Carters Beach, Queens County, Nova Scotia: An Assessment of Present Foredune Stability and Recommendations for Reducing Negative Human Impacts.

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Introduction

Carters Beach, Queens County, Nova Scotia with its sparkling white sand, blue waters, dunes, and small rocky islets has become a photographic gem in promoting tourism in Nova Scotia. The rapid increase in visitors to this beach in recent years is perceived to have accelerated pressure on its natural integrity. On June 8, 2017 a visual assessment of the present beach and dune condition was completed following a request by the Carters Beach Community Stewardship Committee and Protected Areas, Nova Scotia Environment to comment on whether the dunes, in particular, require some environmental management to improve their resilience to increased human visitation and activities.

Physical Environment

Carters Beach consists of three sections, often referred to as first, second and third beaches. The beaches are primarily accessed by people from the north and south ends. Many people also follow a lesser known path from the road across the central part of the beach complex. This path stretches through a natural succession of forest, wetland, dune vegetation and along a stream that flows through the beach to the ocean. Each section of beach has its own special character and exposure to waves because of the presence of Port Mouton Island and other smaller islands in Port Mouton Bay. First beach is closest to the main vehicle parking lot. It is bounded to the south by a tidal stream that flows into the ocean at one of the small rocky islets. The stream outlet occasionally shifts from the south to north and vice versa of the islet and has impacted sediment accumulation on first or second beach and in some cases impacts stability of the adjacent dunes. The stream channel is easily crossed at low tide but less so at high tide. The islet is an important feature anchoring Carters Beach in its present location. The third beach is reached by walking along a path from the road at South West Port Mouton across a tree covered high dune formed 10s to 100s of years ago. Third beach is also separated from second beach by a small rocky islet which produces a change in beach orientation. Second beach is the most remote of the three but is easily reached by anyone who wishes to get away from the more crowded ends on a warm summer day, or use it as an end point for a beach walk. Second Beach

is fringed by the highest dunes and best succession of marine to forest vegetation. Last season the greatest physical impacts to the dunes from foot traffic observed by the Community Stewardship Committee was along the southern end of second beach.

Carters Beach, like all beaches, is dynamic and subject to change caused by storms as shown by natural wave cuts along the older dunes. Yet recent studies have shown that its overall physical character has remained unchanged since the beginning of aerial photographic coverage in the late 1920s and before that, according to older hydrographic charts and topographic maps (Basquill et al. in review, Utting et al., 2010). The overall stability of this shore has allowed a natural succession of vegetation to develop that has prompted its protection under the Beaches Act and its preservation as a natural habitat.

Observations

Inspections of Carters Beach since 2008, discussions with local citizens, and my professional background in monitoring physical changes along many other beaches in Nova Scotia since the early 1980s (Taylor et al. 1985, 1995) have provided the background for this assessment of the present physical condition and resilience of Carters Beach to change.

Carters Beach has developed and maintained itself over hundreds of years because of its location in the lee of several islands and the relative abundance of local sediment supply. The sediment has collected in Port Mouton Bay as outer shores were eroded and broken apart by waves as sea level rose over thousands of years (Piper et al. 1986, Shaw et al. 1993). The large magnitude of the dune system at Carters Beach is evidence of the abundant sediment supply. The foredune, i.e. the most seaward dune, protects inland areas from flooding during storms and sand incursions by strong winds. Erosion of the dunes by waves and wind is a natural process that provides sediment for rebuilding the beaches. Dunes naturally adjust to changing natural conditions.

Recent observations of the beach and discussions with Brian Fisher (local citizen) reinforced my opinion that Carters Beach is resilient to most natural processes. In recent years the foredune along both first and third beaches has experienced alternate erosion and accumulation of sand and renewed growth of marram grass (Fig. 1). At present, both beaches have new vegetated low dunes built seaward of an older erosional dune scarp (Fig. 2). A wide sand beach exists that potentially can provide additional wind-blown sand for further dune building. Along second beach the foredune is higher. Repetitive photos taken since 2008 illustrate the continuity of vegetation cover along the upper foredune and the growth of new vegetation along the back of the beach when it is wide. The photos also show that the continuity of the natural foredune has been broken up and the edge of marram grass has retreated landward, particularly at the south end of second beach. What caused the larger dune responses along second beach? There are no repetitive cross shore surveys of the beach to provide a quantitative assessment of changes in beach width, height and sediment abundance onshore or just offshore. Visual observation of the

