

Management of Lake Huron's Beach and Dune Ecosystems: Building up from the Grassroots

Geoffrey Peach

Lake Huron Centre for Coastal Conservation
P.O. Box 178, Blyth, Ontario N0M 1H0

Dune systems along the southeastern shores of Lake Huron have become severely impacted as the result of increases in recreational activities and shoreline development. Dune conservation activities at Lake Huron's provincial parks have occurred only within the past 20 to 25 years. Activities on dunes outside of the parks, including municipal and private lands, have only occurred within the last ten years. Grassroots organizations have initiated efforts to conserve dune systems locally. The Lake Huron Centre for Coastal Conservation is a non-government organization that is supporting local groups with technical expertise to develop management plans and guidance manuals for implementing sound conservation practices. Its conservation model is focused on community education about dune ecosystems, controlled public access in dune areas, and dune restoration. This paper presents some recent examples of grassroots initiatives in the communities of Southampton and Sauble Beach, along the southeastern shores of Lake Huron. The future of Lake Huron's dunes, and their conservation, will depend on community grassroots involvement, municipal cooperation and participation, and on sufficient government funding.

Keywords: Dune system, conservation, management plan, beach erosion, beach raking, Sauble Beach, Southampton

Introduction

Great Lakes coastal dune systems are considered to be among the rarest and most fragile ecosystems in Canada (Jalava, *et al*, 2003). Great Lakes dunes have undergone significant declines over the past 100 years, primarily as a result of shoreline development and recreational activities on the dunes and adjacent beaches. Among the most heavily impacted dunes are dunes systems along the Lake Huron coast (Jalava, 2004).

Dunes have formed along the eastern shores of Lake Huron since the subsidence of post-glacial Lake Nipissing 6000 years ago. Prevailing northwesterly winds have concentrated dune deposits along the eastern shores, influenced by onshore and nearshore topography. Looking at the whole of Lake Huron, dune systems are limited spatially, in both occurrence and in aerial extent. For the purposes of this discussion, the study area will include the major systems along Lake Huron's main basin, namely,

Pinery-Ipperwash, Point Clark-Lurgan, Inverhuron, Southampton and Sauble Beach (Figure 1). Of these systems, only Pinery-Ipperwash has an active sediment supply, with eroding bluffs and nearshore lakebed, as well as minor contributions from rivers and gullies (Reinders, 1989). The remaining dune systems are relict sand deposits; remnants with no active, viable source of sediment inputs.

Sand dune ecosystems represent a particularly vulnerable coastal landscape. These fragile coastal landforms which are literally held together by beachgrasses, and other vegetation, can be damaged or destroyed once impacts have gone beyond a certain, modest threshold. Ironically, beach-dune systems are prized for their recreation value, and Lake Huron's dune systems are under considerable stress as greater numbers of people utilize the lakeshore for cottaging and recreation.

Dune conservation has not had a long history on Lake Huron. Even Pinery Provincial Park, which includes one of the largest dune complexes on Lake Huron, was initially a recreation park and did not institute natural features

