conservation measures of sand dunes at Cavendish beach and if there was anything they would change because park staff have different positions and their opinions on this topic can vary. A tape recorder was used to record the entirety of each interview for future analysis. The interviews lasted between 30 minutes and one hour each and the participants were given a piece of paper containing project and contact information (see Appendix one (B), Project Description and Contact Information). All interviews were transcribed into a Microsoft Word document for future analysis.

3.5 Storage of Surveys and Interviews

Each survey completed by a visitor was given a number, which was then transferred into a Microsoft Excel document. Each answer from each survey was inputted into this Excel document for further analysis. Interview answers from park staff were recorded on a tape-recorder and then were transcribed individually into a Microsoft Word document for further analysis. All Excel documents and Microsoft Word documents were only accessible on the researcher’s personal computer via password. All information was kept confidential between the researcher and the advisor of this thesis.
3.6 Data Analysis

Data was analyzed using Microsoft Excel where visitor survey information was inputted into Excel where graphs and figures were created and shown within Chapter Four of this thesis. Park staff interviews were recorded and transcribed into individual Microsoft word documents where individual comments and patterns could be identified.

3.7 Adjustments and Limitations

All visitor surveys were completed in an unbiased manner allowing any age group and gender to participate. Originally, perceptions were going to be analyzed with a focus on Canadian-provincial perceptions versus out-of-country perceptions to see if there was a correlation between Canadian citizens versus Americans (for example). When all visitor surveys were completed and results were combined into Microsoft Excel, the number of out-of-country visitor surveys completed was too small to permit meaningful statistical comparisons with completed Canadian surveys. This research thesis now focuses on the perspectives of 16 residents from PEI compared to 52 other Canadian residents who live in other Canadian provinces. Two residents of the United States completed the visitor survey, and their views will also be noted in the research results.
4 Data Analysis

PEI National Park has many conservation and management strategies in place around the Cavendish Beach area to keep people off the sand dunes while also educating people on why dunes are sensitive ecosystems and should be free of foot traffic. In order to measure visitor perceptions towards sand dune management strategies at PEI National Park, 70 surveys were distributed on Cavendish beach to visitors for completion. The following chapter describes the responses to the survey questions including personal information, reasons for visiting the Cavendish area, conservation measures observed, perceptions towards these strategies and opinions on visual conservation signs.

Personal Information

Questions 1.1 and 1.2 under the “About You” category of the visitor survey handed out at Cavendish Beach for visitors to complete stayed fairly consistent in terms of data significance. 43% of visitors were males, 51% were females and 6% defined themselves as ‘others’ who completed the survey (Figure 4.1). In question 1.2 under the “About You” category asking visitors to chose their age category, 11% of visitors were 18 and under, 16% of visitors were 19-29 years old, 27% of visitors were 30-45 years old, 31% of visitors were 46-60 years old which was the biggest age category and 11% of visitors were 61 years of age or older (Figure 4.2). Question 1.3 of the visitor survey asked the visitor where they were from and 23% of people were from PEI while 74% of visitors were from other provinces of Canada and 3% of people were from the United States (Figure 4.3).

![Gender](image)

*Figure 4-1: Visitor survey question 1.1: Gender*
Figure 4-2 Visitor survey question 1.2: Age

Figure 4-3 Visitor survey question: Place of Origin

4.1 Cavendish Area

Question two of the visitor survey handed out at Cavendish Beach asked how long a visitor has been coming to Cavendish Beach. For many visitors, this was their first time or they had been here once or twice before: 30% of people said it was their first time and 31% people stated they had visited Cavendish beach two or more times (Figure 4.4). 6% of visitors said they had visited Cavendish beach ten times or more, while 24% of visitors stated they had visited for five years or more, and 9% of people stated they lived in the area permanently (Figure 4.4). More than half of the visitors surveyed had only been to Cavendish beach a few times.
Figure 4-4 Visitor Survey question: How long have you been coming to Cavendish beach

4.2 Reasons for Visiting Cavendish Beach

Visitors were then asked their top three reasons from the list provided for visiting Cavendish Beach that day. 89% of respondents included sunbathing/relaxing in their top three choices (Figure 4.5). Swimming and the natural landscape almost tied with 53% visitors choosing swimming and 54% of visitors choosing the natural landscape as one of the three top reasons for their visit that day (Figure 4.5). Family was the next biggest reason with 41% of visitors choosing this option, while 20% of visitors chose walking and 13% of visitors chose another reason (Figure 4.5). Breaking it down, Figure 4.5.1 shows that the number one choice of people visiting Cavendish Beach on the day they responded was for sunbathing/relaxing, which was the number one choice for 31% of visitors. 19% of visitors gave family reasons as their number one choice, while swimming and natural landscape were the first choice of 9% and 4% of respondents respectively (Figure 4.5.1).

