macphail ecological woods forestry project

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RESTORING OUR COASTAL SHIELD

A PEI Forested Landscape Priority Place Project

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Environment and Climate Change Canada
Environnement et Changement climatique Canada

Lennox Island First Nation

ISLAND NATURE TRUST

Canada

Prince Edward Island CANADA
Île-du-Prince-Édouard CANADA

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The Krummholz Project began in the winter of 2021, and has been gradually growing in scope, scale and reach. There are many organizations and individuals, both near and far, who have provided an amazing amount of support for this project.

Thank you to both the Provincial Government of PEI and Federal Government of Canada, who's funding through the Forested Land Priority Places for Species at Risk Program made this project possible!

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Thank you to the many land stewards of PEI. From governmental groups like our Provincial Government and PEI National Parks to local conservation organizations such as the Island Nature Trust (INT) and the Nature Conservancy of Canada (NCC) to private landowners. So many have worked hard to conserve our native habitats and graciously allowed me to access to their beautiful properties or provided opportunities to teach others about these special places.

Thank you to Lennox Island First Nation for their assistance and permission in visiting and exploring Pituamkek and Lennox Island. It was a magical experience each visit and such amazing sites to study.

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Thank you to my partner, Mille, for her patience and support with many long days of field and office work and a big thank you to my son, Henry, who helped on several field excursions.

THE KRUMMHOLZ PROJECT

Coastal forest recovering after post-tropical storm Fiona, Point Prim, PE

The Krummholz project was initially inspired by the aftermath of Hurricane Dorian, which landed on PEI September 7th, 2019. Macphail Woods co-director, Gary Schneider, was called to consult on the overwhelming blowdown amongst the aging white spruce at Cavendish campground. Upon assessment, Gary noticed that the gnarled wind-shaped spruce growing adjacent to the campground fared through the high-wind event with minimal damage. Our perspective on these unique **krummholz habitats** shifted, looking past their deformities to truly appreciate their integral and resilient role in our Island's ecological communities, protecting our shores and inland forests.

The first study, ***Exploring the Importance of Krummholz Forests***, took place between January-March 2021. With lots of long winter drives, this study focused on surveying shores across the Island in search of wind-blown coastal habitats. This resulted in the selection of eight sites for deeper study, as well as a host of other potential sites. A variety of data was collected across the study sites over the winter, and an ecological assessment rubric began to develop.

The second study, ***Increasing our Awareness of Krummholz Forests***, ran from March 2021-March 2022. It saw the addition of five new sites, including Pituamkek, for a total of 13 sites across the province. Sites were chosen to represent the diversity of coastal habitats found in PEI. From cliffs to dunes to salt marshes, our Provincial coastlines have been heavily shaped by a number of natural, historic and present-day forces, resulting in a large variance across these priority places. This study focused on understanding the floral and faunal communities that coalesce into the diverse array of krummholzing habitats found on our Island. It also included coastal species seed collection and propagation of a number of integral krummholzing native species.

The third season of krummholz research, ***Continuing Krummholz Preservation and Restoration*** *(2022-23)*, aimed to build off the previous studies, continuing a number of the same activities such as ecological assessment, biodiversity surveys and seed collection, as well as adding new goals such as on-site restoration, community outreach and a field trip to study coastal forests in northern Cape Breton. In the fall of 2022, the powerful Post-tropical storm, Fiona, struck PEI, harshly battering our coasts and forests. This allowed a unique opportunity to study our coastal forest resilience to high-wind events in real-time.

The 2023-2024 season of krummholz research, ***Stewarding Coastal Krummholzing Habitats***, ramped up restoration trials, primarily focused along PEI's north shore. Each site was located on protected land, either in the PEI National Park or with other conservation groups. Sites were chosen to provide a diversity of trial habitats & goals, from enhancement to afforestation plantings. In addition to the restoration work, new sites were surveyed, public walks & talks were given, many new coastal species were gathered and propagated at the Macphail Woods Native Plant Nursery.

All previous reports are available on the Macphail Woods website.

2024-25 SEASON


Coastal Forest Restoration at Stanhope, PEI National Park

The 2024-25 season of the project, **Restoring our Coastal Shield**, was heavily focused on **ecological restoration**, partnering with a variety of local coastal stewards, such as the **PEI National Parks, the Island Nature Trust, PEI Provincial Parks, and Lennox Island First Nation** as well as one parcel each of public and private land. The six sites differed in habitat, from dune to cliff, as well as restoration goals, from afforestation to enhancement. All restoration specimens were grown at the **Macphail Woods Native Plant Nursery**, some from seeds and cuttings collected during previous seasons of this project. All restoration specimens were geo-referenced for on-going monitoring with the goal of improving restoration methods, species selection and placement. Preliminary monitoring on previously planted sites was done with assistance of staff at Parks Canada.

Education and outreach efforts about these unique and important Island habitats also continued. A number of free public walks & talks were delivered throughout the year. These were aimed at targeting a diversity of interest groups, from coastal land/cottage owners, woodland owners, and the general public. In addition to these free events, there were numerous requests from watershed groups and other local organizations for coastal ecology consulting and training. These educational efforts ranged from coastal species identification training, natural shoreline restoration consultation, training and planning, as well as drafting ecological restoration plans.

Seed collection and coastal species propagation continued this season, with a number of rare and native species collected, including seaside sand-mat, juniper cuttings, bayberry seed, and more. Due to the huge demand for native species for restoration, a greater focus was put on propagating more specimens for future site enhancements. Propagation and plant care was done by the staff at the Macphail Woods Native Plant Nursery, who nurtured many new specimens for future planting seasons.


Coastal Krummholz Restoration with the PEI National Park

Although **research and assessment** were not an official component of this year's efforts, the previously developed, simple assessment template, facilitates easy and efficient data collection. New krummholz site data was collected at new relevant areas while collecting seed, surveying for other projects and during the lead researcher's family outings.

COASTAL FOREST RESTORATION

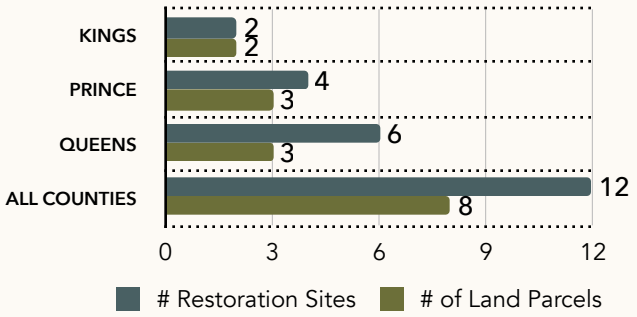
Afforesting a Coastal Buffer, Cabot Beach Provincial Park

Since 2021, eight properties across the Province have been part of this project's coastal forest restoration trials. Across these sites, restoration efforts were focused across 12 distinct planting areas, differing in a variety of qualities, from coastal type to habitat to restoration goals. Planting areas were defined as 300m diameter areas rather than by property parcel. Many of our coastal properties, such as the PEI National Park, are huge, encompassing a diversity of habitats and conditions. By creating targeted planting areas, restoration trials goals and results become much easier and more informative to analyze.

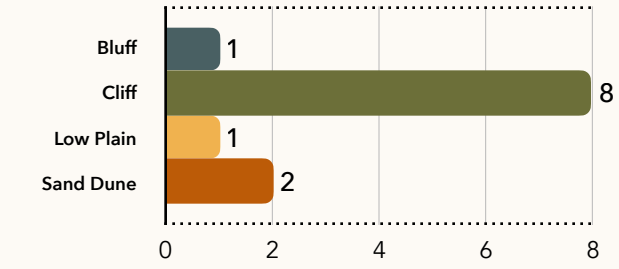
As the charts to the right show, restoration sites were spread equally across the province, although it should be noted that all but one of these sites were located along PEI's north shore. Sites were also selected to target the diversity of coastal types that can be found along our shores. While restoration trials were enacted across each coastal type, a far-greater number of cliff sites were chosen. This is partly due to high-proportion of cliffs along windy shores compared to other coastal types. Willing land stewards and their own goals were also another contributing factor, for example all sites across the PEI National Park selected for restoration were cliff sites. Although a number of trial sites were within the National Park, many other land stewards were also included in restoration trials.

While attempts were made to ensure a diversity of sites across the Province, future coastal forest restoration trials would benefit from increased site diversity, with more sites across low plain and dune shores, as well as areas further inland which still fall within the coastal forest zone.

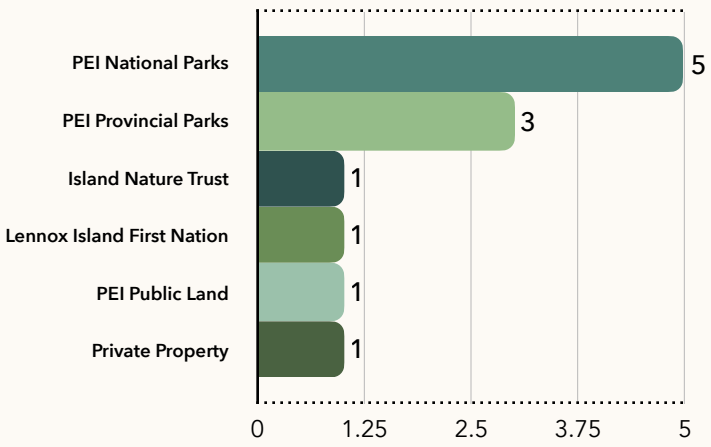
Restoration Sites by County



Restoration Planting Areas by Shore Type



Restoration Plantings Areas by Steward



RESTORATION PLANNING

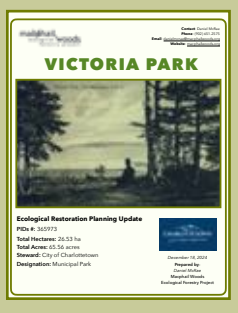
Stanhope Restoration Plantings, PEI National Park

While restoration trials are still underway, with a number of knowledge gaps and monitoring results still to be ascertained, many of the project's developed strategies, techniques, and methodologies have already proven successful. Since 2021, a variety of land stewards and conservation organizations have consulted with Macphail Woods for coastal restoration projects, particularly at high-wind sites. These developing partnerships include private land-owners, PEI Provincial Parks, local watershed groups, and the PEI National Park. A number of restoration plans and plantings have been enacted outside the official scope of the project. Despite this, these activities have relied upon methods, rubrics, and strategies developed over the course of the FLPP coastal forest project.

While there is still much to learn, the expertise gained over the course of this project has already begun to address a number of pressing ecological challenges across our diverse Island coastlines.

Fiona-Felled Coastal Forest Restoration at Cameron Island

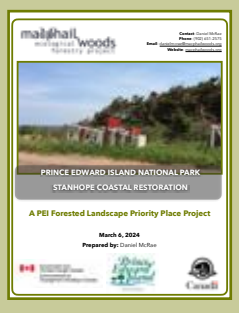
Coastal Forest Restoration Plan Examples



Victoria Park, City of Charlottetown

Cedar Dunes Provincial Park

Cabot Beach Provincial Park



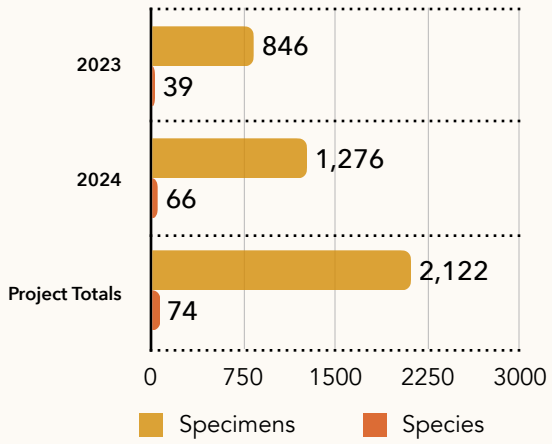
Stanhope, PEI National Park

RESTORATION ACTIVITIES

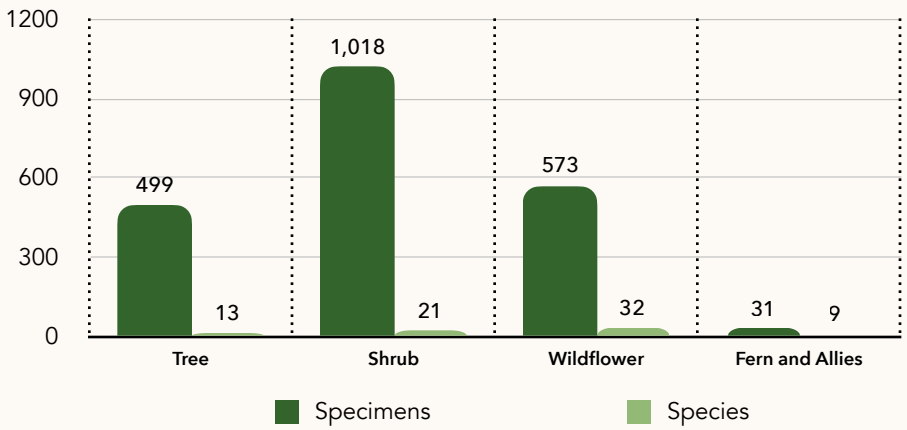
A Plethora of Plants for Coastal Restoration

Similarly to site selection, great efforts were made to plant a large diversity of species across all restoration sites. Over the course of consultation and planning, it was observed that most of PEI's coastal restoration efforts were often planted using only 1-4 species, primarily white spruce, bayberry, wild rose, and marram grass. While these are keystone species across many shorelines, there are so many other native coastal species which play incredibly important ecological roles. As the charts on this page showcase, a diversity of species were used across all restoration trial sites, with over 70 species planted in the last two years. 18 of these species are presently listed as uncommon or rare in PEI, with a total of 236 rare specimens planted during restoration trials. Many of these rare species are coastal specialists, found thriving in other coastal forests. It is hoped that through the restoration trials, we are establishing crucial seed sources which could help to bring back the population and widen the geographic spread of these important species.