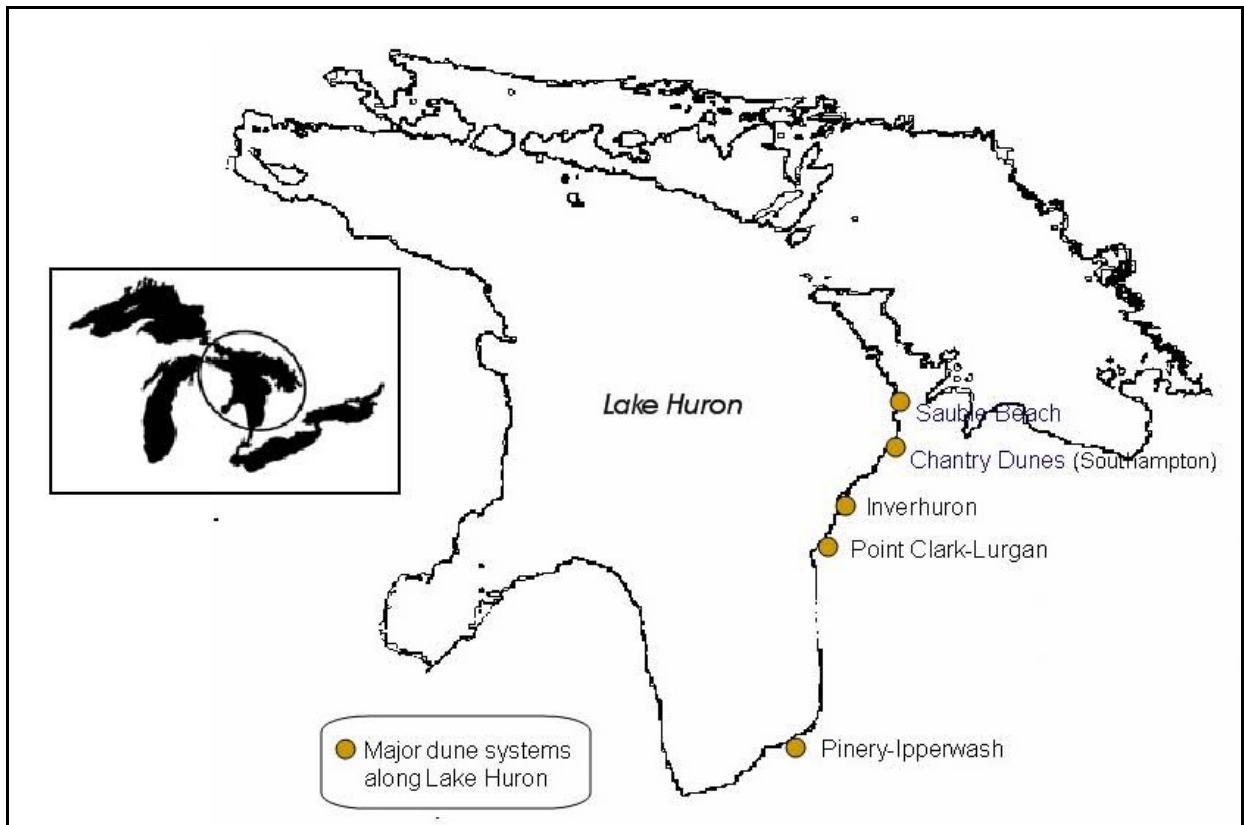


Figure 1: Study area.

protection until the late 1970s (Davidson, 1990). Dune systems outside of the formal management setting of the provincial park were not seriously considered as features worthy of protection until the 1990s when some dune conservation efforts on municipal lands were undertaken. In the meantime, impacts to dunes had taken their toll as demands on area beaches have increased dramatically.

Need for Conservation

Different ecosystems have varying limits of tolerance to human disturbances. Dunes are particularly fragile and vulnerable coastal features with a relatively low tolerance to human activity. Activities which can damage or destroy vegetation on the dunes can initiate an erosion process that can undermine the integrity of the dunes. A study of the effects of trampling on the vegetation of Lake Huron sand

dunes at the Pinery Provincial Park documented how certain dune species can be impacted by pedestrian traffic through the dunes (Bowles and Maun, 1982). In that study, trampling impacts were more or less continuous throughout the summer season during peak public use, and the effects were additive. Dune species can be seriously affected by prolonged exposure to trampling pressures where no time for recovery is allowed (Bowles and Maun, 1982). This is important because most dune systems in the study area, which are in highly utilized, public areas, are continually subject to, in some cases, excessive trampling during the summer season and the intervening low recreation demand period is often not sufficient for recovery. The result has been that aeolian erosion processes have created numerous incisions and blowouts in the dunes and this has led to sand deposits leeward of the active dune system. Where dunes are in urbanized areas of the shoreline, this has posed a concern for the local municipality, which often has to deal

with the removal of sand from adjacent roadways, sidewalks or storm drains.