Looking at the second reason why people were visiting Cavendish beach that day, 19% of visitors said they were on Cavendish beach for sunbathing/relaxing while 14% of visitors chose natural landscape as there second option and 13% of people chose swimming, 10% of people chose family and 4% of people chose walking (Figure 4.5.2). Looking at the third reason why people were visiting Cavendish beach that day, 24% of visitors chose the natural landscape as their third choice, while 21% of visitors chose family, 11% chose sunbathing/relaxing and family and walking tied with 9% of visitors choosing these categories as there third choice (Figure 4.5.3).
**Figure 4-5** Visitor Survey question: Top 3 Reasons for Visiting Cavendish beach today shown in Percentage

**Figure 4-6** Visitor survey question: Top 3 reasons for Visiting Cavendish beach: First choice
**Figure 4-7** Visitor survey question: Top 3 Reasons for Visiting Cavendish beach: Second choice

**Figure 4-8**: Visitor survey question: Top 3 Reasons for Visiting Cavendish beach: Third choice
4.3 Natural Landscape

One aspect of this thesis is to determine if people are coming to Cavendish beach for its natural landscape. Looking at how many people chose the natural landscape as their first, second and third choice for visiting Cavendish beach that day, 4% of visitors chose the natural landscape as their first choice while 14% of visitors chose it as their second choice and 17% of people chose it as their third choice (Figure 4.5.4).

![Top 3 Reasons for Visiting Cavendish beach: Natural Landscape](image)

*Figure 4-9 Visitor survey question: Top 3 Reasons for Visiting Cavendish beach: Natural Landscape*

4.4 Conservation Measures Observed

In question 2.1 of the visitor survey, visitors were asked to check-off what conservation measures they saw that day at Cavendish Beach (Figure 4.6). Boardwalks were the most memorable to visitors with 91% of people indicating they saw them along with 76% of visitors remembering conservation signs, 70% of people specifying rope barriers, 34% of people witnessing wire fences and only 1% of visitors indicated they did not see any of the listed items (Figure 4.6).
4.5 Measuring Perceptions towards Conservation Strategies

In question 2.2 of the visitor survey, visitors were asked how much they agree or disagree with statements directed towards sand dune conservation (Figure 4.7). Visitors had five answers to choose from, ranging from highly disagree to highly agree. Question 6a, 6b, 6c and 6f asked questions about current conservation measures in place at Cavendish Beach, which had an overwhelming number of “agree” answers from visitors (Figure 4.7.1). Questions 6d and 6e asked about how informed the visitor was about conservation strategies and if more strategies needed to be put in place at Cavendish Beach (Figure 4.7.2). Questions 6d and 6e had a much broader range of answers compared to questions 6a, 6b, 6c and 6f which had a large number of “agree” answers that may indicate that there is a lack of education and awareness of sand dune conservation strategies at Cavendish (Figure 4.7.2).

4.5.1 Efforts to Keep People off Dunes

Question 6a asked visitors if people obey wire fences on Cavendish beach and 59% of visitors agreed with this statement while 13% of visitors highly agreed, 23% of visitors responded with a neutral response and 5% of people disagreed (Figure 4.7). Question 6b asked visitors if people obey rope barriers on Cavendish beach and 57% of visitors agreed with this statement while 16% of people highly agreed, 16% of people felt neutral, 10% of visitors disagreed and only 1% of visitors highly disagreed (Figure 4.7). Question 6c asked visitors if posting signs at Cavendish Beach helped keep people off sand dunes and 56% of visitors agreed with this...
statement while 23% of visitors highly agreed, 14% of visitors felt neutral, 6% of visitors disagreed with this statement and 1% of visitors highly disagreed (Figure 4.7). Comparing all of the “agree” answers with all three questions, question 6a had 59% of visitors agree, question 6b had 57% of visitors agree and question 6c had 56% of visitors agree, which supports the assumption that people understand why wire and rope fences as well as signs are placed on and around the dunes and why they are important for conservation.

4.5.2 Current Conservation Perspectives

Question 6e of the visitor survey asked visitors if they felt there needed to be more conservation measures for sand dunes put in place at Cavendish Beach and 46% of visitors indicated they felt neutral about this question while 29% of visitors agreed, 16% of visitors highly agreed and 10% of visitors disagreed (Figure 4.7). Question 6f asked visitors if current conservation efforts were successful in keeping people off sand dunes in general and 63% of people agreed while 27% of people felt neutral, 3% of visitors highly agreed, 4% of visitors disagreed and 3% of visitors highly disagreed. To be specific, 46% of visitors felt neutral about the need for more conservation measures centering around Cavendish sand dunes and 63% of visitors agreed that current conservation efforts towards sand dunes are successful on Cavendish beach. These numbers indicate that people think that dunes are being protected to the greatest extent from human impact by the conservation measures in place now on Cavendish beach because ropes and wire fences are literal barriers keeping people off the dunes.

There were a number of neutral answers to question 6e of the visitor survey. This indicates that visitors believe that conservation measures are essentially “right”. This does not indicate if visitors think that other conservation measures may or may not work better nor does this indicate if visitors are aware of other conservation issues that still remain.

