Coastal Sand Ecosystems

Community Outreach Report
with a focus on Manson's Landing Provincial Park

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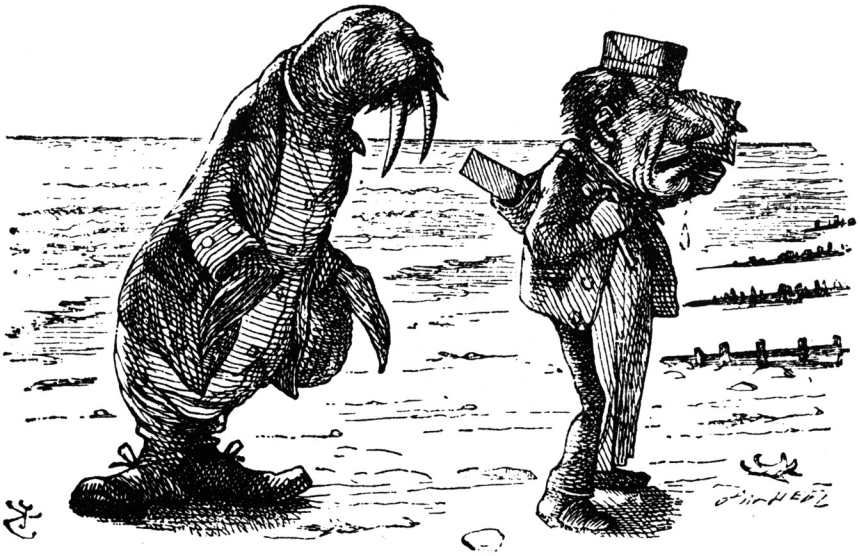

"The Walrus and the Carpenter
Were walking hand in hand:
They wept like anything to see
Such quantities of sand:'
If this were only cleared away.'
They said, 'it would be grand!'

'If seven maids with seven mops
Swept it for half a year,
Do you suppose.' the Walrus said,
'That they could get it clear?'
'I doubt it,' said the Carpenter,
And shed a bitter tear."

Lewis Carroll in *Through the Looking Glass*

Section I
An Introduction to Coastal Sand Ecosystems

What IS, a coastal sand ecosystem?
"Such quantities of sand:"… begins to define a coastal sand ecosystem!
Where sand is the dominant substrate for a community of terrestrial plants, you have a coastal sand ecosystem. Three geomorphic units are generally described: beaches, dunes and spits. These areas are often associated with nearby forests, salt marshes and bluffs.

How are coastal sand ecosystems formed and maintained?
Coastal sand ecosystems form at the interface between marine and terrestrial realms. They are built and maintained by marine-related natural processes: sand movement, wind and wave erosion, tides, storm surges and ocean spray. These are highly dynamic and complex ecosystems!

Where do coastal sand ecosystems occur in BC?

The majority of the BC coast is dominated by rocky shorelines, so that coastal sand ecosystems which occur only irregularly along the coast, represent a unique component. Coastal sand ecosystems are rare in BC and correspondingly, the flora and fauna they support are also rare. 85.6% of coastal sand ecosystems inventoried in BC are protected within parks; 73.8% within BC Parks and within these, Naikoon Provincial Park in Haida Gwaii comprises 66.4% of this total. (Page, Lilley, Walker & Vennesland, 2011)

Why are coastal sand ecosystems important?

Coastal sand ecosystems contribute to BC's biodiversity. These ecosystems are not well studied in BC, with large research gaps about species groups such as moths, arthropods, lichens and bryophytes, to name a few. So much still to learn! Coastal sand ecosystems also provide recreational benefits and buffer inland areas from storm events and flooding.

What are the threats to coastal sand ecosystems in BC?

Coastal sand ecosystems support sparsely vegetated communities that have limited numbers of species that are characterized by distinctive adaptive properties to survive in… sand. These species thrive in the instability of sand habitat!

The primary threat to coastal sand ecosystems is *accelerated succession*; i.e. the development of more stable and densely vegetated communities.