In managing dunes, coastal managers have to balance what is a natural process of erosion and deposition, and what is an unnatural human impact that warrants an intervention. Natural disturbance is characteristic of dune systems and is important for a host of endemic dune species. However, the intensity and form of disturbances caused by human activities often exceeds the natural resilience of dune systems along Lake Huron (Jalava, 2004). In addition, the relict nature of sediment deposits along the Bruce County shoreline suggests that a loss of sand from the dune system resulting from aeolian erosion processes represents a permanent loss from the system. The long term implications of this sand loss puts into question the long term sustainability of these beach-dune systems, and for communities which rely on these systems from an economic perspective this loss could be substantial.

History of Dune Conservation on Lake Huron

Historically, dune conservation along Lake Huron has been modest. Beginning in 1978, the provincial government approved a new park policy that placed emphasis on the protection of natural features and systems and depreciated the mainly recreation focus of the 1950s and 1960s. Pinery Provincial Park (Pinery-Ipperwash area) represented the largest dune complex on Lake Huron at 2,532 ha. Its globally rare oak savannah communities made the park particularly significant biologically. Efforts were made in Pinery to undertake restoration planting and construct boardwalk structures over the dunes.

However, outside the park's boundaries, dunes were not a provincial or local priority. The average beach user had very little appreciation for dunes as an important coastal ecosystem. Some modest beachgrass planting on private lands had taken place in a few areas, but no comprehensive community dune conservation work had occurred.

The challenge of dune management was further complicated by the absence of a single, fully integrated and publicly supported strategy for the management of dunes within the Great Lakes Basin. In the 1990s, the Provincial Policy Statement developed under Ontario's Planning Act recognized "dynamic beach" areas as portions of the shoreline where beaches and dunes were considered to be hazardous from a development perspective. While this

policy helped to restrict new development from the most dynamic, and potentially hazardous, portions of the dunes, it was a narrowly defined planning tool only. The management and conservation of dunes in areas of existing development had no provincial program for the consistent delivery of dune conservation. That would be left to the local grassroots to take on. Like any environmental program, there would need to be someone to drive the process at the local level.

In the early 1990s the author began working with local community groups to begin some conservation measures in Southampton, Ontario. This was one of the first community-driven dune conservation efforts to be undertaken in Ontario. A unique dune complex, referred locally as the "Chantry Dunes," existed along the Town's waterfront, but was under considerable stress due to increasing recreational pressures. While the dune complex was under the ownership of the municipality, it became clear that one of the primary stressors to the dunes could be linked to the Town's mis-management of the dunes. On a number of occasions, the Town's Works Department could be observed with a front end loader taking bucket loads of dune sand away for use as fill. It was apparent that dune education and awareness would need to include Town Council and staff, as well as the general public.

The approach used in Southampton was to involve as many interested community groups as possible in the dune conservation project. The local Beach Association acted as the lead organization, with the technical support of the author, employed at the time with Saugeen Valley Conservation Authority. After an ecosystem evaluation of the dunes undertaken by two summer students, a plan was drawn up by the author and an area landscape architect with experience in environmental design and dune systems. The plan would be used to help secure funding to implement the dune conservation project.