4.5.3 How Informed is the Visitor

Question 6d asked visitors if they felt informed about sand dune conservation strategies at Cavendish Beach and 36% of visitors agreed with this statement while 16% of visitors highly agreed, 26% of visitors felt neutral, 19% of people disagreed and 4% of visitors highly disagreed (Figure 4.7). Educating the public about protecting and conserving sand dunes is important for the future of these ecosystems. With 16% of visitors highly agreeing and 36% of visitors agreeing that they feel informed about sand dune conservation strategies on Cavendish
beach, the idea of preserving sand dunes on Cavendish beach through various educational tools is showing positive progress.

Figure 4-11: Visitor Survey question: Distribution of responses to all parts of question 6 related to Dune Conservation
Figure 4-12 Visitor survey question: Proportion of respondents who agree or highly agree with each component of question 6

Figure 4-13 Visitor survey question: Distribution of answers to questions 6d and 6e
4.6 Visuals

Question 3 of the visitor survey combined three visual conservation signs and asked visitors which sign they would most likely obey by (Figure 4.8). The sign that indicated ‘area closed beyond this point’ had 43% of visitors circle it and the sign that read ‘dunes are damaged by foot traffic…’ had again, 43% of visitors circle it with 14% of visitors circling the sign that read ‘natural regeneration area’ and 4% of visitors circling all three signs (Figure 4.8). This indicates that stating that an area is closed in simple terms gets straight to the point and tells the visitors it is off limits. Also, describing why an area is closed informs the visitor why they cannot enter this area while also being an educational tool.

![Figure 4.14 Visitor Survey Question: Which sign would you most likely obey by](image)

*Figure 4.14 Visitor Survey Question: Which sign would you most likely obey by*
The following sections describe the information obtained from various groups that participated in this research process. The following sections will discuss various perceptions between gender, out of province versus in province residents and different age groups.

4.7.1 Comparing Perceptions by Gender

Comparing female perceptions to visible conservation measures at Cavendish beach, boardwalks were the most memorable accounting for 47% of the 36 females surveyed (Figure 4.9). Conservation signs followed with rope barriers and wire fencing closely behind while only one person did not see any conservation measures. Looking at male perceptions of conservation measures at Cavendish beach, boardwalks were again most memorable followed by rope barriers, conservation signs and wire fencing (Figure 4.9). There are very small differences between male and female perceptions.
Figure 4-16 Out of province versus permanent residents: Frequency of visits to Cavendish beach

Figure 4-17 Out of province versus permanent residents: How informed do they feel about sand dune conservation strategies at Cavendish Beach
Comparison of local visitors versus out of Province visitors

Question 6d of the visitor survey asked visitors how informed they felt about conservation strategies at Cavendish Beach. When looking at different age groups, answers differed highly between 18 and under visitors versus 46-60 years of age visitors. Out of 70 visitors, only 8 people were 18 and under. Most 18 and under visitors agreed that they felt informed about conservation strategies at Cavendish Beach while a quarter disagreed, some highly agreed and some highly disagreed (Figure 4.13). Looking at age 46-60 years of age visitors, all answers were distributed fairly evenly between all answers out of the 22 visitors surveyed.

When comparing out of province visitors’ frequency of visits with permanent residents of PEI, most of out of province visitors indicated that this was their first time visiting Cavendish Beach or they had been to Cavendish Beach two or more times (Figure 4.10). PEI residents had much different answers as most live in the area permanently or have visited Cavendish Beach for five years or more (Figure 4.10).

Comparing permanent residents of PEI’s responses to out of province visitors’ responses to question 6d of the visitor survey, more than a quarter of out of province visitors agreed that they felt informed about sand dune conservation strategies at Cavendish Beach while many felt neutral and few highly agreed, disagreed and highly disagreed (Figure 4.11). Looking at permanent residents of PEI’s responses to question 6d of the visitor survey, many visitors disagreed that they feel informed about sand dune conservation strategies at Cavendish Beach while a quarter agreed, another quarter highly agreed and few felt neutral (Figure 4.11).
Question 3.1 of the visitor survey handed out to visitors of Cavendish Beach asked which signs would the visitor most likely obey. Visitors were asked to circle a visual or as many as they would like. When comparing out of province residents to permanent residents, almost half of PEI residents felt that the “Natural Regeneration Area” sign was most appropriate while a quarter thought that “Dunes are damaged by foot traffic…” a small proportion chose other choices (Figure 4.12). When comparing to out of province visitors’ answers, most visitors circled “Dunes are damaged by foot traffic…” while many also chose “Natural Regeneration Area” as the next choice (Figure 4.12). There are no big differences between out of province responses compared to permanent residents responses to the sign a visitor would most likely obey.