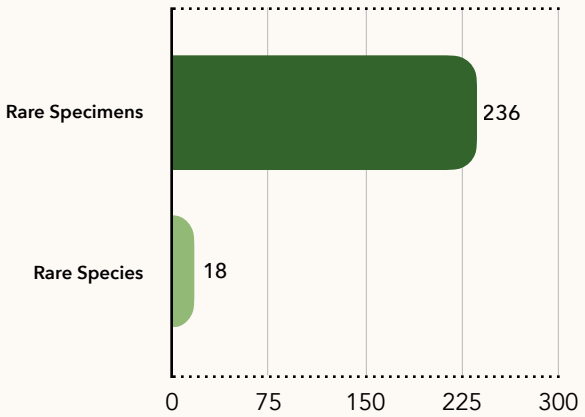
Coastal Restoration: By Year



Coastal Restoration: By Type



Coastal Restoration: By Rarity



RESTORATION SPECIES LIST

Enhancement Plantings with the Island Nature Trust, Cablehead, PEI

SPECIES LIST

FORESTED PRIORITY PLACE	Coastal Forests & Krummholz
PROJECT TITLE:	Restoring Our Coastal Sheild

BIODIVERSITY

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
Red Spruce	*Pinaceae*	*Picea rubens*	S5
Eastern White Pine	*Pinaceae*	*Pinus strobus*	S3S4
White Spruce	*Pinaceae*	*Picea glauca*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
White Ash	*Oleaceae*	*Fraxinus americana*	S2S3
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Sugar Maple	*Sapindaceae*	*Acer saccharum*	S4
American Beech	*Fagaceae*	*Fagus grandifolia*	S3S4
Northern Red Oak	*Fagaceae*	*Quercus rubra*	S3S4
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Osier Dogwood	*Cornaceae*	*Cornus sericea*	S5
Beaked Hazel	*Betulaceae*	*Corylus cornuta*	S5
Mountain Maple	*Sapindaceae*	*Acer spicatum*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Willow	*Salicaceae*	*Salix spp.*	N/A
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Canada Fly Honeysuckle	*Caprifoliaceae*	*Lonicera canadensis*	S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Alternate-leaved Dogwood	*Cornaceae*	*Cornus alternifolia*	S4
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Northern Bush Honeysuckle	*Caprifoliaceae*	*Diervilla lonicera*	S4
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Staghorn Sumac	*Anacardiaceae*	*Rhus typhina*	S3
Hawthorn	*Rosaceae*	*Crataegus spp.*	N/A
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Creeping Juniper	*Cupressaceae*	*Juniperus horizontalis*	S2S3
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Violet Sp.	*Violaceae*	*Viola sp.*	N/A
Northern Willowherb	*Onagraceae*	*Epilobium ciliatum*	S5
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Grass-leaved Goldenrod	*Asteraceae*	*Euthamia graminifolia*	S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Red Baneberry	*Ranunculaceae*	*Actaea rubra*	S4
White Goldenrod	*Asteraceae*	*Solidago bicolor*	S4
Herb Robert	*Geraniaceae*	*Geranium robertianum*	S4
Swamp Milkweed	*Apocynaceae*	*Asclepias incarnata*	S2
Mountain Blue-eyed-grass	*Iridaceae*	*Sisyrinchium montanum*	S5
Partridgeberry	*Rubiaceae*	*Mitchella repens*	S2S3
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Cut-Leaved Coneflower	*Asteraceae*	*Rudbeckia laciniata*	S2
Downy Goldenrod	*Asteraceae*	*Solidago puberula*	S4S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
Intermediate Bellflower	*Campanulaceae*	*Campanula intercedens*	S1
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Pink Corydalis	*Papaveraceae*	*Capnoides sempervirens*	S2
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
Prairie Cordgrass	*Poaceae*	*Sporobolus michauxianus*	S5
Canada Anemone	*Ranunculaceae*	*Anemonastrum canadense*	S1
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
Blue Vervain	*Verbenaceae*	*Verbena hastata*	S1
Downy Yellow Violet	*Violaceae*	*Viola pubescens*	S2S3
Woolly Blue Violet	*Violaceae*	*Viola sororia*	S4S5
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Foxtail Barley	*Poaceae*	*Hordeum jubatum*	S4
NON-NATIVE WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Common Yarrow	*Asteraceae*	*Achillea millefolium*	SNA
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
Common Lady Fern	*Athyriaceae*	*Athyrium filix-femina*	S5
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Interrupted Fern	*Osmundaceae*	*Claytosmunda claytoniana*	S5
Northern Beech Fern	*Thelypteridaceae*	*Phegopteris connectilis*	S5
Mountain Wood Fern	*Dryopteridaceae*	*Dryopteris campyloptera*	S4
Christmas Fern	*Dryopteridaceae*	*Polystichum acrostichoides*	S2S3
Braun's Holly Fern	*Dryopteridaceae*	*Polystichum braunii*	S1
Male Fern	*Dryopteridaceae*	*Dryopteris filix-mas*	S1

Heavy die-back on planted white spruce after 1st winter

Freshly planted white spruce hidden amongst the grass and goldenrods

Reclaiming old trails with a diversity of coastal forest species

SEED COLLECTION & PROPAGATION

Greenhouse, Macphail Woods Native Plant Nursery

Coastal native species seed collection and propagation has been an ongoing activity over the last three years of the coastal forest project. In addition to gathering wild seed, other propagation strategies were used, such as cuttings, both root and stem, as well as transplanting. Stock was gathered responsibly and thoughtfully, with close attention to appropriate and sustainable methodologies to ensure causing harm or long-lasting effects to wild populations would be avoided.

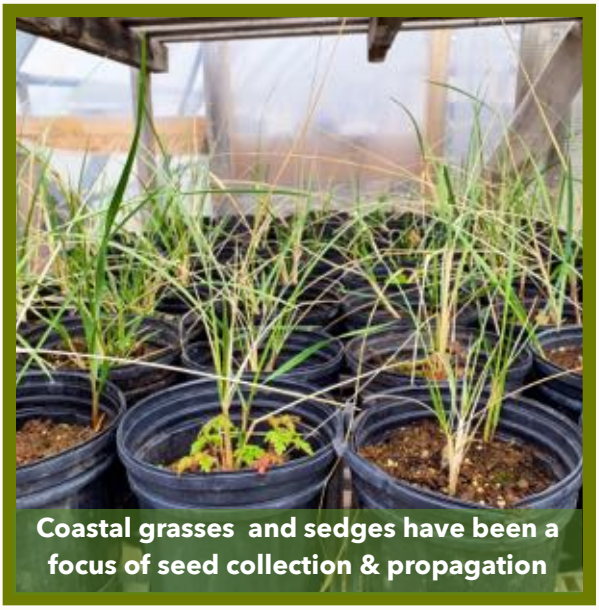
Growing plants from seed can be a long and slow process, although Macphail Woods Nursery Manager, Becky Byrne, has been specializing in native species propagation for over 15 years. Many of our native coastal plants are species that the Macphail Woods nursery has been propagating for decades, using tried and tested methods with high-success rates. Many of the rarer and specialist coastal species are new additions at the nursery, often with little available information on reliable propagation methods. For these species, any available research, as well as Nursery staff expertise and experience was used to develop methodologies hypothesized to have the highest success rates. Depending on the species, differing strategies were employed including various methods of stratification, soil mixtures, watering routines and collection methods. Some species germinate easily and quickly, while other seeds have a longer or specialized process to weaken the seed coating. Some species have other needs, such as sandier soils or more water. Post-germination care was also strategized, with special consideration to specimen conditioning. The greenhouse at Macphail Woods was integral in speeding up propagation. However if these specimens were to survive in harsh coastal winds, then some time to condition and grow outside would be needed as well. Despite this typically being a multi-year process, from seed to restoration specimen, some young plants were used in restoration work to test how well these unconditioned specimens could adapt to windy coastal habitats.

Pink Crowberries

The species list on the following page includes all the krummholz and coastal forest species under propagation at the Macphail Woods Nursery. Additional native species were also collected, where appropriate, and transplanted into the Macphail Woods Arboretum. With no seed produced or found yet, these species are not included on the following list.

SEED COLLECTION & PROPAGATION

Many maturing junipers



Coastal grasses and sedges have been a focus of seed collection & propagation

Beach Sedge, amongst the list of species that are still targeted for seed collection and propagation

Freshly Propagated Sea Rocket, *Cakile edentula*,

Collecting Juniper Cuttings, Crowberries, Three-tooth Cinquefoil, and Mountain Cranberry

SPECIES LIST

PROJECT:	Coastal Forest & Krummholz
	MWoods Seed Collection/Propagation List

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
Eastern White Cedar	*Cupressaceae*	*Thuja occidentalis*	S3S4
Tamarack	*Pinaceae*	*Larix laricina*	S5
White Spruce	*Pinaceae*	*Picea glauca*	S5
Jack Pine	*Pinaceae*	*Pinus banksiana*	S2S3
Eastern White Pine	*Pinaceae*	*Pinus strobus*	S3S4
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Northern Red Oak	*Fagaceae*	*Quercus rubra*	S3S4
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Staghorn Sumac	*Anacardiaceae*	*Rhus typhina*	S3
Mountain Holly	*Aquifoliaceae*	*Ilex mucronata*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Northern Bush Honeysuckle	*Caprifoliaceae*	*Diervilla lonicera*	S4
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Creeping Juniper	*Cupressaceae*	*Juniperus horizontalis*	S2S3
Common Bearberry	*Ericaceae*	*Arctostaphylos uva-ursi*	S3
Pink Crowberry	*Ericaceae*	*Empetrum eamesii*	S2S3
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Black Huckleberry	*Ericaceae*	*Gaylussacia baccata*	S4S5
Dwarf Huckleberry	*Ericaceae*	*Gaylussacia bigeloviana*	S3
Rhodora	*Ericaceae*	*Rhododendron canadense*	S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Sweet Gale	*Myricaceae*	*Myrica gale*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Northern Yarrow	*Asteraceae*	*Achillea borealis*	S5
White Goldenrod	*Asteraceae*	*Solidago bicolor*	S4
Downy Goldenrod	*Asteraceae*	*Solidago puberula*	S4S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
American Searocket	*Brassicaceae*	*Cakile edentula*	S4S5
Saltmarsh Sandspurrey	*Caryophyllaceae*	*Spergularia salina*	S4
Common Pipsissewa	*Ericaceae*	*Chimaphila umbellata*	S4
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Mountain Cranberry	*Ericaceae*	*Vaccinium vitis-idaea*	S3
Herb Robert	*Geraniaceae*	*Geranium robertianum*	S4
Hooker's Iris	*Iridaceae*	*Iris hookeri*	S2S3
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Mountain Blue-eyed-grass	*Iridaceae*	*Sisyrinchium montanum*	S5
Seaside Plantain	*Plantaginaceae*	*Plantago maritima*	S4S5
Sea Lavender	*Plumbaginaceae*	*Limonium carolinianum*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
Smooth Cordgrass	*Poaceae*	*Sporobolus alterniflorus*	S4S5
Prairie Cordgrass	*Poaceae*	*Sporobolus michauxianus*	S5
Saltmeadow Cordgrass	*Poaceae*	*Sporobolus pumilus*	S4S5
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
Partridgeberry	*Rubiaceae*	*Mitchella repens*	S2S3
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Chaffy Sedge	*Cyperaceae*	*Carex paleacea*	S4S5
Seabeach Sedge	*Cyperaceae*	*Carex silicea*	S4
Baltic Rush	*Juncaceae*	*Juncus balticus*	S5
Black-Grass Rush	*Juncaceae*	*Juncus gerardi*	S4
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Male Fern	*Dryopteridaceae*	*Dryopteris filix-mas*	S1
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5

Juniper Cuttings After a Season of Root Growth

Greenhouse Growing

COASTAL FOREST PRIMER

PEI is internationally famous for its shores, beaches, and seaside vistas. Despite our long history of coastal living with incredible numbers of residents and tourists exploring our shores over the years, our coastal forest habitats still remain rather mysterious.

This is partially because they are so diverse. Despite its small size, PEI has over 3000 km of coast line, made up of diverse coastal formations, from our tall red cliffs, to our iconic sand dunes, to our salty estuaries and bays. These structural shoreline differences are the results of interactions between coastal forces, shoreline soils, and the ecologies that develop along these transitional ecotones. With its increased exposure to the Gulf of Saint Laurence, our northern coasts are typically much windier, while our sheltered southern shores are protected from marine winds by the Northumberland Straight. The complex combination of local attributes, such as coastal exposure, average wind speeds and coastal composition, result in a wide variety of coastal forests across the province.

In addition to their complex diversity, PEI's shores have had a long history of ecological degradation. By the early 1920's, over 85% of the province was cleared, including most of our coastal areas. Our tall cliffs were cleared and farmed, dunes were grazed by cattle and set-up with canneries, and even many of our salt marshes were drained and used for livestock feed. While all Island habitats share this history and the associated challenges of ecological recovery, coastal habitats typically grow under much more challenging conditions, slowing natural processes of ecological succession, especially when there are far fewer native seed sources remaining.

This complex relationship between PEI's coastal attributes, ecological development, and land-use history, has left us with little mature coastal forest left across the province. Those few visited have showcased an amazingly surprising diversity of species, suggesting our coastal habitats have more potential than previously imagined and are still on a long and slow recovery process from past and on-going disturbances.

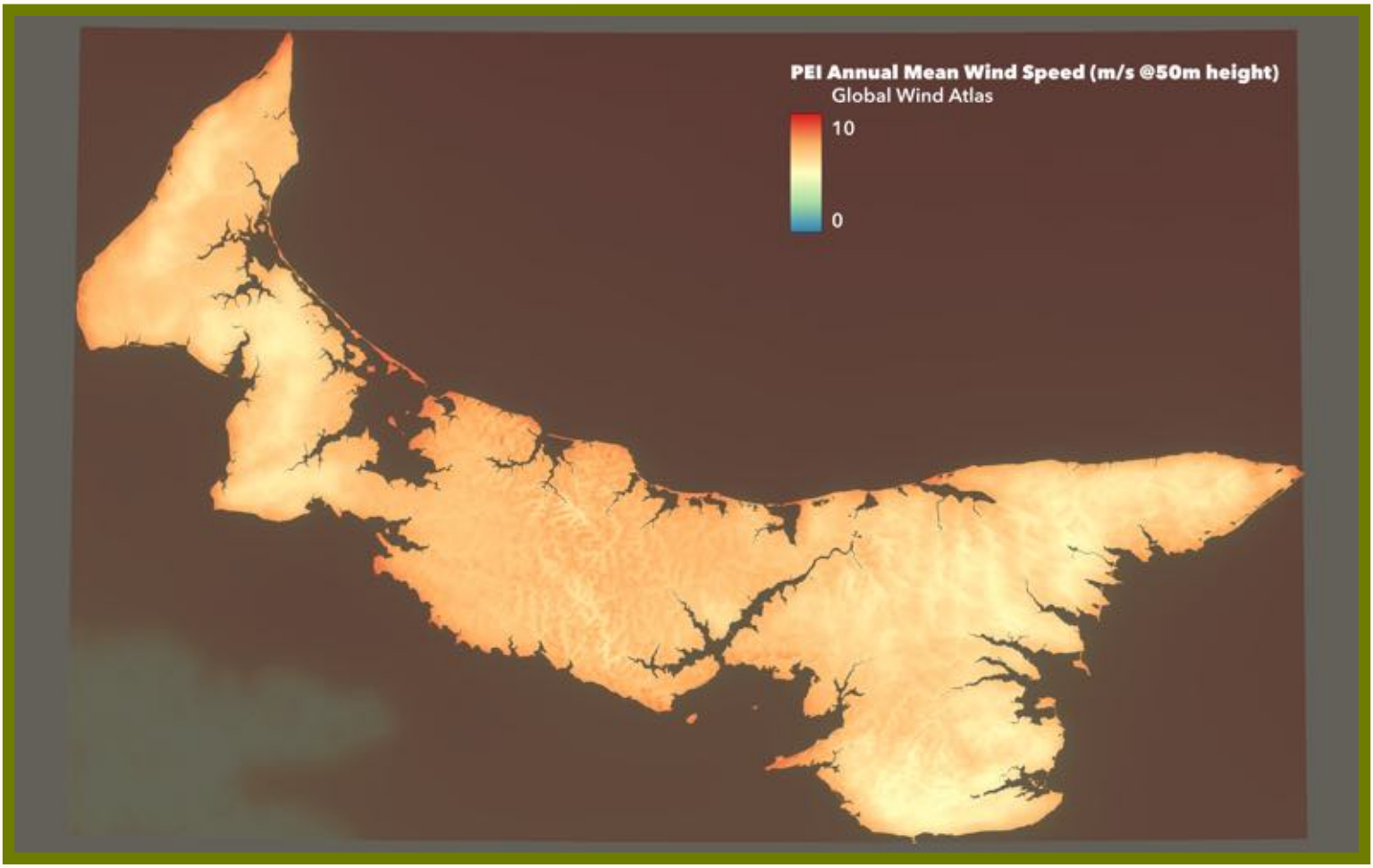
The health of our coastal forests is directly related to the health of our inland habitats and the protection of our local communities, infrastructure, and marine resources. Studies from other regions have linked healthy coastal forests to healthier shellfisheries. Established coastal habitat play a key role in mitigating constant marine forces and high-wind events, protecting inland locations from more severe damage. Despite their lack of direct financial return, our coastal forests are critical habitats, providing a coastal shield for all Island residents, whether leafy, furry, or feathered.