In BC *accelerated succession* results from:

1. invasive plant species, eg. Scotch broom and non-native grasses
2. reduced sand supply and interference with sediment transport processes as a result of shoreline modifications, eg. docks, piers and seawalls
3. atmospheric nitrogen deposition; new research area

Invasive plants are considered the most critical threat to species and ecological communities at risk in coastal sand ecosystems.
They cause functional changes to the ecological processes; enhancing soil fertility, reducing sand movement, directly competing with native species for limited resources; light, water, nutrients. In the Georgia Basin, Scotch broom is considered one of the most critical invasive plants to remove. Scotch broom is present in most coastal sand ecosystems because it prolifically produces long-lived seed that disperses well, it fixes nitrogen in nutrient poor sand soils and is tolerant of summer drought.

Additional threats to coastal sand ecosystems include: coastal development (modification & loss of habitat), climate change (sea level rise & intense storm events), recreational use (trampling & sand compaction) and invasive animals (non-native Canada geese).

Coastal sand ecosystem habitat change since 1930, monitored at 6 selected BC study sites, shows a decline from 35% - 95%; greater losses in the Georgia Basin compared to the west coast of Vancouver Island. (Page, Lilley, Walker & Vennesland, 2011) This highlights the seriousness of the threat of coastal development to coastal sand ecosystems, in the highly developed Georgia Basin.

Section II
Coastal Sand Ecosystems on/around Cortes Island

Let's talk sand supply and movement in our local area
As with the majority of coastal sand ecosystems in the Strait of Georgia, our local coastal sand ecosystems are associated with occurrences of glacially deposited sediments. **Appendix 1.* Following the retreat of the glaciers, 11–12,000 years ago, these sediments rebounded up to 100m, exposing the glacial sediments in steep coastal cliffs on the south end of both Cortes and Marina Islands. These "feeder" cliffs lie to the south of their respective coastal sand ecosystems. Prevailing southwest wind waves in the Strait of Georgia set up longshore currents along the coastlines which transport sand to our coastal sand ecosystems.

The coastal sand ecosystems occurring on Cortes Island and immediately adjacent Marina Island, consist of beaches and spits.

Smelt Bay
Smelt Bay is a large embayment on the SW shoreline of Cortes Island ~2.5 km north of the southern tip of Cortes Island; the glacially rebounded feeder cliffs are located immediately to the south of Smelt Bay. Smelt Bay Provincial Park

fronts the southern shoulder of Smelt Bay. Gravel dominates the intertidal with sand occurring in the foredune area.
The strongest remnant of sparsely vegetated coastal sand ecosystem is found outside the provincial park, central to Smelt Bay, on Crown land. This area is in need of habitat restoration as invasive Scotch broom has created fertile ground for the next wave of tree seedlings, and shrubs. This area is also a popular recreational site and will benefit from community education and clarification of boundaries.

Shark Spit
Shark Spit lies at the northern end of Marina Island, curving eastward to Cortes Island where, at low tide, the tip of Shark Spit narrows the navigable channel, Uganda Passage, to ~200m. A well known and important wildlife corridor occurs here, giving local coastal wolf populations access to the rich clam beds and harbour seal pupping reef of Marina Island.

This is our largest and most intact local remnant of coastal sand ecosystem, with the provincially listed ecological community of large-headed sedge dominant here. Shark Spit is a popular recreational destination, the private landowners allowing camping, for locals, with the caveat that no fires be lit during the summer months. Community education needed here to protect the area from trampling by dingies/ kayaks and feet. Scotch broom not a big problem here but the area needs to be inventoried for invasive grasses.

Manson's Landing
Manson's Landing describes a peninsula at the northern terminus of an uninterrupted portion of the western shoreline of Cortes Island, continuous with the Island's southern point. Feeder cliffs at the southern end of Cortes Island supply the sediment for the formation of Manson's Landing's beautiful sand beaches and the sand spit that forms the narrow entrance to Manson's Lagoon.

Manson's Spit and the immediately adjacent outer shorelines of the peninsula once represented strong coastal sand ecosystems. Remnants of coastal sand ecosystems persist today primarily on the northwestern flank of the peninsula with the progressive loss of vegetation from the sand spit occurring over the past 30 years. The red-listed ecological community of dune wildrye-beach pea remains present.

Dramatic erosional changes to the peninsula, in recent years, have put these coastal sand ecosystems at high risk. BC Parks, who manage this area as Manson's Landing Provincial Park, are working in partnership with Friends of Cortes Island Society to address these issues. See Section III.

How can we, as a community, help to protect our last remaining remnants of coastal sand ecosystems?