4.7.3 Ages, Origin and the need for more Conservation Measures for Sand Dunes

In question 6e of the visitor survey, visitors were asked if they felt their need needed to be more conservation measures for sand dunes at Cavendish Beach. Out of the eight visitors age 18 and under who were surveyed, half felt neutral while a large proportion also agreed that more conservation measures were needed (Figure 4.14). Comparing 18 and under to 46-60 years of age visitors’ answers, more visitors felt neutral in the 46-60 years age group towards the need for more conservation measures for sand dunes while a large amount highly agreed, unlike the 18 and under age group (Figure 4.14).

When looking at how permanent residents of PEI felt about the need for more conservation measures for sand dunes at Cavendish Beach from question 6e of the visitor survey, more permanent residents of PEI felt that there needed to be more conservation measures put in place for sand dunes compared to out of province visitors (Figure 4.15).
Figure 4-19 18 and under versus 46-60 years: How informed do respondents feel about conservation strategies at Cavendish Beach?

Figure 4-20 18 and under versus 46-60 years: Do they feel there needs to be more conservation measures for sand dunes?
4.8 Weaknesses of the Visitor Survey

The weaknesses that were recognized after data were evaluated are mainly derived from the visitor survey itself. Question 1.1 should have had “declines to answer” instead of “others” because this may have given the researcher more data to work with. In question 1.2 of the visitor survey, the number of times a visitor could have visited overlapped. Question 1.2 should have said “2-10 times, 11-19 times and 20 plus times”. Question 2.1 of the visitor survey asked visitors if they saw boardwalks as one of the conservation measures at Cavendish Beach that day. This question could and did alter the results of this research paper because not all visitors of Cavendish Beach access the beach using the boardwalk. Many visitors access the beach from Oceanview lookout or Cavendish campground.

4.9 Interviews

Four interviews were conducted with PEI National Park staff at Brackley-Dalvay. These interviews gave personal reflection into how different roles of PEI National Park are placing core values on sand dune conservation measures at Cavendish Beach and how the placement of conservation measures, staff availability and ongoing as well as future conservation measures are being strategically planned and managed. This along with the 2016 Management Plan for PEI National Park is summarized in Chapter 2 in the background description and will be further examined in Chapter 5 of the discussion.
Conclusion

5 Discussion and Recommendations

The purpose of this thesis is to measure how visitors of Cavendish Beach feel about various conservation measures that are apparent on and around sand dunes in the Cavendish area. With the extraction of data from both the visitor survey filled out by 70 people combined with the various park staff interviews, information about what conservation strategies are working, in terms of age groups and out of province visitors versus PEI residents’ perceptions were found to be quite different and useful for PEI National Park to apply to future conservation strategies for the Cavendish Beach area.

5.1 Limitations

An important focus of the original proposal on which this research is based was to determine if there were differences in their perception of conservation measures at Cavendish Beach between three groups of visitors – namely, residents of PEI, visitors from other provinces in Canada, and visitors from the USA. After two months conducting visitor surveys on Cavendish Beach in July and August of 2016, it was apparent that most people who chose to visit the area were people from other provinces of Canada. With only 23% of visitors being permanent residents, 73% of visitors residing out-of-province within Canada and only 3% from out of country, numbers were too small for making statistical inferences. Most visitors were from another province of Canada, including large numbers from Ontario and the Maritime Provinces. As the data collection window was closing with the changing weather and public schooling coming closer to start date, it became more difficult to target permanent residents of PEI who were visiting Cavendish Beach. This may be due to the fact that most PEI residents have visited Cavendish Beach many times before or choose to visit free beaches (Figure 5.5) resulting in a large number of out of province visitors who are only just discovering and visiting Cavendish Beach for the first or second time. As a result, while some comparisons are made between out of Province versus PEI residents, with the small number of local residents the focus was shifted to place more emphasis on the aggregate responses and on other groupings distinguished by gender and age, in addition to their place of residence.
5.2 How well Informed are Visitors of Dune Conservation Strategies at Cavendish beach

Overall, visitors are highly aware of the conservation measures indicated in question 2.1 of the visitor survey. Almost every visitor surveyed indicated they saw boardwalks, three-quarters indicated they saw sand dune conservation signs and most indicating they saw rope barriers (Figure 4.6). Overall, wire fences were not seen by many visitors (less than half) but this may be due to the absence of wire fences adjacent to the beach area at Cavendish Beach, though they are found at the Oceanview lookout above the east end of the beach and at other locations within the park. Only 1% of visitors indicated they did not see any of the listed conservation measures for sand dunes, which indicates that people are aware that the PEI National Park has different measures put in place to protect the surrounding environment.

Comparing male and female perceptions towards visible conservation measures at Cavendish Beach, there were no significant differences between the two genders (Figure 4.9). All other questions on the visitor survey were answered relatively equally by both genders. This indicates that improving PEI National Park sand dune protection strategies should not be focused on individual gender, rather it should be focused on age groups and out of province residents’ versus permanent residents of PEI’s perceptions. Perceptions between male and female genders do not differ significantly which means that this is not an issue rather, comparing age groups and out of province versus in province perceptions could be targeted for future management strategies for Cavendish beach sand dune systems.