Capturing bird song in a coastal hardwood forest at Greenwich, PEI National Park

a calmer coastal forest

Exposed Clifftop Krummholzing Coastal Forest

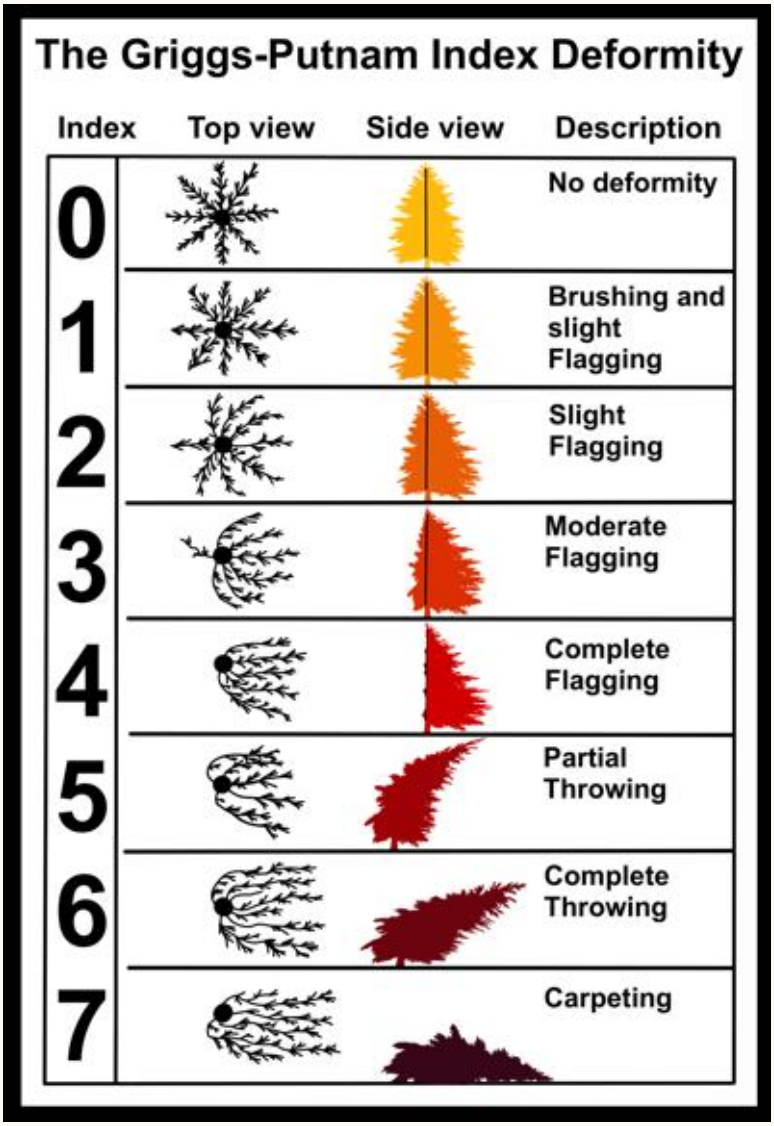
PROVINCIAL WINDS



Due to its small size, marine surroundings, and geographic situation, PEI is a windy place. As the map above from the Global Wind Atlas showcases, most of the province has annual mean wind speeds between 5-10m/s at 50m elevations. While this does not accurately describe the reality of our winds at truly local levels, it does demonstrate the broader trends, highlighting the higher winds across much of our coast line.

In many ways, the whole Island can be thought of as a larger scale coastal forest. The photo below shows a small dune woods on Tracadie island. Exposure to strong coastal winds, especially from the north, have deformed the shoreside spruce. These gnarled trees shelter the more inland areas resulting in more typical vertical growth. As one moves inland, increasingly sheltered conditions allow for a greater diversity of habitats and species, especially when combined with more complex soils, topography, and other variables. As we leave the centre of the woods, and head towards the southern coast, we again see an increased reaction to coastal forces, although less drastic than in the more turbulent north. Strong storms can cause disturbance events, felling large patches or coastal flooding inland, exposing new areas to marine forces. While the forest below does not showcase all that diversity due to its small size, it still serves as a broad example of the Island's ecology as a whole. Prior to European colonization, over 98% of PEI was forested. Our little sandy Island was similar to a larger scale and more complicated variation of the sandbar forest below.

GROWTH-FORM & WIND



As showcased in previous reports, the Griggs-Putnam Index Deformity, while not scientifically calibrated to our species or region, is still helpful in displaying the succession of deformity that woody plants demonstrate in reaction to mean wind speeds. In other words, by observing local woody plant shaping at potential restoration sites, qualitative wind speeds can be ascertained, informing planting strategies and species selection for improved success. The severity of deformity seen on-site suggests the level of conditional stress new plantings will undergo from local winds and waves.

The krummholz effect, while obvious along our windy shores, can be seen across the province, although often in much subtler form. The photos to the right showcase some types of vegetative wind deformation that can been seen across PEI. It should be noted that krummholz shaping is due to consistently strong winds across seasons or the whole year, not periodically strong winds, like those from storm events.

Typical High-Wind Cliff Krummholz - Primary Coastal Forest

Extreme deformation is the result of extreme winds. Globally found at higher elevations, PEI's low topography only lets these windswept forests develop along our coasts.

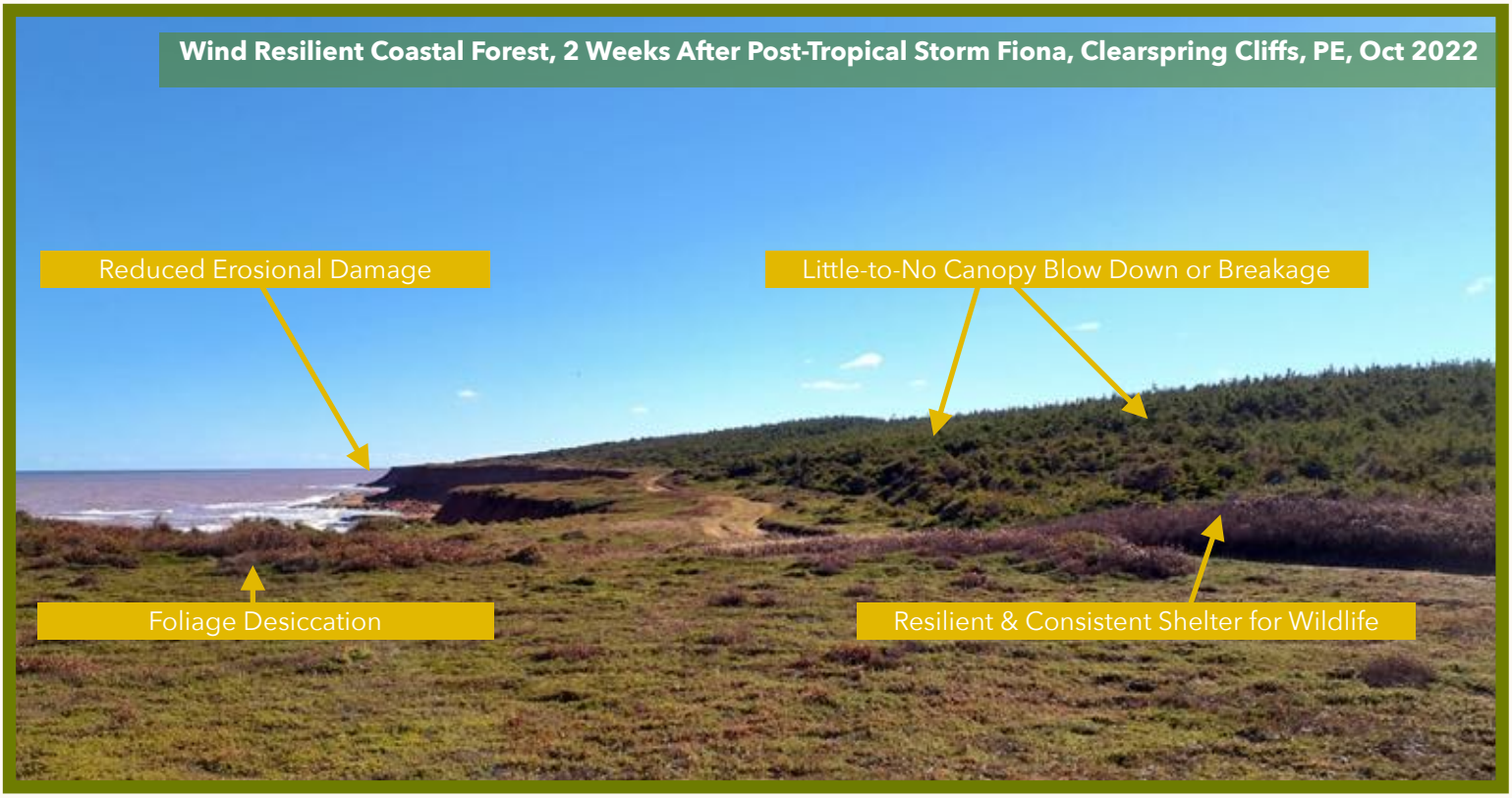
White Spruce with mild brushing where extending beyond Average Canopy Height

Inland areas can also be exposed to strong winds due to past or on-going land-use, isolated or degraded agriculture hedges, urban trees extending past roofs and fragmented forest edges.

Krummholzing Eastern Hemlock along the Murray River

Many of our open rivers, particularly larger systems, like the Hillsborough and Morell, can allow a variety of wind deformation across some surprising species.

PEI FORESTS & WIND



Although it could be argued that all of PEI's forests are greatly affected by our Provincial winds, most would only showcase extremely mild and localized deformation. Wind-events, which are part of PEI's atmospheric cycles, are another story. These are an integral part of forest succession and habitat diversity. In the healthy Wabanaki forest of the past, PEI's large tracts of woods would have provided a relatively unbroken buffer against strong winds and storm events. This would have resulted in more localized areas of blowdown, causing scattered shifts in forest canopy composition, acting as an agent of successional change, soil building, and species diversification.

Over the last 300 years, European colonization denuded the ecology of PEI. Nowadays, our habitats react differently to these historic forces. As seen after Juan, Dorian, and Fiona, our fragmented and degraded forests have much less resilience to these storm events, particularly when they are strengthening in both power and frequency as the climate changes. Despite the damage done, many of these sites are already regenerating and although many areas lack adequate biodiversity, they will still re-forest relatively quickly.

Our coastal forests share a similar history. Cleared, farmed, developed and more, most of our coastal habitats are heavily disturbed, although many have been naturally regenerating for decades thanks to coastal stewards such as the PEI National Park. Despite this recovery time, these high-wind coastal forests are forced to regenerate under harsh conditions. Patterns of ecological succession and intra-species relationships become increasingly important for the success of the whole under drastic and constant coastal winds. Once established, these coastal forests show increased resilience to both consistent winds and storm events, resulting in less blow-down, coastal flooding and erosional storm damage. The few remaining mature sites visited during fieldwork, showcased a surprising diversity of species which are not commonly found in coastal conditions. This would suggest that most of our forested shores are still in a long and slow ecological recovery due to past land-use.

Our coastal forests and associated habitats are incredibly productive and resilient communities, providing a great number of ecological services benefitting local wildlife, and both human and environmental infrastructure. After a long history of ecological disturbance, our coastal forests remain under threat for on-going coastal development, more severe storm events, a lack of biodiversity, and a challenging and slow ecological process of recovery.

COASTAL FORESTS OF PEI

Mature Coastal Forest Canopy, Pituamkek National Park Reserve

As described, PEI's coastal forest have a general history of high-use and widespread land clearing. Although this trend lessened in the latter half of the 20th century with the decline of farming, increasing tourism and shoreline development have led to a slow creep of cutting back into our coastal habitats. Despite their challenging ecological history, large swathes of our coastline are protected by various conservation groups, some areas for many decades. Other parts of the coast are still heavily farmed, preventing the natural regeneration of these important forested habitats. Even more areas have seen substantial changes in their coastal configuration, from erosional rates to littoral patterns, typically due to nearby marine disturbances or long-term local land-clearing. Post-tropical storm Fiona demonstrated our vulnerability to volatile winds, especially in our most disturbed habitats, whether shoreside or inland. Surprisingly, our most intact coastal forests fared the storm with little damage, showcasing the importance of the ecological services they provide.

PEI's coastal forests are a diverse lot, even if much reduced nowadays. The photo above shows off the predominantly deciduous sugar maple, red oak, and white ash canopy found on an island in the Pituamkek National Park Reserve, located along the northern mouth of the windy Malpeque Bay. Its forest floor also showcases an equally impressive and surprising diversity in this relatively undisturbed coastal habitat. This culturally important place is a uniquely mature example of the diverse communities that many of our coastal forests are capable of supporting, given time, space, and seed sources.

Presently, our coastal habitats are highly disturbed or still recovering, seldomly displaying the hardwood dominance or species diversity of the Pituamkek Forest above. Despite this, our coastal forests are still diverse habitats, requiring resilient and adaptable community members to cope with the intense marine forces of winds, waves, salts, and sands. Due to these powerful pressures, growing conditions can shift quickly in a coastal forest, from wind-blown cliffs to sheltered mature dune forests. In the most exposed areas, there is most often only a small specialized plant community that can thrive, while meters away conditions can allow for a whole new botanical community to develop. This pattern of extremes carries forward into other ecological influences, such as soil moisture and nutrient availability, biodiversity, and habitat fragmentation. As the community grows on a thin edge of survival, these other ecological factors become critically important, quickly shifting botanical health, growth form, and diversity. For example, our dry primary dunes generally only support a small community of specialists, for instance marram grass, starry false Solomon's seal and bayberry. While a dune swale, with more water availability, can be home to completely different group of plants, such as sphagnum mosses, bog orchids and Canada rhodora.

CATEGORIZING COASTAL HABITATS

Diverse & Interconnect Coastal Habits, Greenwich, PEI National Park

Similarly to the rest of PEI's natural ecology, our coastal cliffs and dunes often develop into forested habitats, given enough time, space, species, and a lack of ecological disturbances. With the diversity of our coastline geography, morphology, and soil structure, as well as the many native species of PEI, it is no surprise that our local processes of habitat succession can take many forms along our shores.

Categorizing the mosaic of PEI's coastal habitats can be a prickly process. Intense marine forces can create massive differentials between micro-sites, shifting growing conditions quickly and drastically, encouraging very different communities to develop side by side. Not only are these micro-habitats in close proximity, but they are integrally and ecologically linked together for their mutual survival. A spruce grove can't grow on a bare dune, and while the shrub and coastal barren may not officially be a forest, the forest relies on their ecological services to propagate, establish, and thrive.

To the right are a selection of different coastal forests. Despite sharing many similar ecological pressures, most of these are home to vastly different biotic communities,. Typifying all the natural variations of our coastal forest habitats is a herculean effort, rendered nigh impossible due to the wide-spread ecological degradation and successional regression found across most of our shoreline spaces. That being said, identifying and categorizing many of the primary pressures along our coast is a simpler and effective strategy to inform restoration work across our diverse shores.