beach and dune morphology and relative position of large rocks with the beach suggest little overall change in beach width. Since September 2016 the seaward foredune slope has become steeper and been trimmed back, possibly by waves during the high water storm events in March and February of this year. Marram grass, present along the upper beach and base of the foredune in September 2016, is not visible in June 2017. Sand has accumulated along the base and top edge of the foredune. It is possible the marram grass has been buried and not had sufficient time to grow through the sand. Alternatively, the grass may have been removed by waves during the storms. Time will tell. Small cuts along the top of the foredune have allowed sand to migrate as parabolic dune features over the top edge of the foredune. This is a natural evolution of coastal dunes when they are forced to migrate landward due to rising sea level and a reduction in sediment supply. However in the past few years there has been a **significant** loss of foredune vegetation, increase in blowouts and areas of bare sand and increased abundance of sand mounds migrating across the older dunes along the south end of second beach. There is no specific explanation for the large deterioration in foredune condition based on the width of the present beach and sand abundance. Recent storms have impacted the beach and dunes but repetitive photos taken since 2008 suggest, in my opinion, that increased human activity observed by the local stewardship group may have triggered the larger changes or aggravated the situation.

There are presently no toilet facilities at Carters Beach. The stewardship group has reported increasing amounts of waste found in the back dune and treed areas left by people who have crossed the foredune to look for a suitable toilet stop. As the upper foredune vegetation has been trampled and blowouts expanded, it is speculated that the bare sand areas became inviting to younger visitors to run up and down the sand slopes. Photos show that vegetated embryo dunes can and have developed naturally along the end of second beach but new blowouts have developed along the upper foredune resulting in increased sand mobility. Sand which has migrated inland has a negative impact on older more established vegetation. In nature, given a decrease in sediment supply to the beach, these dunes would naturally break apart and migrate landward. However the foredune destruction observed at present surpasses what I would expect given that new dune and marram growth has occurred elsewhere along Carters Beach. I have not witnessed large numbers of visitors on first beach on any given day. It is reported by others living in the area that people often expand into the dune grass. If this is the case, then vegetation covering these new dunes is also threatened. Bottoms and feet are very detrimental to the health of marram grass and stability of these dunes.

Recommendations

In my opinion, the present physical factors, i.e. sediment supply, wave and wind conditions, are appropriate to promote new vegetation growth and renewed dune building following storms but not if the foredune vegetation is disturbed by people. It is human activity that needs to be monitored and managed. Given an increase in visitors this summer and for the future, it is critical

that stewardship of this natural environment be encouraged. A number of actions are suggested that are critical to complete before this summer season begins.

1) well-serviced toilets, e.g. , at a very minimum, porta pottys, are required at the primary public access point, i.e. main parking area at the north end of the beach. Signage of the presence of toilets would also be required on other trails leading to second and third beaches to alert visitors using those trails. Such action should help to potty – train the visitors. However, intermittent visual monitoring of visitors activity and condition of the foredune at the end of second beach should be conducted at regular intervals to better assess whether in the future a second toilet facility is required at the road where the south access trail leads to third beach. The problem is that increased facilities at the south end of Carters Beach may encourage more human traffic to third beach which could be much more detrimental to the biological habitat and physical integrity of Carters Beach. Because of the greater distance from the main parking area, it may found that only toilet facilities closer to the third beach access path will eliminate the need for people to climb the foredune and walk through the backshore vegetation to find suitable toilet stops. However for now, start with toilet facilities at the main parking area at the north end of the beach and monitor whether their presence has a positive impact of decreasing human activity and waste across the dunes, particularly along second and third beaches which are farther away.

2) the base of the foredune at and near the south end of second beach could be roped or ribboned off , or as a minimum, signs should be posted asking for the publics support in protecting the park by not sitting, walking or climbing on the dunes. If by the end of the summer when the ropes, ribbon or signs are removed before the stormy season, a follow-up assessment is required (see monitoring below). The dune condition and natural spread of vegetation should be documented to assess the effectiveness of these management actions and whether other actions such as vegetation transplanting will be necessary the following spring.