Looking at how informed visitors of different age groups feel about conservation strategies at Cavendish Beach, 18 and under individuals highly agreed that they feel informed about conservation strategies while a quarter of 46-60 years of age visitors felt neutral about being informed on this topic (Figure 4.13). The 18 and under age group almost had higher numbers in terms of disagreeing with being informed on this topic than 46-60 years of age group (Figure 4.13). The main difference between these two age groups is that 27% of 46-60 years of age visitors felt neutral about being informed on this topic compared to zero visitors from the 18 and under group (Figure 4.13). This indicates that although a large amount of visitors from both age groups agreed they felt informed on this topic, a large amount of the older generation feel neutral about it and this is why the focus for PEI National Park future conservation strategies should be aimed towards the older generation being able to distinguish and understand different conservation strategies at PEI National Park and why they are important.
Age groups have heavily differed in terms of answers to sand dune conservation measures at Cavendish Beach. Question 6d of the visitor survey asked visitors if they felt there needed to be more conservation measures for sand dunes at Cavendish Beach. Surprisingly although half of the 18 and under age group agreed that they feel informed about conservation strategies at Cavendish Beach, 38% of the 18 and under visitors agreed that they felt there needed to be more conservation measures for sand dunes at Cavendish Beach, and 27% of the 46-60 years of age group highly agreed that their needs to be more conservation measures. It seems as though the 46-60 years of age group felt they generally agreed with being informed about conservation strategies yet more than half felt neutral about the need for more conservation strategies for sand dunes. This may be due to the fact that they are unaware of how conservation strategies could be changed or if there is anything else that PEI National Park could do in the future to better protect these habitats.

This thesis is also focused on out of province perceptions on different conservation strategies at PEI National Park towards sand dune conservation versus permanent resident perceptions on this topic. Looking at question 6d of the visitor survey, out of province visitors heavily agreed and felt neutral about how informed they were about sand dune conservation strategies at Cavendish Beach while permanent resident’s responses were evenly distributed between all answers, with the highest number of visitors in that age group circling disagree. This indicates that out of province visitors feel more informed about conservation strategies combined with most of this age group indicating this was their first or second time visiting. As PEI residents have visited Cavendish Beach more frequently than out of province visitors, it is surprising to see that PEI residents feel less informed than out of province visitors. This could be because PEI residents may have more knowledge of sand dune conservation because they are living in PEI and feel there is not enough information being provided by PEI National Park on the topic. This could also be a positive outcome for PEI National Park because out of province visitors understand the message that PEI National Park wishes to implement on the Cavendish Beach population that sand dune conservation strategies are important and that new visitors such as those from other provinces understand this and are aware of these efforts.

Comparing out of province visitors’ to permanent residents’ answers to question 6e of the visitor survey, almost half of the PEI residents agreed that there needed to be more conservation measures for sand dunes at Cavendish Beach while more than half of the out of
province visitors felt neutral about this question (Figure 4.15). Again, this may indicate that residents of PEI are more educated on sand dune conservation and realize that PEI National Park needs to implement new or more conservation strategies to pretty protect sand dune systems. Out of province visitors may be disillusioned by the amount of signs and boardwalks apparent which could make them think that enough is being done to protect these systems. It is interesting to realize that visitors (generally those who are permanent residents of PEI) answered “highly agree” and “agree” to this question because they felt that not enough is being done by PEI National Park to protect sand dunes and that they have witnessed visible changes from the years they have previously visited (as indicated in the comments section of the visitor survey).

5.3 Areas of PEI National Park that need more Attention

Conservation efforts towards sand dunes at Cavendish Beach appear to be successful in terms of visibility. All visitors at the time of data collection were using the boardwalks to get to and from Cavendish main beach, they were not on the sand dunes themselves and at one point when a few children ran up one of the dunes, a lifeguard yelled and told them to get down. It seems as though conservation signs, rope barriers, wire fences (where applicable), boardwalks and lifeguards are helping tremendously in getting the message out to visitors that sand dunes are to be protected, not walked on or played on.