The design approach was to focus efforts on education, controlled public access through the dunes and restoration planting. Education efforts included the installation of interpretive signs within the dune complex and the distribution of literature throughout the community. Controlling public access involved the installation of post-and-rail fences to guide people through pre-determined areas of the dunes, intended to place the least impact on the dune system. Control structures were placed in areas where vehicles traditionally had access to the beach. Finally, restoration planting was undertaken in areas where dunes had been extensively damaged or destroyed. The Chantry

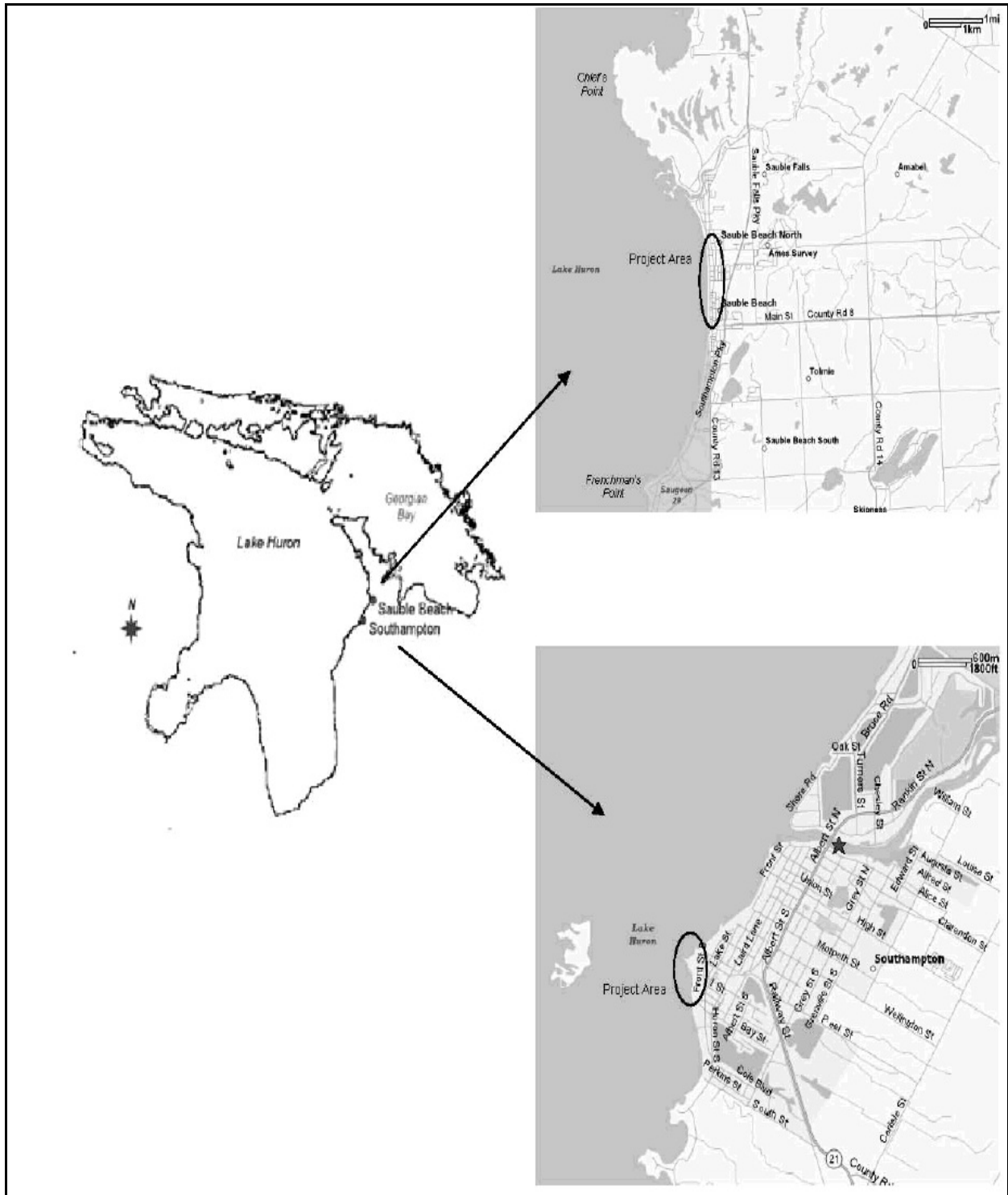


Figure 2: Map of Sauble beach and Southampton identifying their respective project areas.