Clifftop Krummholz Coastal Forest


Swampy Cedar Dunes Coastal Forest


Developing Dune Swale Coastal Forest


Low Plain Coastal Bog Forest

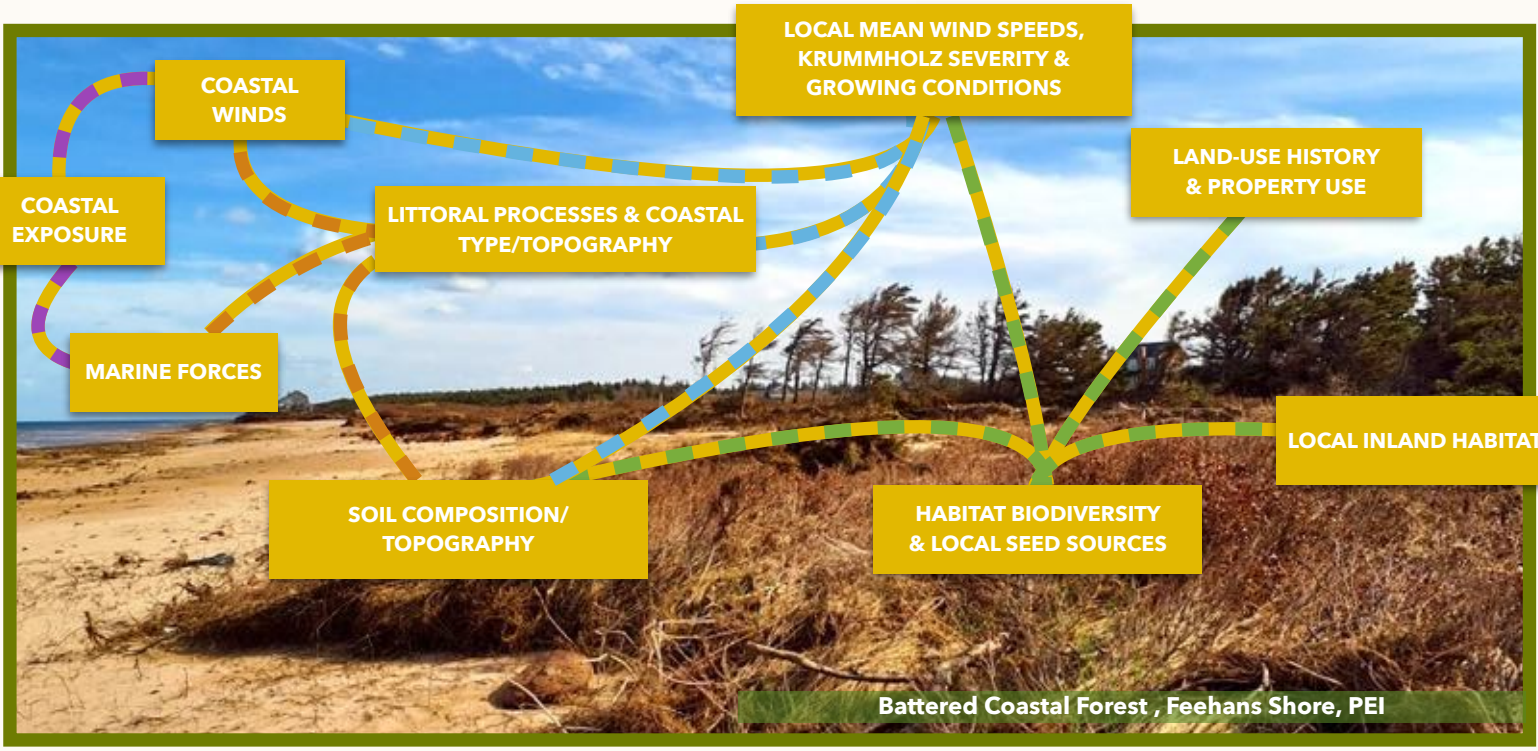

Disturbed & Denuded Coastal Area


Secondary Dune Black Spruce Basin Head Coastal Forest

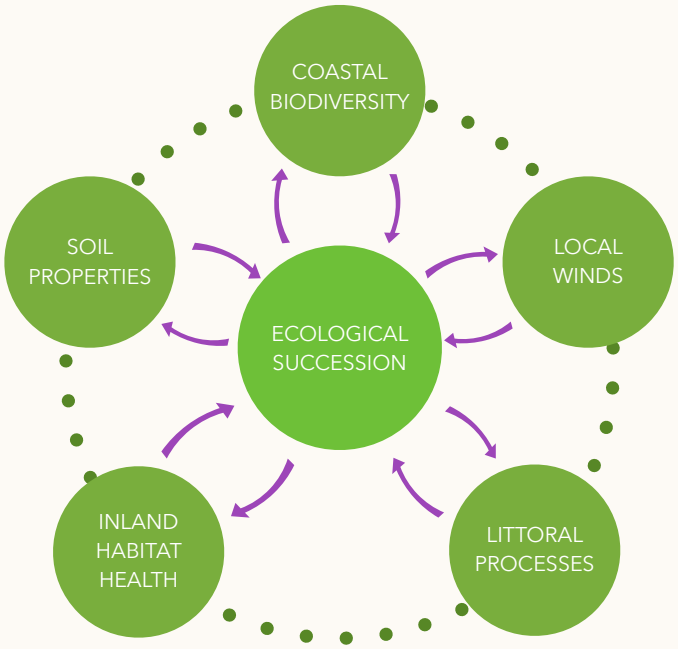

Mature & Undisturbed Deciduous Pituamkek Coastal Forest


Perched Bog Coastal Forest North Cape

COASTAL FOREST INFLUENCERS



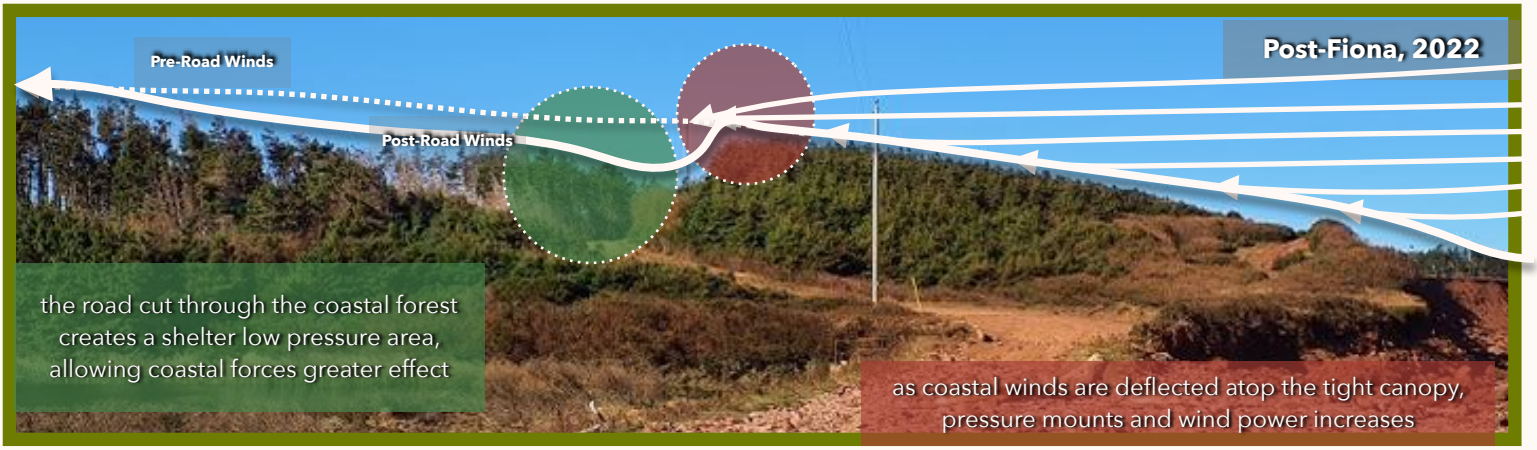
PEI's diverse array of coastal forests and associated habitats all grow under the pressures of categorically similar and interconnected forces. The flow chart and photo above, attempt to illustrate some of these major forces and associated characteristics. While an oversimplification of a incredibly complex ecology, the chart does demonstrate the interrelations between some of the major conditional pressures influencing local biodiversity, habitat health and ecological succession.



A shore's exposure to coastal forces, whether along our seaside northern cliffs or in a sheltered estuary, greatly affects the power of coastal winds, waves, salt sprays, and erosion. In turn, these forces, interacting with the area's soil composition and topography, result in the type and severity of coastal littoral processes and local wind speeds. The growing conditions of these ensuing coastal landscapes, whether exposed cliffs, shifting dune systems, or marshy estuaries, are micro-dynamic and heavily altered by small changes in wind speed, soil moisture, and vegetative shelter. Local inland habitats and land-use history are typically the other dominant influences on coastal habitat biodiversity and associated floral communities.

Again, this is an oversimplification, failing to acknowledge key feed back loops caused by time and ecological succession. As coastal forests mature, their vegetative community begins to fulfill a variety of ecological services, from soil building and enrichment to lowering local wind speeds. Coastal growth can alter littoral processes, slowing erosional rates through dense vegetative rooting. As coastal protection develops, inland habitats and infrastructure are better sheltered from strong winds and the ravages of storm events. Although complex, the role of time and ecological succession on coastal habitats is an important consideration to inform quality habitat restoration, strengthening the innumerable benefits of our healthy coastal forests.

WINDY COASTS



Many of our coastal forests grow under extreme marine pressures, constant and powerful winds and waves, heightened to dramatic levels during storm events. It is in along these coasts where careful attention must be paid to all coastal attributes, as the extreme conditions make these habitats particularly vulnerable to ecological disturbances. The photo diagrams above showcase the same site near Gillis Pond in Clearspring over the last couple of years. It visualizes some of the complex local winds and their patterns in relation to vegetative changes. A road was cut into the coastal forest between 2000 and 2010, reducing the canopy's protective layering and shifting local wind patterns. The newly exposed forest had originally grown under more sheltered conditions, never developing as much resilience to wind, resulting in sudden blow-down. Over the last 15 years, more local specimens, now even more exposed, have succumbed to die-back and death. More frequent storm events such as Fiona and Dorian, will only allow these strong coastal forces to further penetrate and disturb these newly exposed areas, reducing canopy closure even more and powering this feedback loop onwards. It is worth noting the relatively undisturbed coastal forest front, changing very little over the course of the photos. It demonstrates the powerful resilience that our coastal habitats develop when left intact and allowed to mature, not to mention the protections they can provide for our more inland habitats.

These effects are decidedly less pronounced along our lower wind and more sheltered shores. Along these shores, often our southern or estuary coasts, marine forces can still cause great effect, although these tend to be more infrequently during storm events. Interestingly, these calmer coastal forests can be more vulnerable to high-wind events as they lack the constant conditioning of windier sites. Despite their typically calmer weather, many of these coasts are associated with lower elevations, creating a greater susceptibility to daily tides, sea-level rise, and coastal flooding. Again these tend to happen during our more infrequent coastal events, however, if severe then they can cause expansive change in coastal forest ecologies, saturating inland soils with salts, resulting in massive canopy loss amongst other damage. Road-building along our shores can greatly exacerbate coastal flooding effects, trapping salty waters in new places for longer periods.

MOVING INLAND

High-Wind Coastal Cliffs, Naufrage Littoral Cell, PEI

These complex, dynamic, interconnected feedback cycles between abiotic and biotic variables are not unique to coastal habitats. However, along our windiest coasts, the sheer magnitude of these forces create extreme growing conditions, overshadowing the selective pressures of more traditional forest influencers like shade and sunlight. As one moves inland, these marine driven forces lessen in power and ecological dominance, allowing more traditional habitat conditions to have greater pressure on ecological succession and species composition.

The magnitude and reach of these tapering coastal forces is primarily dependent on the exposure and mean winds speeds along the coast. At our windiest sites, this coastal effect can be a prime ecological influencer for hundreds of meters inland. Along our calmer estuaries and sheltered shores, more typical inland habitat configurations can be found growing abutting the coast.

In many way, PEI's riparian forests & coastal forest share some thematic similarities. Both are effectively interactive ecotones, transitional spaces centred around places where very different ecologies meet. The character of a river running through upland hardwood habitat differs from one passing through a boggy woods, or a denuded field. Although both riparian and coastal habitats have their own native specialists and ecological patterns, their baseline ecology is often heavily influenced by the systems that they cut through or abut against.

There are a number of famous examples of this phenomena across PEI. Cedar Dunes Provincial Park is a coastal dune system which is adjacent to inland forested swamps. This has resulted in a unique coastal dune cedar forest, more traditionally dune-like near the shore, while more like a classic Island cedar swamp as one moves inland. This process can be more apparent in western PEI, with its distinctive soils of predominantly lower drainage, resulting in semi-swampy coastal forests. It can also be seen along our calmer southern shores, where the weaker winds allow more inland species to thrive.

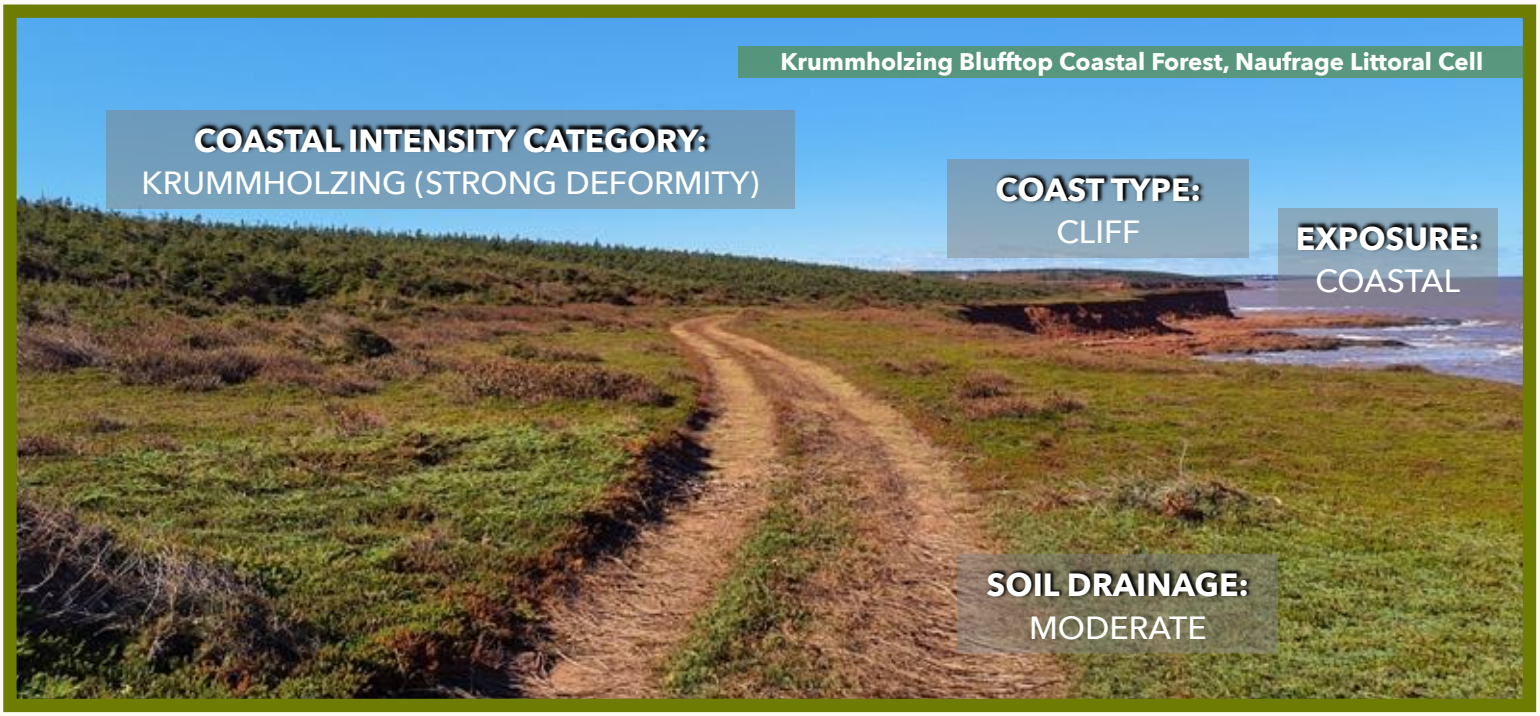

No Cedars on the shore but many grow on old sheltered and swampy dunes


In the Calmer Percival Bay, inland wet woodlands grow abutting the shore, showing only minor wind deformation


Much of the National Park has regenerated from limited seed sources under harsh open conditions, facilitating the dominance of the wide-spread white spruce seen today

This same effect can occur when inland habitats have seen long-term ecological disturbances. Most areas of the PEI National Park were cleared and farmed prior to protection. Many of the recovering coastal forests in the park are predominantly old field white spruce, initially growing with poor biodiversity due to a lack of nearby native and historic seed sources. These areas are often home to a greater populations and varieties of non-native species, weedy holdovers from past agricultural production. Interestingly, though dense, the park spruce stands have been breaking up in recent years, revealing a sporadic new generation of deciduous species.