1. The first thing to do is…
… to head out to Manson's Landing, Smelt Bay or Shark Spit to check out the coastal sand ecosystems there! Introduce yourself!
You will recognize this ecosystem by the unique plants growing there, not to mention the *"…quantities of sand:"*

Abundantly sprawling in the foredune area immediately above the intertidal is…
Silver burweed *Ambrosia chamissonis*
A twisted mat of burweed may be up to 10' across and a foot thick; a hardy member of the sunflower family! The flowering stems are covered in small knoblike flowers that develop into effective burs that aid in this perennial plant's dispersal. Take a smell… with a name like *Ambrosia,* one would expect burweed to smell sweet!

American searocket *Cakile edentula*
To live in this shifting sand habitat, searocket needs to have a strong & deep taproot. It also has a thick leaf cuticle to prevent the loss of water from its leaf surfaces. These are two of the adaptations that the unique plants of the coastal sand ecosystem have evolved to live here. Studies of searocket have shown that when it is buried in sand, it puts on more growth and produces more seeds!

Above the searocket and burweed you will find large clumps of…
Dune wildrye *Leymus mollis ssp.*
Dune wildrye is still the dominant grass at Manson's Landing; in a lot of coastal sand ecosystems, non-native introduced grasses are taking over. Culturally prized by many coastal First Nations, the tough leaves of dune wildrye were woven into tumplines, pack straps, reef nets and basket handles.

Beach Pea *Lathyrus japonicus*
Showy pink/purple flowers will catch your eye on this coastal peavine! Curling tendrils tip the leaflets and the pea shaped pods are unmistakable! The Haida First Nations called the plant, "Raven's Canoe" because the ripe, black seedpods looked to them like a canoe fit for a Raven!
Together as a community, Dune wildrye and beach pea are a provincially red-listed ecological community.

Large-headed sedge *Carex macrocephala*
Remember your childhood jingle…*sedges have edges, reeds are round and grasses are hollow like a hole in the ground!* The stiff, solid stems have edges because the stem in cross section is triangular. *Macro* means 'large' and *cephala* means 'head' which perfectly describes the large headed flower spike on this sedge. Long rhizomes connect tufts of sedges across sandy expanses. The large-headed sedge is a provincially red-listed ecological community and in Canada, it only occurs within BC shorelines.

2. The second thing to do, is…
… to **know - *what to do***, to ensure that coastal sand ecosystems will continue to be a part of our local coastal landscape.

* **Respect these ecosystems;** explore them from the intertidal areas below the growth of searocket and burweed or from the forested areas above the growth of dune wildrye and beach pea.

Neither drag your dingy/kayak ashore through these areas nor store your dingy/kayak in these areas. Trampling of these unique plants and compaction of the sand are to be avoided. Use trails where defined for beach access.

* **Do not allow your dogs or cats to defecate in these ecosystems**, as the nitrogen from their feces will fuel accelerated succession; we don't want to be fertilizing these areas for invasive plant growth!

* **Volunteer when the call goes out** for removal of invasives, trail building or restoration planting.

* **Please report the sighting/s of any species at risk** observed in these ecosystems. The common nighthawk, which may have historically nested in these ecosystems is provincially listed as a species at risk. Caspian terns are frequently seen resting & preening on Shark Spit during our summers and they too, are a provincially listed species at risk. FOCI has a complete listing of the provincially listed species at risk in our coastal sand ecosystems, for your reference. Please report sightings to the FOCI office @ 250 935 0087 or friendsofcortes@gmail.com

Section III
Manson's Landing Provincial Park

Changes through Time
Manson's Landing lies within the unceded traditional territory of Klahoose and Sliammon First Nations. The large midden just upslope from the spit shows how well used the area was by First Nations for shellfish harvest.

Manson's Landing was later named for pioneering Michael Manson, who "landed" on the peninsula in 1888. A public wharf was petitioned for in 1892 and stands today, operated by the Harbour Authority of Cortes Island.

In 1989, almost 100 years later, a study by the then, Ministry of Parks, discussed the possible effects of the public wharf on the longshore transport of sediments in *"an investigation of erosion of the spit at Manson's Landing"*.