Cavendish Beach stretches far beyond where the main flow of human-traffic flows. Between Cavendish main boardwalk and Oceanview lookoff (Figure 5.0) is part of Cavendish main beach where visitors can walk, play and swim. Rope barriers are at the bottom of the foredune from Cavendish main boardwalk up until about three quarters of the way to Oceanview lookoff. The other quarter of the beach until Oceanview lookout is absent of rope barriers. This indicates to visitors that it is safe to walk on and throughout this part of the dune system when in reality, it is just as dangerous for this part of the dune as it is for the dune systems where visitor traffic is heavier. During personal observation, visitors who were walking on Cavendish main beach to Oceanview lookoff were using the dunes as an access point to get to higher elevation to see the views that Oceanview offers. As no rope barriers are in place in this area along with no safe access point from Cavendish main beach to Oceanview lookoff and its corresponding boardwalk, visitors are using undesignated pathways to access this location, furthering dune and marram grass erosion.
Cavendish main beach, where visitor traffic is the heaviest, has conservation measures starting from the main parking lot leading to boardwalks, rope barriers on the dunes and conservation signs not far from the entrance point to the beach. The Cavendish area close to Oceanview lookout has not been protected with conservation measures nor has the beach area near Clark’s pond but these areas still have high visitor traffic. It may not be as heavy as Cavendish main beach, but visitors feel as though they can meander through these sand dunes for a variety of reasons, which could be due to the absence of PEI National Park conservation measures, or because they are in a more private area of the beach. As stated by a PEI National Park staff member “most of our issues is that once people get to the beach, its going from the beach to inland, we have it under control for people going from inland to the beach but once people get to the beach, then they want to climb the dunes so that’s the issue we are facing” (Personal communication, September 2016). Since Cavendish main beach is being protected to the best of PEI National Park abilities today, many parts of Cavendish beach are lacking signs, rope barriers and wire fences. PEI National Park needs to re-evaluate the management efforts in place now and they need to reconsider if more of the same signs (or different signs) and rope barriers could be placed in and around Cavendish east and west beaches to better protect dune systems.

Park staff were asked questions about the area of Cavendish Beach that is free of rope barriers and other conservation measures. One of the Coastal Resource Officers interviewed at Brackley-Dalvay described that [in reference to the absence of rope barriers], “Its not the whole way along, but aesthetically, just this year the work involve to set up T-bar rope we kind of put in strategically around the main access point where most people come in so we don’t have people dropping their towel right there” (PEI National Park staff member, personal communication, September 2016). Other issues include the aesthetic appeal of Cavendish Beach, because there is a unique balance that a national park needs to maintain between keeping the natural landscape scenic and free of human intervention while also protecting it for future generations. One park staff member explained that, “it’s really not designed to rope off the dune [rope barriers], it’s to channel people down to the beach and to provide a good experience mixed with protection” (PEI National Park staff member, personal communication, August 2016). Another PEI National Park staff member who was asked about the absence of rope barriers at this area described, “ the issue with putting up rope and T-bar is that we oversee it and we rely on other groups to do this and their availability to put kilometers of rope up becomes an issue” (PEI National Park staff member, September 2016). Three issues arise
from the information obtained from park staff interviews; staff availability and the availability of volunteer groups, the tug and pull between keeping the natural aesthetic feel of the area versus implementing conservation strategies, and the high concentration of visitors at one area of the Cavendish Beach where conservation measures are heavily in place, leaving other areas of the beach with little to no protection strategies.

![Image of Cavendish main beach]

*Figure 5-1* Cavendish main beach: Red circle: No rope barriers. Black circle: Highest visitor traffic and rope barriers- Kirsten McCaffrey, July 31 2016.

### 5.3.1 Areas of PEI National Park that need more Attention: Cavendish main Beach

Cavendish main beach has parking lot, which is connected directly to the main boardwalk leading through the canteen and washroom facilities and then down onto the beach area. This boardwalk essentially does not allow visitors to touch any vegetation from the parking lot through to the beach. There are very limited sources of information available to visitors on the boardwalk and at the park facilities at Cavendish main beach pertaining to sand dunes, dune vegetation and the efforts being executed by PEI National Park towards dune conservation. The only sources of information available to visitors at Cavendish main beach is a billboard at the start of the boardwalk near the parking lot where various small posters of events being held, emergency contact numbers and one or two pages about dune conservation are posted. The dune conservation posters are for example, a laminated copy of one of the sand dune signs. As visitors walk through the park facilities, there is no information pertaining to conservation efforts towards sand dunes, nor is there information on endangered piping plover nests or fragile landscapes nearby. As visitors walk the boardwalk down onto the beach, visitors are warned by “No Dogs Permitted” signs as well as how riptides are apparent in Cavendish waters with no signs or information pertaining to sand dunes. When a visitor hits the end of the
boardwalk and walks onto the beach, rope barriers are funneling visitors away from the foredune with no explanation as to why this rope barrier is placed in this area.

Rope barriers line most of Cavendish main beach to provide a soft barrier to keep visitors off the foredune, but there is a gap in knowledge between the visitor and the PEI National Park. Rope barriers are paired with few conservation signs such as “Regeneration Area”, but there is no information available to the visitors as to why rope barriers are used which also poses the same problem towards wire fences at Oceanview Lookout. Information should be readily available to educate the visitor on why rope barriers and wire fences are being used at PEI National Park and how they are designed to protect sand dunes from foot traffic.

An example of an area where education on sand dune conservation is vital for the future of Cavendish Beach area is the dune blowout adjacent to the main boardwalk. This dune blowout is enormous and restoration efforts by PEI National Park have been initiated the past few years including the placement of dead Christmas trees along with marram grass planting. There is no information available to the visitor on the boardwalk or on the beach of why and how restoration efforts are taking place to restore this dune. This information could not only educate visitors on why dune conservation is vital for the future of Cavendish beach, but could also reduce foot traffic in this area and other areas of Cavendish Beach sand dunes.