COASTAL ATTRIBUTES

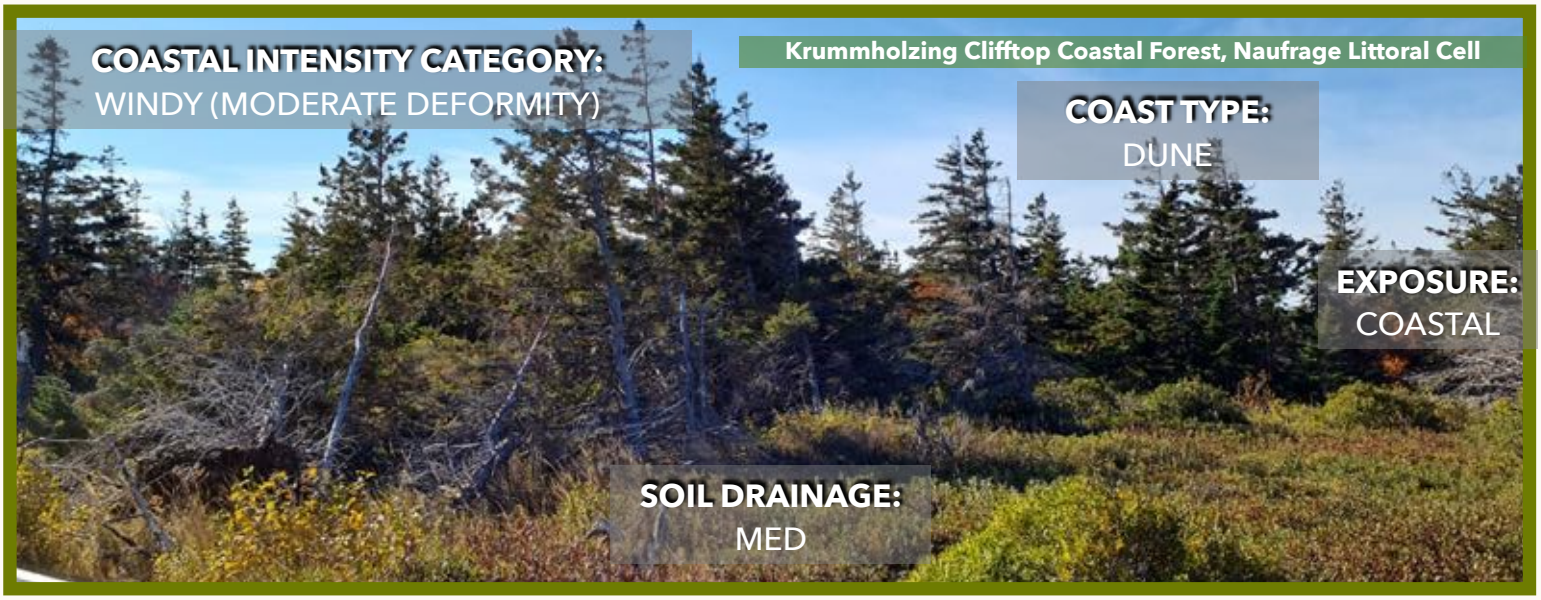


As described, PEI's coastal habitats share a number of similarities with our inland forests. In many ways, our coastlines are transitional spaces, merging marine and inland habitats. Where marine driven forces are strong enough, they can become the dominant influence on local growing conditions, sometimes for hundreds of meters inland. When assessing coastal forests and their interconnected habitats, with the goal of ecological restoration, it is crucial to comprehend the severity and effects of local coastal forces. These forces vary greatly across our shores, due primarily to a small number of complex attributes, from geographic position and location to local topography and soil composition to the coastal intensity of winds and waves. In addition, the effects of these forces can be incredibly localized and although there are a number of data-sets and GIS layers available describing some of these attributes, most fail to accurately capture critical site specific nuance. This necessitates on-site assessments when planning any restoration work, in which quantifying most of these coastal attributes can be timely, inefficient, and often an unneeded activity.

To simplify this process, the coastal forces that influence growing conditions across our shores have been broken up into primary and secondary coastal attributes. Many of these attributes have been simplified into qualitative categories, allowing for more efficient field assessment while still yielding useful ecological insights. By determining the category for each of these coastal attributes, some general conclusions can be drawn about the average coastal conditions, their existing habitats as well as their ecological needs. This information can be used to inform future restoration strategies, species selection for plantings, as well as address on-going ecological issues and build resilience for the future.

Given the diversity of coastal conditions and habitats, these coastal attributes can greatly vary on their local effects, both in intensity and inland reach. Along calmer shores, only assessing the primary coastal attributes may be more than enough to inform successful and efficient restoration work. While our windiest cliffs and dunes can often require more intensive understanding of local growing conditions to ensure restoration success. These intense *krummholzing and windy* coastal forests are under extreme conditional pressures, which can vary across a site. Restoration along these windier coastal habitats generally benefit from a more in-depth field assessment, using the secondary coastal attributes and/or more intensive quantification methodologies.

PRIMARY COASTAL ATTRIBUTES



PRIMARY COASTAL ATTRIBUTES:

The primary coastal attributes are generally the most dominant pressures on local coastal ecology. Though these categories are simplifications of incredibly dynamic processes, they successfully distill broader ecological challenges, pressures, issues, and solutions. The goal of this system is to efficiently gather information about local growing conditions at a macro-level, with the focus of improving restoration work.

SECONDARY COASTAL ATTRIBUTES:

Each of the primary attributes has a number secondary characteristics, as well as numerous ways to quantify these metrics which can yield deeper analysis and more site-specific conclusions. The ecological dominance of these coastal pressures can reach hundreds of meters inland at the windiest sites. While sheltered shores will have a very limited zone before these weaker coastal forces give way to more typical inland growing conditions. Not only can shoreline forests be dramatically different due to varying coastal conditions, but these extreme conditional variations will often occur across the site.

PRIMARY COASTAL ATTRIBUTES

1) **EXPOSURE**

How exposed is the site to consistently strong winds and/or coastal forces? Knowing an area's exposure can suggest how powerful and from what direction the winds typically blows, as well as anticipating what other coastal forces may be affecting a site.

Are you located on a wind-blown coast? A sheltered estuary? Along a wide and windy riparian area? Inland amongst our fragmented upland forests and old fields?

2) **COASTAL TYPE**

While helpful to understand greater littoral processes, identifying what geomorphic coastal landform your habitat is growing on helps to define a number of ecological characteristics.

Are you on a tall cliff? Amongst the sandy dunes? Wading in a salt marsh? Perched on a small crumbling bluff?

PRIMARY COASTAL ATTRIBUTES

3) **COASTAL INTENSITY**

This category attempts to summarize the consistency and intensity of coastal forces, primarily wind, in our shoreline habitats. By observing local tree deformation on-site, average wind intensity can be gauged qualitatively. This attribute has massive effects on local growing conditions, habitat resilience to storm-events, and species distribution and composition.

Are the local trees: Wind-blown, gnarled, half-dead looking and growing low to the ground? Less-obviously wind-shaped, slightly bending with the winds, quickly resuming typical growth-forms just inland? No intense woody-shaping but with reduced or no foliage growing on the windward face of the trees? Is there minimal deformation, appearing to be a typical inland forest but just growing along the coast?

4) **GENERAL SOIL CHARACTERISTICS**

Local soils are the medium of growth for our botanical community and their composition has wide-effects on erosional rates and more. In lieu of in-depth chemical testing, some simple and often obvious soil characteristics can be enough to inform restoration, improving species selection and placement.

Are the local soils: dry and sandy? More-or-less standard red Island soil? Are there pools of standing water and fine-grained silty soils, often grey? Are soils thin, underlain by sandstone, and on the top of a cliff? Or deep, dark, and mucky in a coastal marsh.

5) **LOCAL BIODIVERSITY**

Knowing your local plant and animal community is crucial for good restoration. Whether taking note of available native seed sources, documenting canopy composition, or noting nesting bird species, get to know the population of your coastal ecology.

What species are: Growing in the canopy? Along the shore? In highest winds? Covering the ground? Nesting on site? Browsing or feeding?

EXPOSURE


Coastal Cliff Near Red Point Provincial Park

Exposure to winds and other coastal forces is a multi-faceted attribute. The magnitude and reach of its effects are dependent on a variety of factors, complicated to quantify. Basically, regional atmospheric conditions drive wind speeds locally, depending on changing temperatures and air pressures. Despite their strength, winds will be slowed through frictional contact with local landforms, vegetation and more. Along our most exposed coastlines, local winds are typically stronger, primarily due to the low-frictional qualities of water. For example, our windy northern shores are widely exposed to the large Gulf of St. Laurence, a vast and low-friction expanse, slowing coastal winds little. The frequency and power of our local waves are integrally driven by local winds and their *wind fetch*, the unobstructed distance winds can travel over open water in a constant direction. Coastal exposure is effectively a measure of a locational probability to receive to stronger average winds due to greater wind fetches. This a quantifiable metric, with an Island-wide analysis done in 2012, used as a baseline for the following exposure categories. With the goal of simpler and more efficient assessment, the following four exposure categories were determined to be adequate during restoration trials, although secondary exposure characteristics were also used as well.

Across our windy province, all forested habitats are affected by their exposure to strong atmospheric forces, although most inland areas do not see the consistent intensity needed for extreme wind effects such as tree deformation. That being said, local land-use, elevation and topography can greatly increase the exposure and susceptibility to strong winds across any inland or riverine habitat.

Along our coast, higher exposure not only means higher average winds, but also brings a bevy of wind-powered coastal forces including high-waves, salt-spray, and more vegetative desiccation. Although a site's exposure is a nuanced and complicated pressure, it can be simply and aptly categorized into four types. Each of these types share similar resiliencies, challenges, and pressures when it comes to winds and waves.

At a micro-level, changes in coastal configuration, orientation and maturing vegetative growth can all shift a specific area's exposure to winds and other coastal forces. The broad exposure categories below are both an oversimplification and generalization, failing to truly capture the nuance of our coastal habitats. While our tall red cliffs are often categorized with *coastal* exposure, there can be vast differences between a headland and bay. Again, a number of ecological feedback loops exist, changing a site's exposure with time and growth. As coastal habitat mature, their expanding vegetative cover increases the frictional drag on local winds, incrementally weakening their power, lowering exposure on the leeward side.

While our estuaries, rivers, and inland sites can be highly exposed to local winds and coastal forces, these areas generally lack the *wind fetch* needed to facilitate consistency, both in direction and power. These areas can still be highly affected by local winds and waves, however due to a drastic drop in consistency and power, the magnitude of the wind's ecological influence can be overtaken by other ecological variables. This effect creates a number of vulnerabilities and resiliencies at these sites, such as less wide-spread and extreme wind deformation, but a great susceptibility to storm events, coastal flooding, salt water intrusion.

COASTAL

East Point Krummholzing Clifftop Coastal Forest

Perhaps the most obvious category, *Coastal* sites develop along our open coasts, often exposed to the strongest shoreline winds. While not all our coastal sites have extreme winds, our *krummholzing* coastal forests are only found growing along these highly exposed shores.

With little to divert or slow oncoming marine winds, our coastal sites tend to grow under the most consistent winds, both in terms of speed and direction. This consistency, when coupled with strong winds, creates incredibly harsh growing conditions and woody plant deformity, resulting in our most gnarled krummholzing coastal forests. This process is generally more extreme along our higher-elevation cliffs and bluffs. Although typically hit by even stronger winds, these tall sites often have thinner soils but with just enough water availability to support extreme vegetative deformation, such as low-growing carpeting spruce. In our dunes, diverse topography, low-elevation blow-outs, and typically dryer soils reduce the apparent krummholzing effect despite equally strong winds. Coastal sites tend to be more resilient to forest damage from storm events but are often subject to the most powerful erosional forces, as well as coastal flooding at low-elevation sites. These sites often grow under the harshest conditions and can be extremely sensitive to land clearing and other ecological disturbances.

ESTUARY

Low-plain Estuary Forest

PEI's sandstone structure, numerous rivers, and coastal diversity have helped to carve many bays and estuaries across the province. These are located across all our coasts and although still heavily affected by marine forces, they are generally sheltered from the strongest and most consistent winds. Highly associated with the low plain/salt marsh coastal type, these shores typically have much calmer winds due to their decreased exposure.

This fact is both a blessing and curse. Lower average winds results in less deformity and easier growing conditions, sometimes resulting in more typical inland habitats growing to our shores. However, without constant exposure to strong winds, these habitats develop with less resilience to high-wind events, never needing to root as deeply or shape themselves more aerodynamically. After Fiona, sites along our estuaries typically had more resulting blow-down damage.

With calmer winds and waves on average, these sheltered sites can differ greatly from *coastal* areas. Their associating with lower elevation shores causes them to be more prone to coastal flooding.

EXPOSURE

As mentioned, an area's exposure to winds and marine forces is a complicated site-specific confluence of a variety of ecological attributes. For most restoration efforts, exposure values do not need to be specifically quantified, knowing the type of exposure will be enough to anticipate a number of ecological stresses and challenges. That being said, there are a number of secondary qualities about an area's exposure, its effects and ecological patterns. Firstly, noting the marine orientation of the coast can be helpful. On PEI, our northern coasts are typically more exposed with higher average winds. While on our southern shores, marine winds rarely have the fetch, power, or consistency to form krummholzing forests. Obviously, one exposure rating for each site fails to accurately describe the varied micro-conditions across the area. When combined with ecological wind zonation, qualitative or quantitative exposure values could be applied across a site, noting more nuanced shifts in growing conditions, improving species placement during restoration work.