3) enhance protection of foredune vegetation along both first and third beaches (Figs. 1,2) by posting signs along the seaward edge of the dune grass. The signs should remind people of the negative impact of sitting or trampling the dune grass and to avoid walking on the grass.

4) people walking along the central wooded trail from the road to the beach should be directed near the present beach to follow the river course rather than walking over the present foredune (Fig. 6) to reach the beach. This would protect the dune vegetation but might have implications for other biological concerns, e.g. birds, along the stream. It would also be useful to close off some of the many walking trails across the high dune adjacent the public access to third beach. It is difficult to prohibit people from walking across the high dune for a better view of Port Mouton Bay; however, by limiting the number of trails to one, it allows natural recovery of vegetation along other trails.

5) carrying capacity of visitors to natural protected areas in Nova Scotia has not received a lot of attention in the past, as far as I know. For the future, as part of the stewardship program,

Protected Areas, Nova Scotia Environment needs to begin developing criteria for establishing the carrying capacity of Carters Beach to daily and seasonal visitation. What is the maximum number of people the beach can sustain before there are significant negative impacts to the physical integrity and to specific biological species and the natural habitat? Buctouche Park in New Brunswick has addressed the problem of too many people on hot summer days by limiting the numbers.

6) local residents and visitors should be kept informed about the Stewardship Program at Carters Beach including present and future activities, scientific monitoring and timely (annual or after specific programs) reviews of all activities, including both successes and failures.

Monitoring Stewardship Activities

1) Prior to posting signs or cording off dune areas or paths, photographs should be taken of the sites showing the present physical condition. Photographs at the foredunes should include views looking both ways alongshore and the adjoining beach and inland dunes. Repetitive photos should be obtained from the same locations at each site. Monitoring, should be conducted after a major storm, after one or more days of intense human activity and at the end of the summer, i.e. September to October 2017.

2) The seaward edge of continuous marram grass along the foredune with signage and a sample area without signage, should be mapped during the monitoring program using a hand – held geographic positioning system (GPS). However because the accuracy of these instruments vary considerably, ground control at survey monuments or other features with well-known GPS coordinates should also be mapped with each GPS instrument before and after each vegetation survey. The data could then be plotted on geographically rectified maps or aerial photographs to illustrate changes in grass expansion or reduction.

3) Dates when the position of the stream outlet shifts from the north to the south (or vice versa) of the rock islet between first and second beach should be noted together with any impacts the shift in stream flow has on adjacent beach and dune stability.