Manson's Landing Provincial Park was designated as a Class 'A' marine park in 1974. Beautiful sand beaches culminate in a sand spit that forms the narrow entrance to Manson's Lagoon. At low tide the lagoon dries, with a channel draining water from a persistent pool in the southeastern corner of the lagoon. The narrow entrance to the lagoon appears to act as a piston, enhancing the movement of water into and out of the lagoon with the tides. As a result of all this nutrient and oxygen rich water being "pumped" into the lagoon, the marine life is accordingly rich and biologically diverse!

Consistent and methodical observations by local residents since 1978, have documented changes in the movement of sediment in this area, with the resultant observed loss of eelgrass habitat within the lagoon, increased erosion on the NW flank of the peninsula and the persistent erosion of the sand spit. The question was asked as to why the loss of these coastal sand ecosystems and if that could also be related to the loss of eelgrass habitat in the lagoon.

Study of historical, on-the-ground observations, **Appendix3*, lead us to the following hypothesis:
By process of elimination, we identified that a disruption of water borne sediment through the intertidal was the most plausible explanation for the observed changes. We confirmed that the sand supply from the source continued, the movement of sand from the beach face to the upper beach was intact and there appeared to be no reduction of aeolian (windblown) sand movement. We concurred with the results of the 1989 Parks study which concluded that, *"Since the wharf is relatively distant from the site, it is not likely that the wharf is a major factor."*

During the mid 1980's an increased focus on commercial clamming in the lagoon was observed. The prolific clam beds lay immediately adjacent to the high current channel that drains the lagoon on a falling tide and fills the lagoon on a rising tide. When clams are removed from the substrate, the surrounding sediments are disturbed and readily suspended in the water column when the water returns. Depending on the direction of the tide, there could have been increased movement of sediment both into and out of the lagoon. Over the course of several years, it was observed that the sediment moving into the lagoon filled in the subtidal habitat of the eelgrass, shallowing the pools to the point where migrating geese could pull the plants out by their rhizomes, rather than just feeding off the ends.

The sediment that moved out of the lagoon slowed once outside the entrance to the lagoon and dropped, gradually building up an intertidal sand bar on the western flank of the sand spit. This sand bar disrupted the intertidal transport of sand to the northern extremity of the sand spit, resulting in a net loss of sediment.

That, coupled with increasingly intense storm events and rising sea levels could explain the destabilization that we are observing at the sand spit and the dramatic erosion along the western flank of the peninsula.

Current and future work at Manson's Landing Provincial Park

Sea level rise, increased storm intensity and modified sediment transport processes/shorelines have led to increased shoreline erosion in many areas of coastal BC.

The first steps in Manson's Landing Park has included invasive plant removal to restore dynamic processes that maintain coastal sand ecosystems.
The Scotch broom seriously threatening the remnant of coastal sand ecosystem, identified on the western flank of the peninsula immediately inside the government dock, was removed in 2016; work sponsored by BC Parks and facilitated by Friends of Cortes Island (FOCI) Society. Further broom removal in the park continued in 2017. Broom was removed from the associated forested habitat on the peninsula, reducing re-colonization. Broom removal will need to be carried out annually for at least 10 years.
Future restoration of this ecological community at risk will also involve the planting of native species. Invasive plants will be replaced by native species that comprise the coastal sand ecosystem. This is an important part of restoration!

BC Parks will be trying to connect with local FN to learn how erosion is affecting their archaeological sites and cultural values. We will also be enlisting the expertise of coastal engineers to provide suggestions for reducing the rate of erosion at the spit.

Future work will also include reducing accelerated erosion from people, through increased public awareness and better defined access points on and off coastal

sand ecosystems. Delineation of trails is proposed to reduce trampling of and erosion to the coastal sand ecosystem. The removal of stored recreational water craft from the coastal sand ecosystem to a newly designated area at Manson's Landing has also been identified as a priority.

Community education is essential; this community outreach report will be followed up with a community presentation and ongoing community education addressing coastal sand ecosystems at risk on Cortes Island will continue. New signage at Manson's Landing Provincial Park is proposed to explain the value of the coastal sand ecosystem and ask people to respect it.

FOCI welcomes the volunteer efforts of community members in all of these future conservation initiatives to conserve our unique coastal sand ecosystems.