Figure 3: Sauble Beach. Lakeshore Boulevard is the main roadway aligned parallel to the dunes. Angle parking along the shoulder of Lakeshore Blvd promotes the development of numerous pathways cut through the dunes as people make their way to the beach. The resulting trampling of dune vegetation can lead to Aeolian erosion and the development of ‘blowouts’.

Dunes project was completed within one year, primarily with community volunteer labour. This project, in a high visibility area, became a useful demonstration site for other community groups having similar aspirations.

Recent Conservation Efforts by the Lake Huron Centre for Coastal Conservation

Chantry Dunes

Southampton's Chantry Dunes project (Figure 2) demonstrated that dune conservation could be successfully carried out by a local community concerned with the future of their waterfront. The author, now manager of the Lake Huron Centre for Coastal Conservation (the Coastal Centre), continued with this approach. While the Southampton project had many successes in engaging the local community to take ownership of the issue and to continue advocating for dune conservation, the municipality was not yet fully involved in dune conservation. The ongoing maintenance of the Chantry Dunes project was not occurring. It became evident that after the completion of the project, the Town had no guidelines to follow concerning the continued management of the beach and dunes in Southampton. To complicate matters, Southampton had amalgamated with the Town of Port Elgin and the Township of Saugeen to form the Town of Saugeen Shores. Changes in personnel meant that many of those involved with the Chantry Dunes project were no longer present.

To assist the municipality, the Coastal Centre prepared a "Beach and Dune Guidance Manual for the Town of Saugeen Shores". The manual included a plain language description of dune processes and identified specific management approaches that Town employees could use in the day-to-day management of the beach and dune system. Workshops were held to present the manual to Town staff, including senior officials. The guidance manual was vital to ensuring that the Town had information at their disposal that could assist in understanding the natural processes that sustain dune systems and in placing management approaches in the context of those natural processes and functions.

Sauble Beach

Sauble Beach is a beach-dune complex spanning approximately 10 kilometres between two rock headlands: Chief's Point to the north and Frenchman's Point to the south (Figure 2). The southern four kilometres of this coast is under the jurisdiction of Saugeen First Nation, while the remaining portion to the north is, for the most part, under the ownership of the Town of South Bruce Peninsula, and forms part of the community of Sauble Beach. This beach attracts thousands of beach-goers each summer season, and is one of the most popular beach destinations in the province.

In 2003, Friends of Sauble Beach, a local grassroots organization interested in conserving the dunes at Sauble Beach retained the Coastal Centre, with funding it received from the Trillium Foundation, to prepare a management plan. The plan would be based on three main assumptions: (1) coastal science and management planning are tools that the local community needs to manage the dune ecosystem; (2) taking an ecosystem approach should lead to a minimum of intervention; and (3) looking toward the future, lower lake levels resulting from climate change could affect the way local beaches and dunes are managed.

(1) *Coastal Science and Management Tools* - To begin to develop a management plan for the dune ecosystem at Sauble Beach, it was felt that the community would benefit from a better understanding of the ecological structure and processes that are unique to this part of the Lake Huron coast. To assist in this process, the Coastal Centre initiated an ABC (abiotic, biotic and cultural) Resource Survey approach to look at the Sauble Beach study area from an ecosystem perspective. This approach was originally developed and has been widely used by Dr. Gordon Nelson, University of Waterloo. The survey involved identifying and recording abiotic features and processes, the dominant plant communities and signature species, and the values and impacts that the community places on the beach-dune system. A brief discussion of the findings follows.

Structurally, the dunes at Sauble Beach are shore parallel features composed primarily of relict post-Nipissing deposits, contained between two rock headlands. The distance between headlands is approximately 10 km. The beach is fine grained and low gradient. The nearshore component of the beach comprises at least three sand bars within about 200 metres from shore. The subaerial beach during low lake level stage can extend greater than 100 m from the waters edge to the dune margin. The dunes vary in height from approximately 3 m to 15 m. The dunes are wide, approaching 150 m, at the north end of Sauble Beach



Figure 4a: Beach raker at Sauble Beach. Vehicle owned and operated by the municipality. Typically the raking is done 3 or 4 times a week in the summer season.