References

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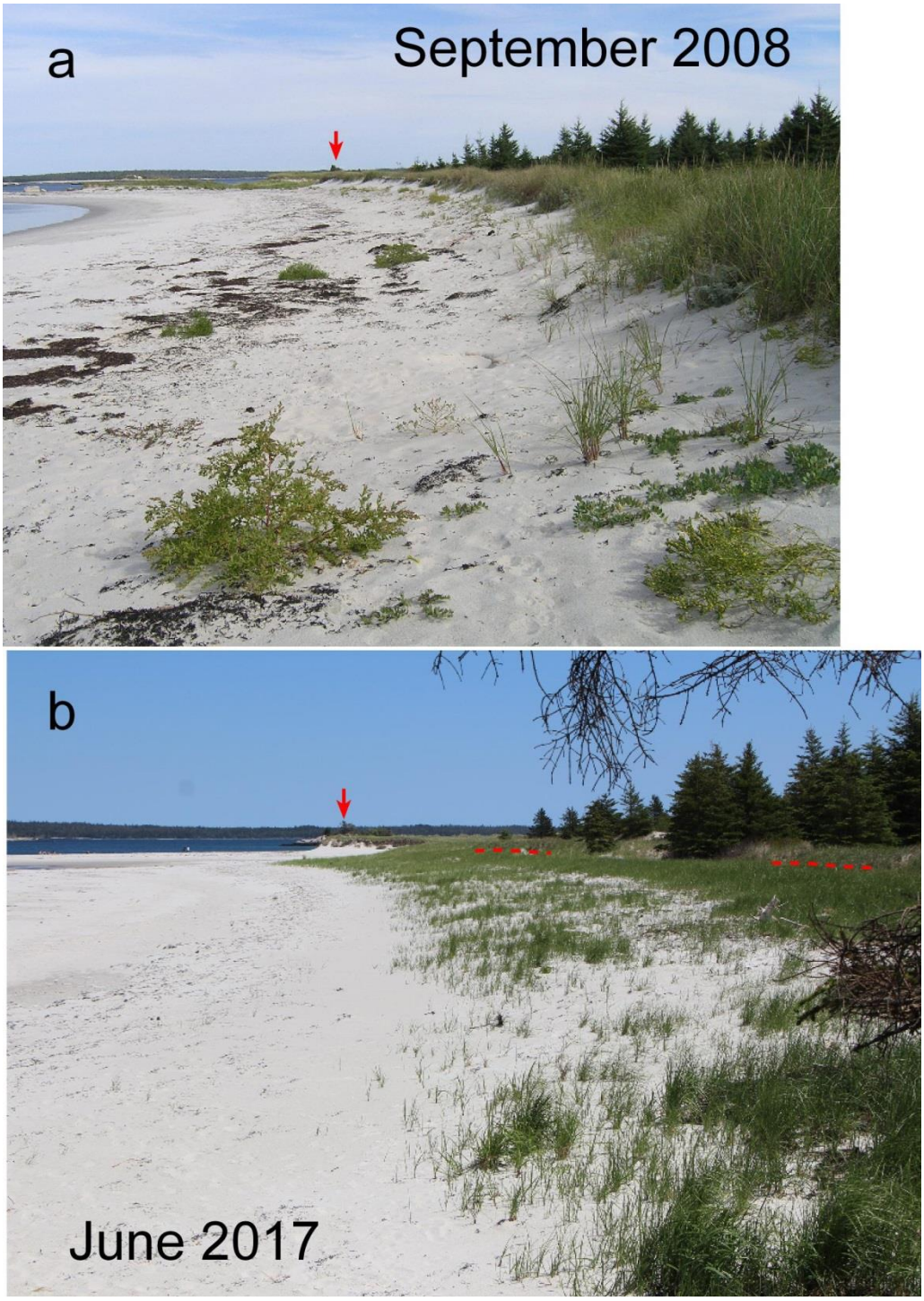

Figure 1. Between (a) 2008 and (b) 2017 the foredune along first beach (Carters Beach) has been eroded and naturally rebuilt a number of times. The dash line on the 2017 photo marks an older dune cut from waves generated by a Nor'easter a few years ago (Brian Fisher, local resident, pers. comm. 2017). The dune has built seaward as sand accumulated and became revegetated by June 2017.