THANK YOU…

… for ensuring that coastal sand ecosystems will continue to be part of

" 'A pleasant walk, a pleasant talk,
Along the briny beach:'" Lewis Carroll

Acknowledgments
We wish to acknowledge the help and support of:

Tamsin Baker; who first brought the Cortes Island coastal sand ecosystem remnants to our attention in 2014 and clarified their ecological significance and provincial at risk designations.

Ian Disney; for offering to dig out his shoeboxes of photographs of Manson's Landing and the invitation for us to join him in sorting these (1975 – present).

Jill Milton/Cortes Island Museum and Archives Society's archivist; for cruising the collections and finding wee gems of information about Manson's Landing.

Ruth and Dr. Fred Zwickel; whose consistent observations and scientific documentation of the changes through time (1978 – present), to the peninsula of Manson's Landing, are providing an historical baseline informing the future.

We also wish to thank all the volunteers, over the many years, that have put in volunteer efforts to support the ecology of Manson's Landing Provincial Park.

References
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www.hakai.org/research/coastal-sand-ecosystems

www.sccp.ca/projects/coastal-sand-ecosystems

Appendix 1:
i. Notes on the "Reef" South of Marina Island by Hans Trettin
ii. Figure 2. Table of Formations

Appendix 2:
Historical photo documentation of Manson's Landing Provincial Park
by Ruth and Dr. Fred Zwickel
i. Loss of eelgrass in Manson's Lagoon: a., b., c.
ii. Erosion of Manson's Spit: a., b., c.
iii. Erosion of Manson's Landing: a., b., c.

Appendix 3:

Definitions

Gravel *2-64mm*

Sand *is composed of coarse particles 0.0625mm-2mm*

In coastal BC, most sand is composed of angular quartz (silicon oxide) and alumium oxide) particles with minor amounts of shell debris. Quadra Sand is the dominant sand material in the Georgia Basin.

Silt *0.004-0.0625mm*

Clay *< 0.004mm*

A shoreline *is essentially the point where water and land meet on a beach. In tidal areas, the shoreline will fluctuate from the lowest to highest tide elevations. For mapping and some legal/jurisdictional purposes, the high water mark is often used. This is often indicated by some natural line or feature on a beach such as an erosional scarp, the toe of a foredune, or limit of terrestrial vegetation. the intertidal area below the high water line is known as the foreshore and the supratidal area above it is known as the backshore. The subtidal zone from the low tide mark to the point of wave shoaling is known as the nearshore.*

Sand beaches *encompass sloping shoreline areas that are predominantly sand (but occasionally intermixed with gravel and/or cobble), whose form is defined by the movement of sand by wave swash, nearshore currents, and winds on the upper beach. Larger beaches often have a storm berm (a low backshore ridge; Figure 5) that reflects the highest landward extent of storm wave action.*

Sand dunes *are terrestrial sand ridge features that are found landward of sand beaches in coastal areas (Figures 5 and 6). Dunes are formed by the movement of sand by wind (aeolian transport). Coastal foredunes are dune ridges that form at the back of the beach due to onshore aeolian sand transport and are often vegetated with beach grasses. Dunes may be active (sand movement occurs at present) or remnant or stabilized (sand movement occurred in the past). given the low percentage of sandy shoreline in BC, sand dunes are inherently sparse in occurrence.*

Sand spits *are linear to curved coastal features made of sand that are formed by the deposition of sediment into shallow water (see cover photos). They are attached at one end to a larger terrestrial land mass. Their form is controlled by the movement of sand by waves and nearshore currents.*

Sand bars *are sub-tidal to intertidal sand ridges that are formed by wave action and nearshore currents. They can extend from the intertidal beach (shore-attached) or exist in the subtidal nearshore, where they often cause wave shoaling. Bars can be shore-parallel, oblique, or crescentic in form, depending on wave climate, tidal currents, and nearshore currents (e.g., offshore rips, alongshore). Sand bars can move (migrate) and change their form, spacing, and proximity to the beach with seasons and/or in response to large storm events. Sand bars are an important store of sand in the intertidal to nearshore zones that may replenish beach and/or dune systems as they move alongshore and/or on-offshore during their migration.*

Longshore drift *or littoral drift, is the geological process that consists of the transport of sediments along a coast parallel to the shoreline. Longshore drift is the sediment moved by a longshore current. This* ***longshore current*** *is created when oblique incoming wind squeezes water along a coastline generating a water current that moves parallel to the coast.*