(towards the Sauble River) and become more narrow to the south where the dunes are about 15 to 20 m in width. Sauble beach was identified as an area of geomorphological significance on the Great Lakes using the Herdendorf classification system for coastal zone areas (M. Bowes, 1989).

Biologically, the dunes at Sauble Beach exhibit a fascinating diversity of dune plant species, particularly in the least disturbed areas of the dunes. The dominant dune grass which acts as a key stabilizer at Sauble Beach, is *Calamovilfa longifolia* var. *magna*. This plant grows in abundance at Sauble Beach, but is spatially restricted in Canada to the shore of Lake Huron (Dore and McNeill, 1980). *C. longifolia* is also the species studied by Bowles and Maun in their study of vulnerability to trampling effects. *Ammophila breviligulata* is restricted to the windward portion of Sauble's foredune and dune margin. *A. breviligulata* is an important pioneer colonizer that assists greatly in sand stabilization at Sauble Beach. In particular, during low lake level stages when the exposed beach becomes wider and more prone to wind erosion, *A. breviligulata* can be observed migrating shoreward, increasing the volume and areal extent of the dunes.

Human interaction with the dune ecosystem has been substantial in recent decades. Sauble Beach attracts thousands of people during the summer season (Town of South Bruce Peninsula, 2003). The high volume of people is further compounded by the lack of suitable parking for beach users. Lakeshore Boulevard is a primary north-south roadway in Sauble Beach that is situated to the lee of the dunes. Parking has evolved on the western shoulder of Lakeshore Blvd. against the lee side of the dunes (Figure 3). In the absence of controlled access through the dunes, people have made their own pathways, and this has led to the development of nearly 400 pathways incised into the dunes. A number of the more

active pathways have resulted in the formation of blowouts, exposing the dunes to erosion as the anchoring vegetation has been damaged or destroyed (Peach, 2004).

In addition to sand erosion related directly to trampling effects, beach erosion has been exacerbated by the beach management practice of mechanized beach raking performed by the municipality to maintain the aesthetics of the beach (Figure 4). This practice involved a tractor pulling a tilling rake. Frequency of raking was typically three to four times per week. Since Sauble's fine grained, low gradient beach typically has a high moisture content, raking had the effect of aerating and desiccating the upper sand layer making it more prone to wind erosion. The raking also had the effect of obliterating sand binding beach vegetation, particularly along the lakeward dune margin. Subsequent to raking, *A. breviligulata* plants were observed crushed and rhizomes severed. This management practice, which seeks to eliminate vegetation from the beach and flatten the sand, has effectively undermined the critical relationship between lake levels and dune development. Between 1998 and 2004, Lake Huron has experienced below average lake levels which has had the effect of increasing the subaerial extent of beaches and, in turn, increased the potential for aeolian



Figure 4b: The effects of raking along the upper beach and dune margin on the pioneer grass species *Ammophila breviflora*. As this plant spreads lakeward by underground rhizomes, the mechanized raking severs the roots and mangles the plant.

erosion to occur. During low lake levels, pioneer species migrate lakeward through underground rhizomes and colonize areas of the dune margin and upper beach and facilitate the dune building process. Beach raking into the dune margin has disturbed the dune building process by destroying these pioneer plants.

Sand erosion and drifting onto Lakeshore Blvd has been a maintenance issue for the Town of South Bruce Peninsula who is obliged to remove it. The Ontario Ministry of the Environment policy restricts the municipality from placing sand removed from the roadway back onto the beach due to the potential for introducing deleterious materials. Instead, the municipality is required to truck the sand away to the local landfill. The result has been ongoing economic costs of sand removal, as well as the long term costs of losing the sand resource from the active beach-dune system. While it is recognized that the roadway and associated parking are in inappropriate locations relative to the dynamics of the dune system, they are now permanent features and the matter of dealing with sand deposits beyond the actual dune is a management issue.