NON-COASTAL EXPOSURE TYPES

While not coastal, our inland habitats can nonetheless be highly exposed to winds and potentially even coastal forces. This is highly depending on local site elevation, topography, fragmentation, and land-use history. As we saw during Fiona, many of our inland forests were heavy hit by the post-tropical winds, primarily highly exposed and poor health habitats.

While this category won't be useful in assessing coastal forests, it was used during analysis to clarify the ecological difference between our inland and shoreline sites. Further work would be valuable to better understand Inland exposure and its effects to better inform restoration and land-use planning.

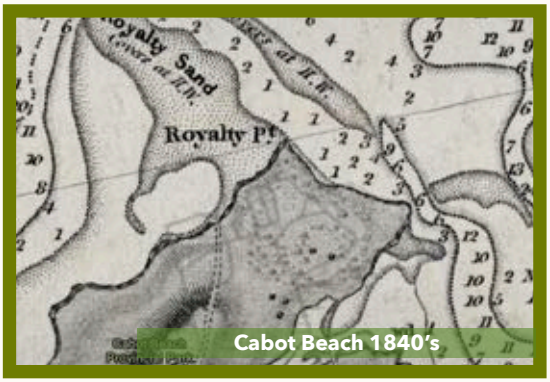
Generally very similar to Inland areas, PEI boasts a large number of diverse rivers. While the bulk of our rivers are small, shallow, and boasting small vegetative buffers, others are wide and variable saline watercourses. These larger river valleys, such as the Hillsborough and the Morell, can act as aeolian tunnels, funnelling winds down the valley. This can result in both small-scale wind deformity, especially in some surprising species, as well as increased blowdown and damage from storm events.

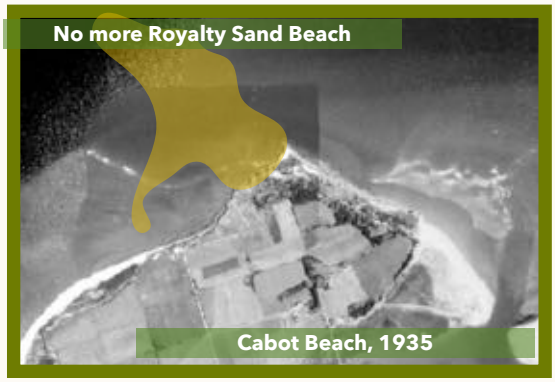
COASTAL TYPES

As described in previous reports, PEI's shores can be broken up into sections, or cells, which are interconnected through their coastal littoral processes. These littoral cells act much like watersheds, but grouping related areas of sediment transportation along the coast, instead of water through the land. Through the interaction between PEI's geography, geology and the powers of local waves and winds, our coastline is shaped into its recognizable scenes of tall cliffs, rolling dunes, and swampy marshes.

By identifying the coastal type, many typical ecological conditions, pressures, stresses, and processes can be presumed. These simplified categories improve the quality and enhance the efficiency of restoration planning and work. Obviously, our coastal formations are more nuanced and diverse, with areas which transition between two or several types in close proximity. These structures can even shift and change quickly considering their geological origins, with storm events and land-use causing fast and sometimes massive alterations.

Disparate shores across PEI can be interconnected through littoral processes, where changes in sediment movement in one area can have effects kilometres down the coastline. Even sediment disturbances in the water can end up having affects across the littoral cell or in localized areas. While small restoration plantings and projects along the coast may not need this wider understanding of littoral processes, any infrastructure or land clearing projects can end up causing unforeseen and detrimental effects when coastal sediment flow is not accounted for. Cabot Beach Provincial Park is a perfect example. Once home to much a larger dune system and most likely mature forests and wetlands across most of the property, the 1935 historic aerials and even earlier records show that most of the land was cleared other than a thin coastal forest buffer along the northern dunes. The expansive loss of dunes since the 1840's map are also of note. Cabot Beach sits in a sediment accretion area, fed by littoral processes from both the east and west. While the exact origins of local marine dredging are unknown, the park's waters are dredged to the east and west, preventing historic littoral transportation patterns and disrupting dune-building processes. Coupled with the extensive land-clearing, this has resulted in dramatic changes to the coast line, a reduction in dune habitat, and decreased ecological resilience to local marine forces.





COASTAL TYPES

CLIFFS & BLUFFS

Coastal Cliff at Cabot Beach Provincial Park

While distinctive each on their own, cliff and bluff coasts share a number of ecological similarities. Often elevated well above the waves, these sites are less prone to coastal flooding but are generally more exposed to stronger winds. These higher-elevation shores are the only coastal type in which *carpeting* flora specimens have been found. This coastal types tend to share many of their floral specialists with Cape Breton's coastal barrens.

Despite their elevation above the waves, these coasts are still battered by waves, typically causing higher average rates of erosion, especially along bluffs of unconsolidated material. Bluffs tend to have more growth along their coastal front, due to their less vertical structure and high-rates of erosion. Bluff-top sods of coastal specimens often slump down the bluff, taking root before they reach the shore.

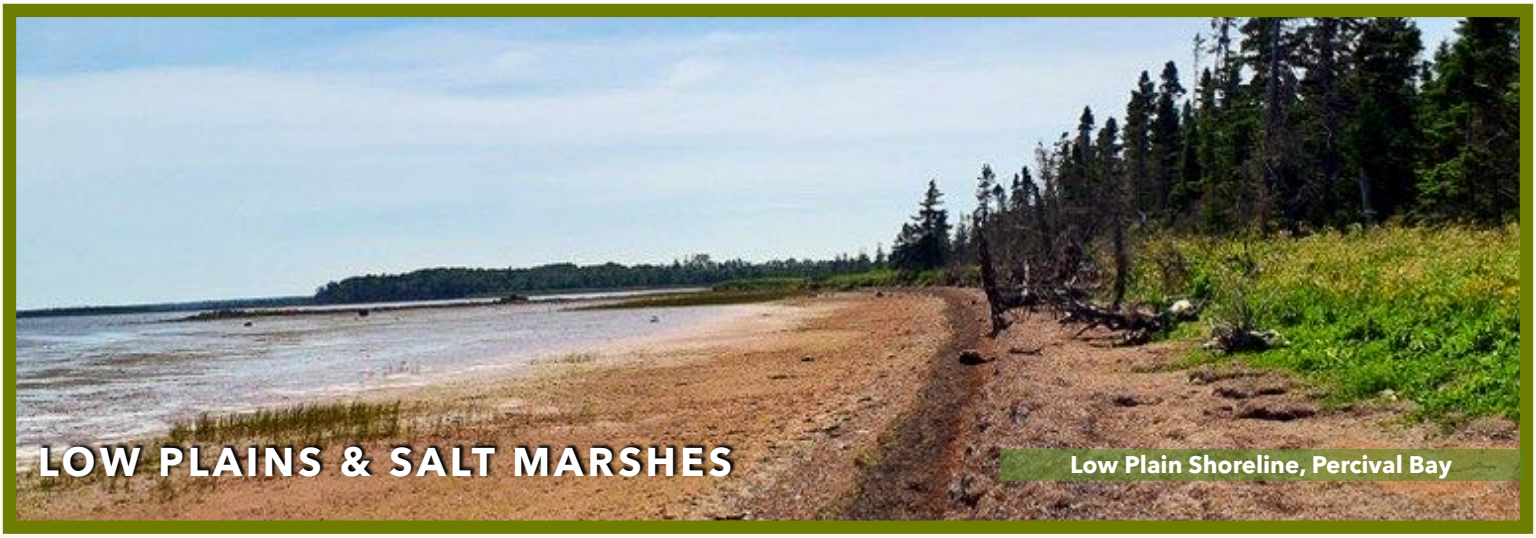
Our Island's cliffs and bluffs were often heavily farmed, removing the original coastal forests. Historical records suggest these areas once supported predominantly deciduous coastal forests shielded by impenetrable coniferous thickets.

DUNE SYSTEMS

Dune System at Long Pond, PEI National Park

PEI is famous for its dune systems, unique and sandy coastal habitats created through littoral sediment deposition. Often found growing along high-wind coasts, wind and waves play an intricate role in the formation as well as the frequent disturbance events in these habitats. In addition to high winds, the pure sand soils make growing conditions even harsher due to a lack of available nutrients, poor water retention, and extreme temperatures. While generally tough places to grow, many dune specialist species are native to PEI, able to colonize these challenging habitats, all while improving growing conditions for less adapted species.

Like most of PEI's land, even our dunes have experienced ample ecological disturbances, whether through the shellfish industry, cattle grazing, infrastructure development, and/or tourism. Many of our dune systems remain reduced in biodiversity and extent. Sandy seas of marram, bayberry and spruce once supported herds of caribou, wolves, reindeer lichens and much more.



LOW PLAINS & SALT MARSHES

Low Plain Shoreline, Percival Bay

Low plain and salt marsh shores are home to arguably the most diverse coastal forests and tend to grow in more sheltered and/or lower-wind locations. These coasts can be either depositional, along our estuaries and salt marshes, or erosional, sometimes with a small high-tide berm. Our lower elevation shores are generally located along our southern coasts. Typically, these less-exposed areas are associated with lower speed winds, showcasing little tree deformation or none at all.

These coasts can be prone to marine flooding, although when protected by healthy salt marshes and/or coastal bogs, they tend to have much more resilience to the effects of high-waters. Species composition along these coasts is highly dependent on local soil drainage and saline intrusion. Like dune systems, these areas can be especially vulnerable to road construction and other drainage changes, sometimes resulting in drastic effects on shoreline habitats.

SECONDARY QUALITIES

Generally, determining the basic coastal category type is enough to inform restoration planning for successful results. Certain Island shores, such as dune systems and salt marshes, already have helpful publications to explain ecological processes and suggest restoration techniques, although many of these are not PEI or even Maritime Canada focused.

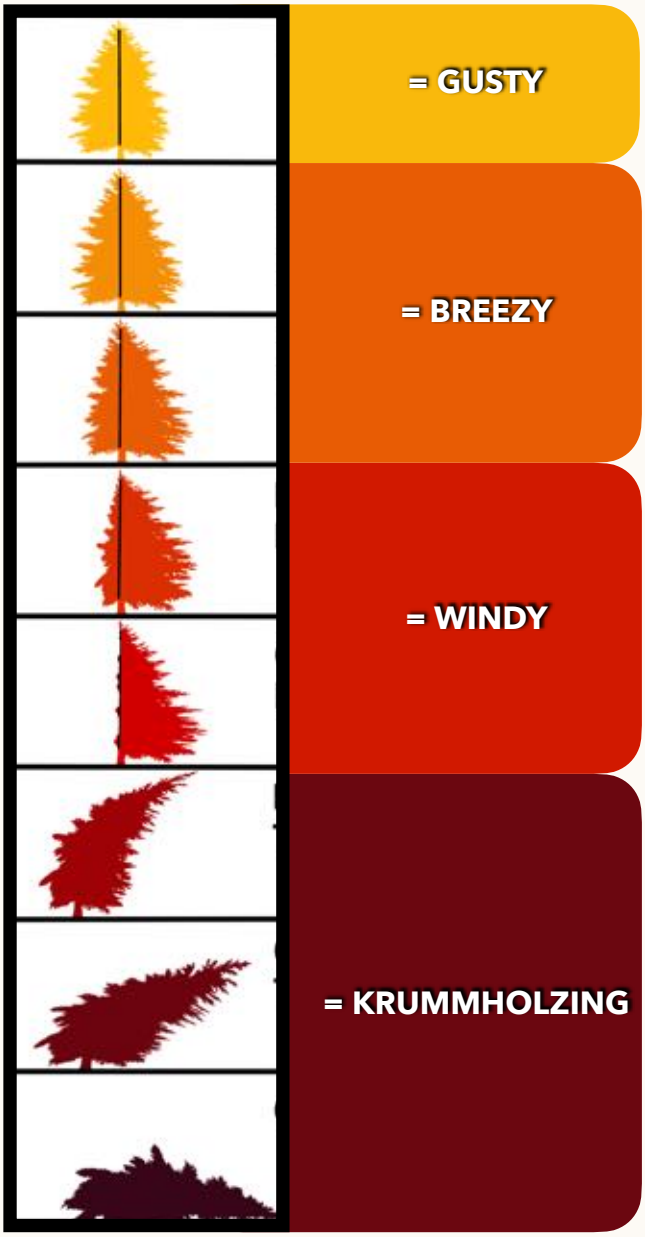
PEI's coastal littoral processes are vast, interconnected and complex. Beyond simply naming the coastal type, there are a number of other qualitative and quantitative methods which can enhance restoration efforts. Although valuable, especially in wide land-use planning, these metrics can be time-consuming to gather in the field. Luckily, there are a number of public databases and services which can be accessed for coastal habitat restoration. These include local coastal flooding risks, accretion and erosion rates, as well as historic information about our coast lines through aerial photography and other records.

Our coasts are dynamic places and understanding their history as well as their relational processes with adjoining shores and habitats can greatly enhance restoration activities.

COASTAL INTENSITY

In lieu of gathering long-term and localized wind speed data along every stretch of PEI's shores, the following prototypical categories are an attempt to quickly ascertain practical information about the intensity and severity of local wind conditions.

Quantifying winds accurately at a site is a cumbersome and lengthy task, poorly adjusted for efficient restoration work. By referencing the Griggs-Putnam Deformity Index, trees on-site can quickly reveal a qualitative gauge of the wind's influence on local growing conditions. While there is much nuance to the wind's effect across a site, not to mention the whole province, these four simple categories assist in anticipating many of the wind-related restoration challenges as well as habitat vulnerabilities and ecological key functions.



Although coastal winds are a dynamic force with incredible localized variety, influencing a wide-variety of ecological factors along the coast, many of their key characteristics can be summed up simply. By gauging their maximum intensity through on-site vegetative deformation observations and assigning a corresponding coastal intensity category, many major coastal pressures can be identified and anticipated.

Shores with lower average winds, *gusty or breezy* coastal intensities, can be ecologically similar to inland Island habitats. The low-average power of marine forces can only shift growing conditions, species composition and other ecological characteristics slightly toward our more typical coastal configurations. Without consistently strong winds, waves, and salt, these habitats show little coastal specialization, save very close to the coast, allowing for more traditional and typical restoration strategies to be used, such as in our inland forests.

Our *windy and krummholzing* shores, on the other hand, are constantly battered by strong coastal forces, requiring much more habitat and species specialization to thrive along the coast. The sheer intensity of winds and waves are a constant and overpowering influence on growing conditions. The abrasive and desiccative powers of the winds are a drain on local vegetative resources, further increasing the importance of other local ecological factors like soil drainage and nutrient availability. Local topography, both geographic and vegetative becomes increasingly important to note, as shelter from wind becomes an important consideration for successful restoration work.

The coastal intensity categories are essentially a simplified Griggs-Putnam deformation index, which is evaluated based on the most intensely deformed specimen found during field work. It will quickly become obvious that every site is home to a huge number of deforming specimens undergoing an incredible variation of growth-form showcasing examples from across the GP deformation index. This mosaic of krummholzing forms are effectively showcasing the present and historic qualitative values of very localized average winds speeds. While this landscape level effect is complex and dynamic, it is extremely informative in visually showcasing localized coastal intensities, enhancing a number of ecological restoration efforts.