5.4 Staff Availability Issues

Staff availability has been an ongoing issue throughout the months of data collection for this thesis. Suggestions of having park staff on the beach at all times monitoring visitors actions were brought up by people who completed the visitor survey for this thesis many times. Although lifeguards have been doing their part in telling people to get off the dunes, it is not their responsibility. Park staff that were interviewed about this problem had varying answers, but most had the same opinion about the need for a longer season in terms of employment for protection of beaches. A PEI National Park staff member explains that “We can always do more, there’s areas where we’ve done restorations and it’s always on the agenda to add more Christmas trees and more stakes and there’s so many unauthorized trails in the park that if we had more time we could do more” (Personal communication, August 2016). Another park staff member explains that [in reference to question four of the interview questions] “we could probably extend the working season a little bit more in the fall period at the end, but so far we have been able to work within that boundary but we are also forced to work within this barrier”
(PEI National Park staff, personal communication, September 2016). Another PEI National Park staff member commented “It may take cooperation from other parts of the park, it’s a team operation it may slow a bit but its certainly not stopping our efforts” (Personal communication, October 2016). As it stands, PEI National Park is a seasonal park with no maintenance for six months. Although the busy season is within the working period of PEI National Park staff, visitors may still enter the park at their own risk every day of the year. This poses a threat to the dunes, but staff availability issues also pose a threat to the scarcity of conservation measures and people available to personally keep people from trampling on and throughout the dunes on Cavendish main beach. With only a small window to implement protection strategies for Cavendish sand dunes in the beginning of each season, volunteer groups are being heavily relied upon to help with marram grass planting and Christmas tree placement on and throughout the dune systems at Cavendish beach.

As PEI National Park tries to balance its protection efforts between implementing conservation strategies towards sand dune systems while also keeping the natural environment intact with little human interference, it poses a big gap in terms of how much conservation measures like signs, different fences and boardwalks should be created and placed in this environment while also keeping it natural and healthy. This may be the reason why rope barriers are only where high volumes of visitor traffic are in peak-season times and absent further down Cavendish main beach.

**5.5 Target Groups**

As a large number of visitors age 18 and under agree and/or feel neutral about the need for more conservation measures for sand dunes and age 46-60 years of age highly agree and/or feel neutral about this topic, PEI National Park should focus on educating the younger generation while also keeping the older generation up-to-date on current and future conservation strategies. Looking at out of province residents’ perceptions on the need for conservation measures for sand dunes, most agreed or felt neutral about this while residents of PEI highly agreed and/or agreed on this topic. PEI National Park needs to focus more on visitors who are visiting Cavendish Beach for the first time as they feel there are enough measures put in place now, which in reality is not true.
5.6 Knowledge Gap between Conservation Efforts and the Visitor

The conservation measures that need more explanation for educational purposes for visitors are wire fences and rope barriers. Wire fences are only apparent at Oceanview lookoff where undesignated paths were made and used by visitors who were meandering the dune systems. Wire fencing was installed in front of these paths to stop visitors from continuing to use these pathways. Although this is a management technique used by the park, there is only one sign (question 3, sign two of the visitor survey) that indicates why dunes are damaged by human interaction. Although it is quite obvious why these signs are there, it does not acknowledge the fences as a conservation measure for a particular reason. Providing visitors information on each protection measure used could be an influential educational tool for visitors to read, learn and take better steps towards conserving other parts of PEI National Park. Rope barriers are another management strategy used by PEI National Park to keep people off the dunes. Rope barriers are doing a great job in funnelling visitors from Cavendish main boardwalk onto the beach, but they have become towel racks and are a easy obstacle for children to climb over and under onto the dunes. Conservation signs in varying types are obvious near Cavendish main beach and near rope barriers, but signs do not indicate why rope barriers are placed where they are. There is a gap in knowledge between PEI National Park wanting to educate people on protection of the dunes, but there is no information on why the strategies that were chosen are implemented in the places they are and how these are helping conserve the dune systems.

5.7 Future Conservation Strategies to Consider

The need for educating the public about dune conservation is the most important concept to grasp from this thesis. Whether it is different age groups or out of province versus in province visitors, education is the key ingredient in protecting Cavendish sand dunes for future generations. One of the PEI National Park staff members mentioned that they would like to see more education surrounding sand dune environments for islanders and maritimers because it should be common knowledge about blowouts which should be reached by public outreach and with visitor experience programming (Personal communication, August 2016). Another PEI National Park staff member explained, “we are always looking at citizen science, the university of PEI has marram grass planting at Cavendish but with citizen science it requires long term monitoring” (Personal communication, September 2016). Other PEI National Park staff explained that the staff and the park itself are doing all they can do with the small seasonal window they have to protect different environments and make changes (Personal
communication, September 2016). Three visitors expressed interest in changing the conservation sign “Natural Regeneration Area” to better reflect a grade four reading level (subbing “regeneration” for a more easier word to understand for French-speaking visitors). It is noted that the word “regeneration” in English is easily translated into “régénération” in French, although this word is not at a grade four reading level which could be confusing to children as well.