The ABC resource survey approach was a useful exercise to provide a simplified description of the coastal ecosystem at Sauble Beach that would help the community to understand the basic relationships between physical and biological processes, and how human interaction with the beach-dune system has modified or transformed those processes. This information could then help the community to place dune conservation recommendations into context.

(2) Taking an Ecosystem Approach and Minimizing Intervention - The ABC survey provided the groundwork for developing an approach for dune conservation. It was important for the community to understand that an aggressive management intervention was not required nor desirable at Sauble Beach. Allowing natural processes to take place, while at the same time

reducing or minimizing human impacts was the fundamental objective. The Coastal Centre's model for dune conservation focussed on three measures:

- Public education;
- Controlled access through the dunes;
- Restoration, in areas where natural regeneration is improbable.

The *first measure*, public education, would need to encompass a broad spectrum beginning with Friends of Sauble Beach as the implementing organization, the broader Sauble Beach community, the municipality, and finally, the general public who use Sauble Beach as a recreational resource. In developing the plan for Sauble Beach, it was felt that it would be useful to those who would be implementing the plan, to design it as an educational tool, as well as a planning document that would help to guide the community in dune conservation efforts.

The resulting plan was a plain language document explaining ecosystem functions and processes, the impacts of concern and identifying some approaches to address those impacts. School groups were brought in to assist with the planting of a demonstration garden providing an opportunity for local students to learn more about their coastal environment. The distribution of literature, media articles, workshops and speaking engagements were all communications techniques used to help inform the local community.

The municipality, and in particular, the Town Council were given detailed presentations summarizing the plan and its implementation responsibilities. It was necessary to foster Council's understanding of the issues related to Sauble Beach's environment, and to influence some changes in their habitual management regime of beach raking.

To reach the broader general public, the use of interpretive, informational and instructional signs were recommended to be used throughout the study area. This approach was successful in the Chantry Dunes project, and has been used effectively in provincially and federally managed parklands throughout Ontario. As a result, the general public have derived some familiarity with this communications approach over the years.

The *second measure* sought to change the conventional approach toward beach access. This approach consisted of beach users finding their own access way to the beach through the dunes, and this has led to a myriad of pathways and potential erosion points, to one of controlled access where a limited number of clearly defined pathways would guide the majority of users to the beach. Twelve controlled access routes over an approximately three kilometre distance of lakeshore was recommended in the management plan. Each access would be defined using post-and-rail fencing on either side of the pathway. Access routes would be clearly marked and directional signs used to lead the user to the appropriate access.

The use of boardwalks was not considered to be necessary, in part because of economics, but also because of the challenges associated with maintaining a static structure in a highly dynamic environment. Experience with the Chantry Dunes project in Southampton demonstrated that post-and-rail fencing with a bare sand pathway was quite effective in meeting public access objectives, while posing less interference with natural processes. Angling the pathways to be perpendicular to prevailing winds would help to ensure that the public pathways did not become erosion channels.

Dune restoration was the *third measure* where beachgrass planting was considered useful in areas where natural regeneration was improbable. There were some locations at Sauble Beach where dune vegetation had been physically removed to accommodate sunbathing, picnicking, or some other beach activity. The continual use of these areas and the loss of anchoring vegetation led to sand erosion and the creation of towering dunes to the lee of the disturbance. The vertical development of the dunes caused the loss of shore vistas from cottagers along Lakeshore Blvd. Faced with this loss, some affected residents took measures to mechanically alter the dunes by removing the top portion in an effort to reinstate their view.