COASTAL INTENSITY

While our krummholzing shores are not the most geographically common, they are perhaps the most iconic of our coastlines. These wind-swept and exposed habitats are diverse and include both our dune systems and tall red cliffs. Consistently blasted by marine forces, these are ecologies dominated by drying winds, abrasive sands, and powerful waves. Growing under these harsh coastal conditions tends to create some unique and specialized communities, generally forced to grow low along the windy coast, only becoming a taller coastal forest a bit further inland. The constant coastal condition can actually make these extremely resilient habitats once established, able to cope with high-wind events better than more sheltered areas.

While *windy* habitats do not showcase the extreme deformation or the intrusive inland effects of *krummholzing* coasts, they are still highly affected by relatively strong and consistent marine forces. Never observed displaying the most extreme deformation forms, these habitats nonetheless are home to moderately wind-blown specimens. This krummholz effect can taper off quickly, often pronounced along the shore, with more typical vertical growth beginning shortly inland. These *windy* places are less acclimatized to strong winds then *krummholzing* sites, but tend to still develop good resistance to strong wind events compared to less windy shores. With lower average wind speeds, growing conditions across *windy* sites tend to be more lenient, allowing a greater diversity of species to be present, generally with fewer coastal specialists.

Breezy coastal habitats are still obviously coastal, although they never display the more moderate and severe forms of wind deformation. Often located along our southern and estuary shores, growing in more sheltered locations with less exposure to powerful winds. Depending on other ecological variables, such as soil drainage, these coastal habitats can take a myriad of forms. With less distinctive specimen deformation, species composition, and habitat configuration than windier habitats, these *breezy* coasts can be more difficult to categorize. Similarly to windy sites, the dominance of marine forces generally tapers quickly inland, giving way to more typical inland habitats quickly. These shores are generally sheltered from the worst of everyday marine forces, but are often more vulnerable to high-wind coastal events and the damage they bring.

COASTAL INTENSITY

GUSTY

Gusty coastal habitats are much harder to define. While shoreside, often with full coastal exposure, these shores are located where average winds speeds are lower, or too inconsistent in power and direction to result in wind deformation. While not growing under the constant force of strong, desiccating winds, these places are nonetheless greatly affected by their proximity to the shore. Despite their inconsistent winds, these coasts can still be battered by high-wind events, typically resulting in more blow-down, flooding and other storm damage than windier sites.

While there are examples of *gusty* areas across all coastal types, these lower-wind habitats are typically associated with low-plain shores. As mentioned, PEI'a coasts are transitional space between marine and inland habitats, and in these *gusty* locations, the inland component can play a much stronger role in defining the coastal forest. *Gusty* sites can showcase a wide variety of habitat forms, often highly associated with adjacent inland forests and local soil conditions. Due to the less extreme growing challenges, species composition and placement become a less-nuanced task, both in species selection and placement.

SECONDARY QUALITIES

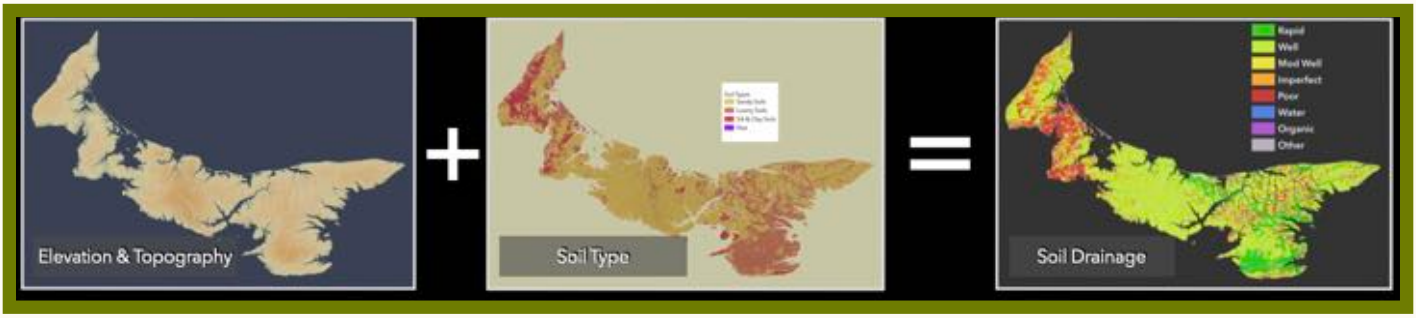
In so many ways, PEI's coastal habitats are heavily defined by their coastal intensity. Along our windiest shores, the intensity of marine forces is an incredibly dominant force, shifting conditions quickly and extremely. While along our calmer coasts, this metric has much less effect and requires less nuanced consideration for quality restoration work.

That being said, there are a number of more detailed ways to quantify and qualify local coastal influence on our coastal forests and associated habitats. Although informative, these secondary qualities are generally most useful to determine along shores with more severe coastal conditions.

Some of these secondary metrics are relatively simple conceptually but more difficult to ascertain, such as the wind's effective distance inland, the proportion/type of abrasive materials (ex: sands, salts, ice) affecting local vegetation and the seasonal variations in wind speed and direction.

At sites with the harshest growing conditions, taking note of local ecological wind zonation can be very valuable to inform species selection and placement for restoration work. Similarly to our tidal zonation in our marine habitats, our windy coastal forests tend to display relatively organized and distinctive ecological zonation based on wind speeds and exposure. While still a prototypical classification system, ecological wind zones help to create a more nuanced map of local growing conditions, greatly improving restoration efforts.

SOIL CHARACTERISTICS



Local soils are another complex, diverse, and poorly understood characteristic of our coastal forests. Similarly to climatic and coastal process, our shoreline geology and soil characteristics are distinct disciplines unto themselves. Proper soil testing, while informative, is expensive and inefficient for most instances of shoreside restoration. Due to PEI's more uniform geology, our soils are typically similar across the Island. That being said, along our coasts, soils can change quickly due to powerful littoral processes, changes in topography, as well as vegetative cover.

When planning restoration, there are some simple soil characteristics which will generally be the most influential on local growing conditions. Arguably, the most important characteristic is the quality of soil drainage. This factor will greatly influence local plant community composition, as well as shift the desiccating effects of coastal winds.

Our coastal ecological conditions can shift quickly, with variable soil drainages across small sections of coast. When noting soil characteristics, aim to find the soil which best sums up the whole site, and then note specialized areas with soil changes, much like denoting distinctive habitats when assessing local biodiversity.

Coastal habitats which showcase widespread low-drainage soils are more common in Prince County and along our low-plain estuaries and southern shores. These soils can trap fresh or more saline waters, setting growing conditions to develop into coastal bogs, salt marshes, and shoreside swamps. Across other coastal habitats, low drainage areas tend to be more localized, such as along coastal riparian areas and amongst dune slacks.

Perhaps the hardest to define and/or identify, our medium drainage soils are the most widespread and generally resemble our typical red Island loamy soil. These soils are generally a mixture of clays and sands with varying organic matter depending on local land-use history. This category is more or less the standard norm to be used when there are no obvious signs of higher or lower drainage levels.

Sandy soils tend to have the highest natural levels of drainage, coupled with the least amount of available nutrients and organic matter. Along our windier coasts, sand dominated growing mediums do little to negate the effects of marine forces, resulting in incredibly challenging growing conditions. A complex pattern of ecological succession often occurs in these soils, generally involving a strong fungal component. Other shores, such as our looser bluffs can also be places of higher drainage as well.

SOIL CHARACTERISTICS

Another important factor is the composition of the soil. While our provincial soil structure is relatively uniform in mineral origins, the individual grain sizing and sorting can vary dramatically. Changes in grain sizing can greatly affect a number of important soil properties, from water retention, nutrient availability, compaction, and susceptibility to erosion.

In addition to these two main descriptive categories, there are a number of other useful geological metrics. Cliff sites often have thin soils, underlain by bedrock, slowing drainage despite soil composition. Studies from Nova Scotia have found surprising chemical compositions in their coastal soils, likely due to wind-blown marine nutrients and local lichen growth. While most restoration work does not require intensive soil testing, little is still known about our coastal soils. Darker and muckier soils tend to have higher rates of organic matter.

While different, clay and silt are both fine-grained particles and typically form less porous soils, slowing the movement of water through the ground. This often results in low drainage and higher water retention, often shifting species diversity Strangely, these soils are often more resilient to erosional forces. These similar soil types are rarer in PEI than the other varieties and have a higher association with western PEI.

Loamy soils are less of a distinctive type of soil, but rather an equal mixture of sand, clay, and silt. The ecological effects of this combination can vary based on other characteristics such as soil depth. Generally, this is the standard category for most typical Island soils, red and grainy, with pretty average drainage levels. Sites with loamy soils can very, generally having less specifically associated floral communities.

These soils are made up of large grains of sand, often coupled with large porous spaces between them. In terms of soil succession, sand grains are the least weathered, resulting both in their larger sizing as well as typically low levels of organic matter and other available nutrients. Island sand is a challenging growing medium at the best of times, and when located along our windy and salty coasts, they create incredibly harsh growing conditions. Luckily there are a variety of native specialist species adapted for these difficulties.

LOCAL BIODIVERSITY

Coastal Forest Floor, Basin Head Provincial Park

As always, noting the local biodiversity is a critical activity to ensure quality ecological restoration. This can be a daunting task, involving skills in identification across multiple taxonomic groups of flora, fungi, fauna, and more. The sheer variety of our coastal forests and their many associated habitats can lead to a surprising diversity along our shores, particularly at less-disturbed and/or more mature sites. While all species can play important roles in our coastal forests, thorough surveying to ascertain all species present is a time-consuming and skillful task. Although useful information, most restoration efforts do not require that level of detail or coverage.

It can be more efficient to collect targeted biodiversity data across a number of important groups. While this method will miss a number of species with important roles, these less common specimens are both trickier to locate and identify as well as typically having less pronounced and/or widespread effects on local growing conditions. The core groups below are hardly comprehensive, but rather aim to focus assessment on understanding the key species present, their distribution, as well as their role in mitigating strong coastal forces.

PRIMARY TREES

Tree species are a core component of our coastal forests, whether growing sparsely along the shore, in vast thickets in high-wind areas, or more typically just inland. Conifers species are generally going to be a dominant cover across younger and more exposed sites, while deciduous species typically play a more important role a bit further inland.

PRIMARY SHRUBS

Shrubs are another critical group of flora to note. These lower-growing woody species often dominant large areas along our coasts, especially in our dune systems. A number of our native shrubs are coastal specialists such as bayberry, sweet gale, wild rose, and our native junipers. Other species can still grow along the coast but typically less-commonly. Again coastal shrubs play a key role in ecological succession, coastal protection and ecological health.

PRIMARY GROUND COVER

The community of species found covering the soil of our windy shores is an incredibly important component of our coastal forests. In sheltered spots, many typical native forest species can be found growing in our coastal habitats. The grounds along windier shores tends to dominated by a variety of coastal specialists, often providing important insight into soil, shore-type and other coastal attributes.

PRIMARY FAUNA

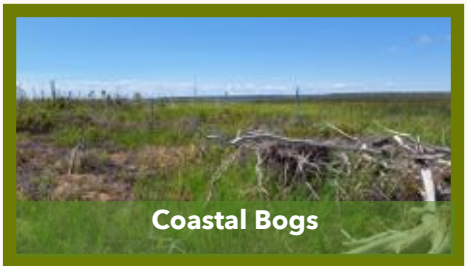
Properly cataloguing faunal species can be an even more intensive task than native flora finding. Not only do these specimens move around, but many species are seasonal residents and/or have nocturnal schedules. Without ample field time, as well as additional resources such as automatic recording units and wildlife cameras, it can be challenging to confirm species, whether common or rare. While there are likely many incredibly important ecosystem-wildlife interactions which are essential to the health of our coastal forests, at least take note of the most critical species, those that are threatened or those that can cause larger habitat effects. Often, looking for indirect evidence, such as browsing signs, scat, and/or dens/nests can be a great way to catalogue what species are using the site.

DISTINCTIVE HABITATS

PEI's coasts are a mosaic of diverse and interconnected habitats. Due to the extreme conditions, local littoral processes, and variable soil characteristics, habitat variation across our shores can shift more quickly and drastically than typically seen inland. The photo above shows Basin Head's dune coastal forest and its associate habitats, including a small but very wet dune swale, areas of bare sand, dune barrens, as well as copses of black spruce/balsam fir forest. While accurately mapping this ecological diversity is generally too intensive, noting the various types will help to create a much more nuanced restoration plan with more successful results. While the list of potential coastal habitat variation across the Province is huge, there are a number of important common and distinctive coastal habitat types which are worth taking note of due to their unique growing conditions.


Coastal Riparian Areas


Salt Marshes


Coastal Bogs

ASSESSING PRIMARY COASTAL ATTRIBUTES

1 EXPOSURE?

- **COASTAL** — under consistent coastal forces
- **RIVERINE**
- **INLAND**
- **ESTUARY** — sheltered but susceptible to flooding

2 COASTAL TYPE?

- **CLIFF/BLUFF** — our eroding vertical cliffs and sloping bluffs are often tall and exposed to the worst winds
- **DUNE** — unique and harsh habitats, famous across the province, the shifting sands can be a tricky growing medium
- **LOW PLAIN/ SALT MARSH** — depositional places, often wet and salty, found more frequently in Prince county and along our southern shores

GROWING CONDITIONS?