Educating the public is now easier than ever with the introduction of the Internet and its availability virtually everywhere. Every age group and people across Canada can get involved online from their own home. A suggestion that may help PEI National Park educate new visitors, residents of PEI, and different age groups would be to implement a sand dune watch program that would be year-round. The comments that were left on the visitor survey indicated visitor curiosity about social media programs, which could be used as an educational tool for their children. As access to Cavendish Beach is free during the off-season and it is generally easily accessible most of the winter with the proper equipment and safety precautions, visitors can take photographs and upload them to a website where they can be catalogued together to see the changes in the dune systems over the winter months and compare them to the summer months. This could also help PEI National Park see if human interference on the dunes is impacting the dunes significantly more or less during the summer months or if storms and severe weather along with an increase in snow and ice could also be affecting the dune systems. This gives a visual image or a so-called storybook into how dune systems are changing, why they are changing and how people can get involved in protecting the dunes. PEI National Park could update the site, give statistics into how many people are participating and expand this project to other parts of PEI National Park such as Greenwich which also has expansive dune systems. This citizen science project could create an archival library of photographs for years to come while also providing PEI National Park with valuable information about where management strategies should be focused on while also educating the public. A suggestion for PEI National Park is to implement long-term citizen science programs. Although this seems unreasonable, as PEI National Park is a seasonal park, social media is now a popular tool for people of all ages to continue to learn about the environment. Another suggestion for PEI National Park would be to reconsider the wording of the conservation signs now in place on Cavendish Beach. All signs should be at a grade four reading level and should be easily read by children and adults to make sure the message of conservation is getting across.
References


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Appendix One

A.) Survey

1.) ABOUT YOU

Please circle:

1.) I am:  Male   Female   Other
2.) Age:  18 and under  19-29  30-45  46-60  61+
3.) Where are you from:  Prince Edward Island  Other province of Canada  United States  Other ______

2.) How long have you been coming to Cavendish Beach area?

A.) This is my first time
B.) Two or more times
C.) Ten times or more
D.) Five years or more
E.) I live in the area permanently

3.) Please number 1-3 the top three reasons why you are visiting Cavendish Beach today

1.) Family ____  5.) Sun-bathing/Relaxing ______
2.) Walking____  6.) Natural landscape ______
3.) Swimming_____  7.) Other _________
2.) SAND DUNE CONSERVATION

1.) What of the following conservation measures have you seen today? (Please check all that apply)

1.) Wire fences ______
2.) Rope barriers ______
3.) Boardwalk ______
4.) Conservation signs ______
5.) I have not seen any of the listed items ______

2.) Please check how much you agree with the following statements towards sand dune conservation

<table>
<thead>
<tr>
<th>Highly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Highly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>People obey wire fences on Cavendish beach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>People obey rope barriers on Cavendish beach</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Posting signs at Cavendish Beach helps to keep people off sand dunes</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>I feel informed about sand dune conservation strategies at</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
Cavendish

Do you feel that there needs to be more conservation measures for sand dunes put in place at Cavendish beach?

Do you think that current conservation efforts are successful in keeping people off sand dunes in general?

1.) Of the three signs shown below, please circle which sign you would most likely obey by
4.) Comments:


Thank you for your time!

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**B.) Project Description and Contact Information**

This research project is being conducted by Kirsten McCaffrey for my Masters Thesis in Coastal and Marine Management at the University Centre of the Westfjords in Isafjordur, Iceland. The information you provide today will be kept confidential. Your personal information will be kept under a file number. If you have any questions or would like to follow-up with this research project, please contact me at kirsten15@uw.is. Thank you for your time!
Appendix Two

A.) Interview Questions

1.) How long have you worked at PEI National Park? Do you have previous experience working with Parks Canada in the past?

2.) Can you describe the conservation measures that are in place on Cavendish beach to protect sand dunes?

3.) I heard that conservation measures are put in place primarily during peak season. How does PEI National Park decide what restoration efforts to use at Cavendish beach and at what time to install these efforts?

4.) The instalment of conservation efforts at Cavendish beach is based on staff availability. To your knowledge, does staff availability pose an issue to the implementation of conservation measures towards sand dunes?

5.) Do you think there are enough staff-seasonal or permanent- to carry out all sand dune restoration efforts? Are volunteers used in this effort?

6.) From your time at PEI National Park, have you noticed any changes in the sand dunes? What about visitor’s awareness to conservation efforts? Have visitor’s attitudes towards conservation measures changed from the past?

7.) How do you feel about current conservation measures of sand dunes in at Cavendish Beach? Is there anything you would change? Do you have any more overall thoughts on current conservation strategies within the park?