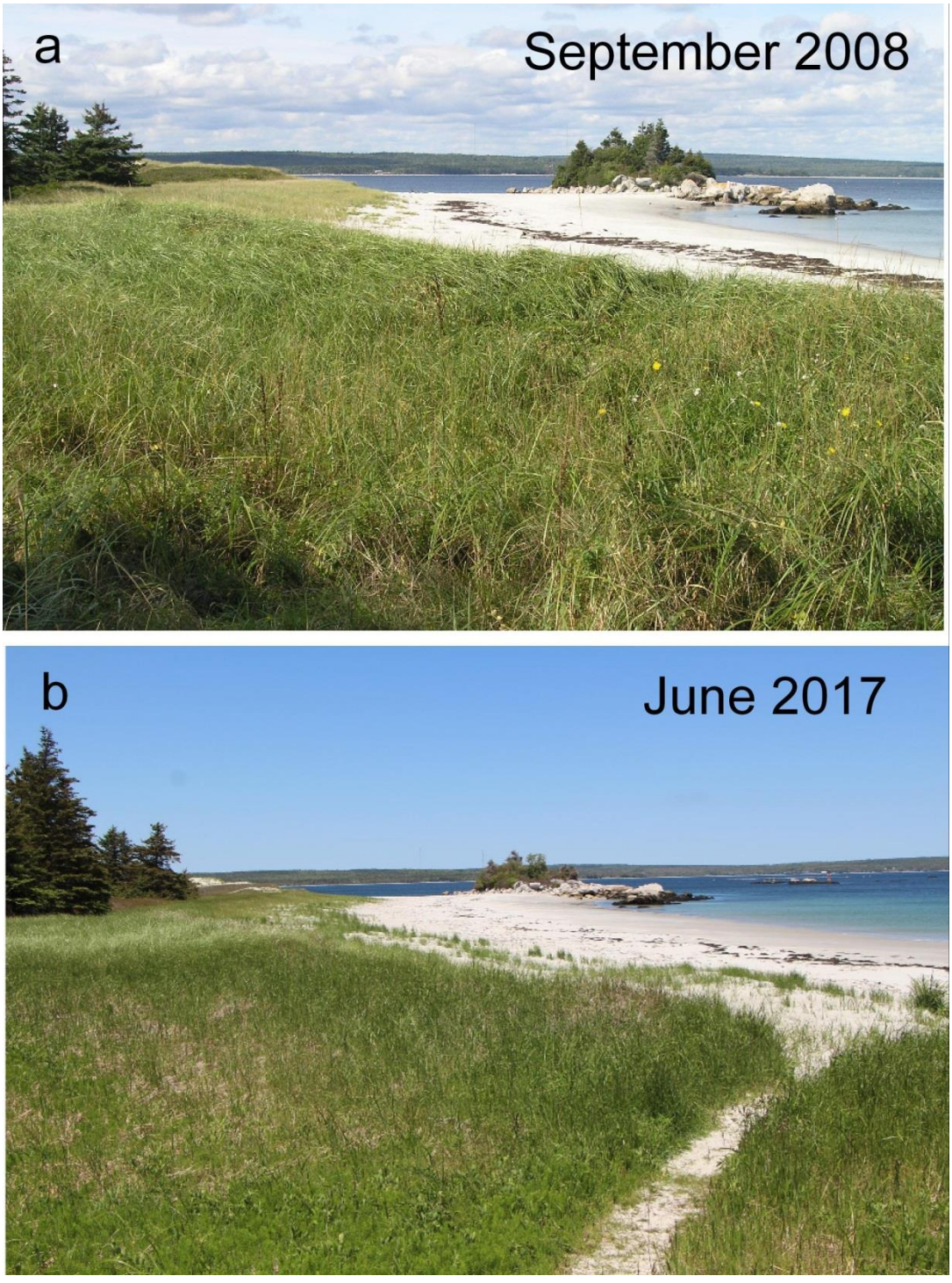

Figure 2. The foredune at third beach also has been eroded and rebuilt naturally one or more times between (a) 2008 and (b) 2017 illustrating the resilience of Carters Beach to rebuild following storms.

Figure 3. Second beach looking south in (a) 2010 and (b) 2017 illustrating less recovery of vegetation and foredune compared with changes observed along first and second beaches (Fig.1 and 2), Carters Beach, Nova Scotia. The largest increase in dune blowouts was at the southern end of second beach. Arrows pointing to the same trees in both photos provide a visual reference for measuring foredune changes.

Figure 4. Between September 2016 (a) and June 2017 (b) the slope of the foredune along second beach has increased, the grass cover along its base has decreased and sand migration across the top of the foredune has increased. The changes are natural and could be attributed to the high water storm events in February and March 2017 (2016 photo by Brian Fisher, Port Mouton).

Figure 5. Sequence of photos illustrating the loss of vegetation and physical deterioration of the foredune along the southern end of second beach from (a) August 2010, to (b) September 2016 (photo by Brian Fisher, Port Mouton); and, to (c) June 2017. The severity of change along second beach compared with other parts of Carters Beach suggest the change may have been triggered or aggravated by human activity.

Figure 6. Views of the path that extends seaward from the highway along central Carters Beach and crosses the foredune adjacent to the stream that divides first and second beaches. (a) By September 2016 pedestrians had worn down the trail and trampled the vegetation but in (b) June 2017 grass was naturally spreading across the trail. Signs re-routing visitors away from this path to follow the edge of the stream would encourage more rapid recovery of vegetation across the path and stability of the dunes.