In these instances, managing vegetation on the foredune and the lakeward margin, and ensuring non-interference with their growth, was recommended in the plan. This would help to promote the lateral, lakeward growth of the dunes and discourage, to some degree, their vertical growth. This type of intervention was only recommended in extraordinary circumstances where human interference with the dune system was acute.

The use of sand fencing was also recommended as a method to reduce the amount of sand drifting onto Lakeshore Blvd. This was particularly important where there were large breaches in the dunes, and where blowing sand could travel unimpeded to areas landward of the dunes. Access for emergency vehicles provide an example of where the use of sand fencing during the off-season could be installed help to reduce the wind transport of sand from the beach.

(3) *Climate Change: looking toward the future* - Lake Huron's recent experience with low lake levels may be instructive to what experiences coastal communities could encounter over the course of the next century. Climate change projections for Lake Huron suggest that the lake level range could shift downward by as much as one to two metres. A level decline of that magnitude and the corresponding increases in the subaerial extent of beaches could affect the way local beaches and dunes are managed. Coastal climate change research conducted in the Oliphant area, twenty kilometres north of Sauble Beach, suggested that aeolian transport would increase during this century, particularly on low gradient beaches that are particularly sensitive to changes in water level (Tupman, 2004).

The below average lake levels experienced on Lake Huron over the past six years and the correspondingly wider beaches have resulted in an increase in aeolian transport at

Sauble Beach. Increases in sand drifting and lakeward encroachment of dune vegetation have been observed during this time period. Activities like beach raking have been obstructive to dune processes, and significant breaches in the dunes caused by trampling effects have resulted in aeolian transport beyond the active dune system.

These types of impacts, if left unmanaged, could magnify under the projected climate change scenarios. The promotion of dune conservation and the management of human impacts to dune systems is, in our view, practical in the short term and precautionary in the longer term. While the proponents of the Sauble Beach plan were focussed on the immediate concerns of the area, it was important for the local community to understand that local impacts associated with climate change could be ameliorated with actions taken now.

Conclusion

Dunes along the Great Lakes are an important coastal ecosystem and one of the rarest and most fragile ecosystems in Canada. Beach-dune systems attract large numbers of beach users in search of summer recreation and relaxation. The nature of dune systems and their low tolerance of human disturbances is requiring that efforts be undertaken to develop some balance between how the beach is accessed and used, and the requirements of the ecosystem.

Dune management and conservation along Lake Huron appear to be evolving from a parks focus, and the narrow aim of protecting 'dune sanctuaries,' to include a broader scope that includes beach and dune systems that are municipally or privately owned. Ironically, despite the fact that beaches, in whole or in part, are a public resource, the Province of Ontario has not played a substantive role in managing beach-dune systems. The federal government has been no more resolved to commit to action despite having identified Great Lakes dunes as under stress and faced with continued degradation in the 2005 State of the Great Lakes report. It has been left to non-government organizations like the Coastal Centre to provide leadership in local dune conservation efforts. Such organizations with the passion, local connections and the technical, science-based experience are the best to ensure that this work gets accomplished.

The Coastal Centre has been guiding municipalities and private organizations and individuals to protect their beach and dune ecosystems, primarily through the use of education and awareness, but also with technical guidance

to help them to reach their own socio-economic objectives while at the same time bringing the requirements of the dune ecosystem to the forefront.

There has been a positive shift in recent years as more and more local citizens appear to be more engaged in coastal conservation and in becoming involved in stewardship activities that will benefit their local community. This momentum has seen major grassroots initiatives at Sauble Beach and Southampton, and smaller initiatives along other parts of the lakeshore. The grassroots can play a powerful role in the long term health of our dune ecosystems. Their direct involvement in dune conservation, or indirect involvement as overseers of municipal activities, will be important to the future of Lake Huron's dunes. Municipalities need to become active players in dune conservation. Governments need to assist grassroots dune conservation efforts by making sufficient funding available for planning and implementation.

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