3 LOCAL WINDS SPEEDS?

COASTAL INTENSITY CATEGORY

NO DEFORMITY	= GUSTY
MINIMAL DEFORMITY	= BREEZY
MODERATE DEFORMITY	= WINDY
STRONG DEFORMITY	= KRUMMHOLZING

4 GENERAL SOIL CONDITIONS?

TYPICALLY

WETTER ↕ DRYER

LOW DRAINAGE	CLAY/SILT
MODERATE DRAINAGE	LOAMY
HIGH DRAINAGE	SANDY

5 LOCAL BIODIVERSITY?

- PRIMARY TREES
- PRIMARY GROUNDCOVER
- PRIMARY SHRUBS

OPTIONAL

6 SECONDARY ATTRIBUES?

COASTAL SPECIES SELECTION & PLACEMENT

Greenwich National Park's mosaic of coastal habitats & forest

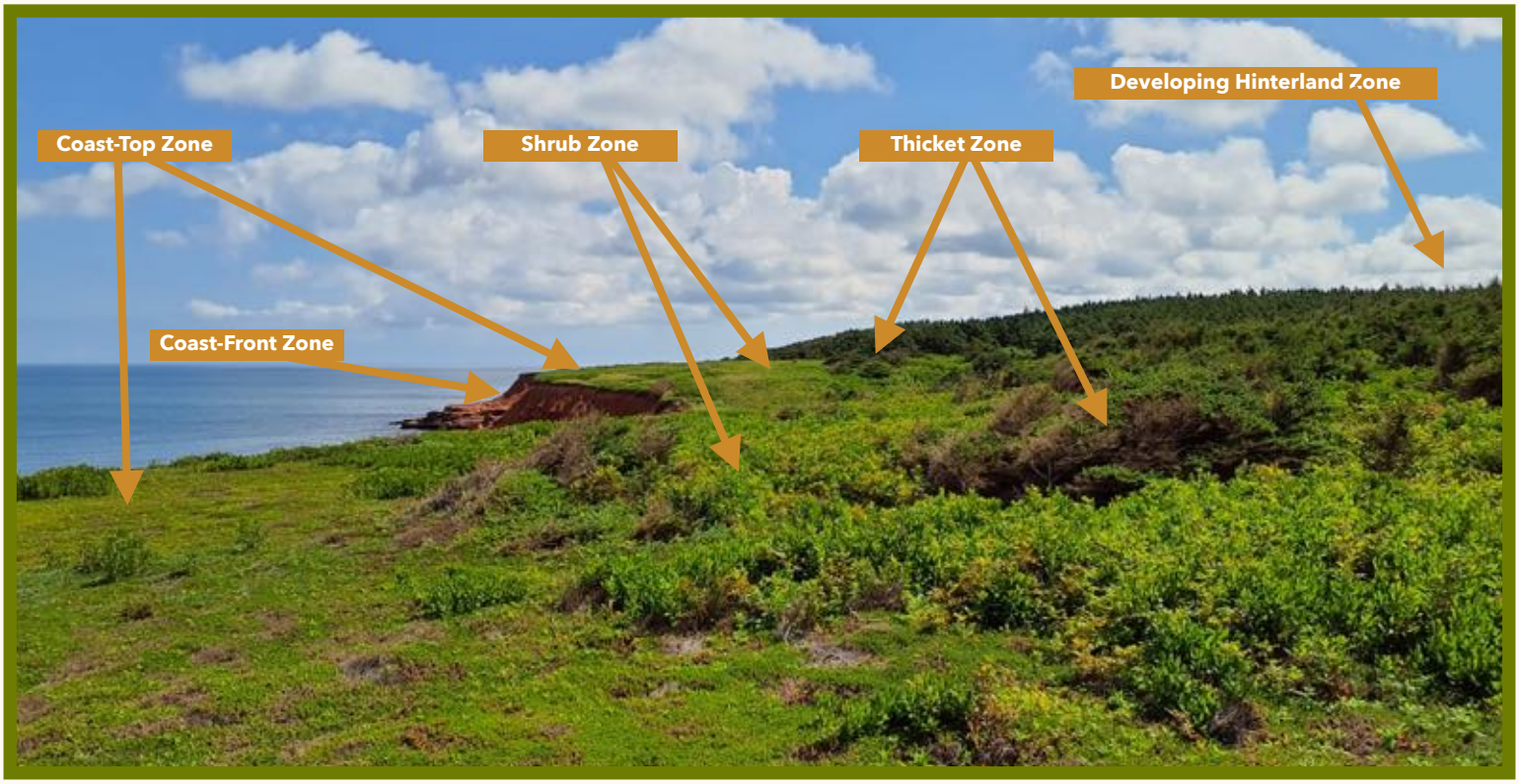
As the photo from the Greenwich dune system above demonstrates, PEI's coastal forests and associated habitats are a varied lot. Constant and powerful coastal forests shape our most exposed shoreline systems, shifting growing conditions, species composition, and habitat type quickly and drastically. This results in dynamic vegetative zonation, where habitat growth, development and diversification continually shifts conditions, resulting in a feedback loop of ecological succession. While inland habitats tend to shift with ecological succession more vertically, taller forest canopies heavily influence light availability for understory species. Along our coasts, this vertical growth is slow and begins with a horizontal succession of increasing height to help mitigate the powerful coastal forces.

The ecological wind zones help to categorize and differentiate these conditionally related growing spaces along our shores. Trying to grow species outside of their preferred zone typically results in poor health and/or specimen death. Using the natural patterns of ecological succession and developing shelter, allows restoration efforts to work with the shoreline system, helping the ecology develop naturally with increased success rates, improved resilience and faster establishment of newly planted specimens. The following pages build off of the primary coastal attribute assessment, providing restoration species lists for a variety of PEI's coastal habitats. In addition, there are representative landscape cross-cuts to help visualize natural distribution patterns and improve species placement during restoration work. While these species suggestions are hardly comprehensive, with a lot more to learn, they do provide the basis to get started healing and improving these amazing Island habitats.

young spruce sheltered amongst the shrub zone

coastal riparian have ample water, shifting species composition quickly

ECOLOGICAL WIND ZONATION



ECOLOGICAL WIND ZONE SUMMARIES:
(Further described in previous reports)

0-BACKSHORE or COAST-FRONT ZONE: is closest to the oncoming coastal winds. This zone is located where land and sea meet, whether vertically along a cliff-face or lying low among the tides in a salt marsh. The windy coast-front often faces other harsh conditions depending on coastal type such as shifting sands, erosion, and salt-intrusion. This zone is generally colonized by native specialist species, although some more common species from further inland zones can end up growing here due to erosional forces.

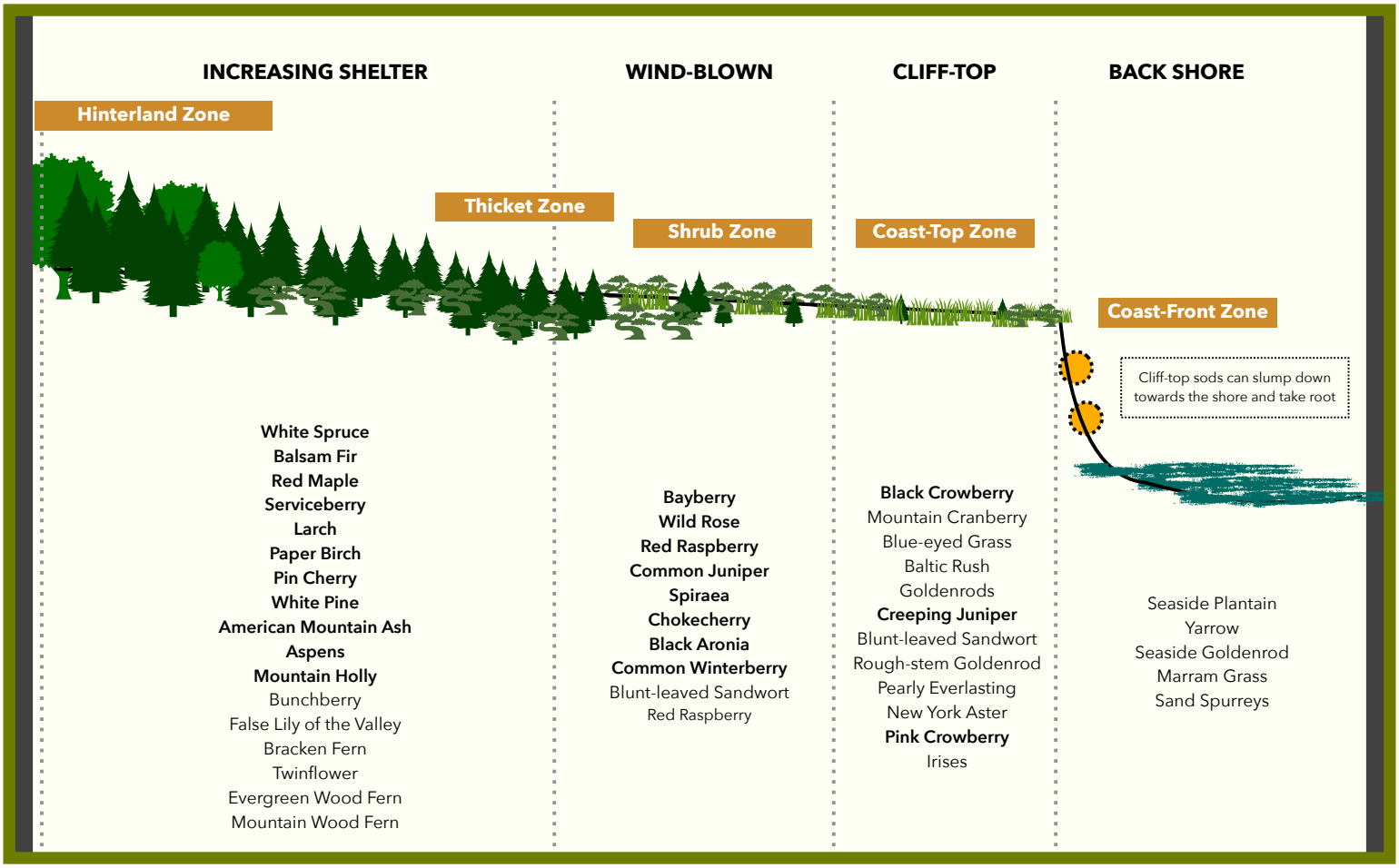
1-COAST-TOP ZONE: is located directly interior to the backshore. Still exposed to very strong winds, but often with lessening marine effects. These forces limit the height and propagation of native flora, limiting the number of species that can grow in this zone. Often taking on a "barrens" form along our windiest cliffs and secondary dunes or a "coastal meadow" form along our yellow dunes and low plain shores.

2-SHRUB ZONE: occurs once frictional forces along the preceding coast-top zone, primarily due to vegetative development, allow for substantially increased survival rates for woody flora, particularly shrubs. Sparse native tree species, especially conifers, tend to vary in deformity depending on coastal wind intensity and position amongst the shrubbery.

3-THICKET ZONE: is named after the historic nomenclature used to describe our coastal krummholzing habitats. The area is partially-sheltered from coastal winds by the preceding shrub zone. The protection created by this preceding zone increases the survival-rate of young conifer trees, often white spruce, resulting in the dense and tightly-packed thicket zone. Whenever seed sources are present, other tree species, some deciduous, can grow throughout this zone.

4-HINTERLAND ZONE: is an area that bears much more study. Pituamkek Forest showcases the potential for restoration work within this zone, with many typically inland species found growing near the coast. This zone begins as local tree-form becomes more typical, often with reduced canopy height but mild deformity. These canopy specimens can be well-spaced and this coastal forest system is clearly capable of supporting rare and native traditionally upland flora when mature.

ECOLOGICAL WIND ZONATION: CLIFF/BLUFF



CLIFF/BLUFF ECOLOGICAL WIND ZONATION

Cliffs and bluffs tend to follow an ordered and organized succession of ecological wind zonation. Along the edge of our high-wind bluffs and cliffs, specimens are unable to grow to their typical heights, resulting in scattered and stunted spruce and shrubs, as well as a variety of low-growing coastal specialists. As one moves inland, developing vegetation gradually slows marine winds, allowing for an increase in vegetative height and less specialized species to grow. As shelter and protection grows, a coastal forest will develop, which can include a wide diversity of species.

0-BACKSHORE or COAST-FRONT ZONE: A harsh location, often very vertical. Battered by winds, waves, and associated erosional forces, this zone has a very limited list of native species that can survive. Our less-vertical coastal bluffs will often have compact sods of coast-top plants sliding down the slope and rooting in place.

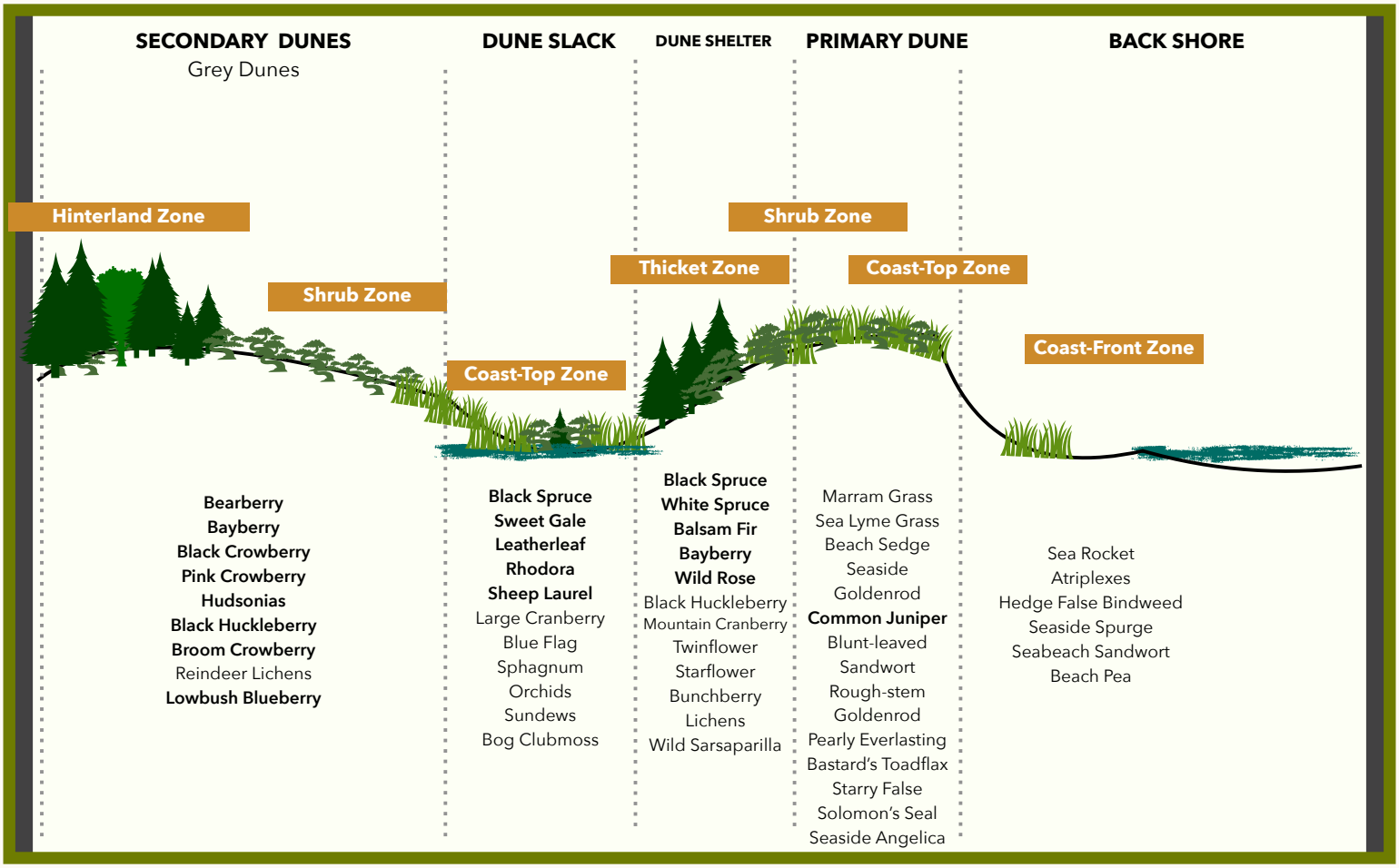
1-COAST-TOP ZONE: This zone is often densely packed with low-growing native specialists. While there will be scattered shrubs and trees, this zone is dominated by low semi-woody species and a host of native wildflowers.

2-SHRUB ZONE: A prickly zone of bayberry and wild rose amongst other coastal shrubs. This is a busy area with lots of wildlife activity. The taller woody shrubs increasingly slow coastal winds, creating calm and sheltered alcove with developing thicket zone species.

3-THICKET ZONE: Dominated by conifers and shrubs, this is a dense area, especially along our windiest cliffs. Dense and bushy growth helps all specimens to protect each other and disperse the wind's energy.

4-HINTERLAND ZONE: This is perhaps the most mysterious zone, as there are few mature cliffside hinterland zones left in PEI. Historical records, as well as our best sites, suggest that a number of surprising species can develop in this zone as coastal forces give way to more inland conditions.

ECOLOGICAL WIND ZONATION: DUNES



DUNE ECOLOGICAL WIND ZONATION

Our high-wind dune systems are difficult places to grow. Not only do they deal with strong coastal forces, including high winds and storm surge events, but local soils tend to be sandy, dry, and lacking nutrients. Not only that, but dunes are dynamic systems, experience more common localized disturbance events and an ever-shifting topography. These factors can create a much less ordered and organized progression of coastal zonation.

0-BACKSHORE or COAST-FRONT ZONE: This zone is generally dominated by bare sand, as well as the few species capable of thriving in these incredibly hot and harsh conditions.

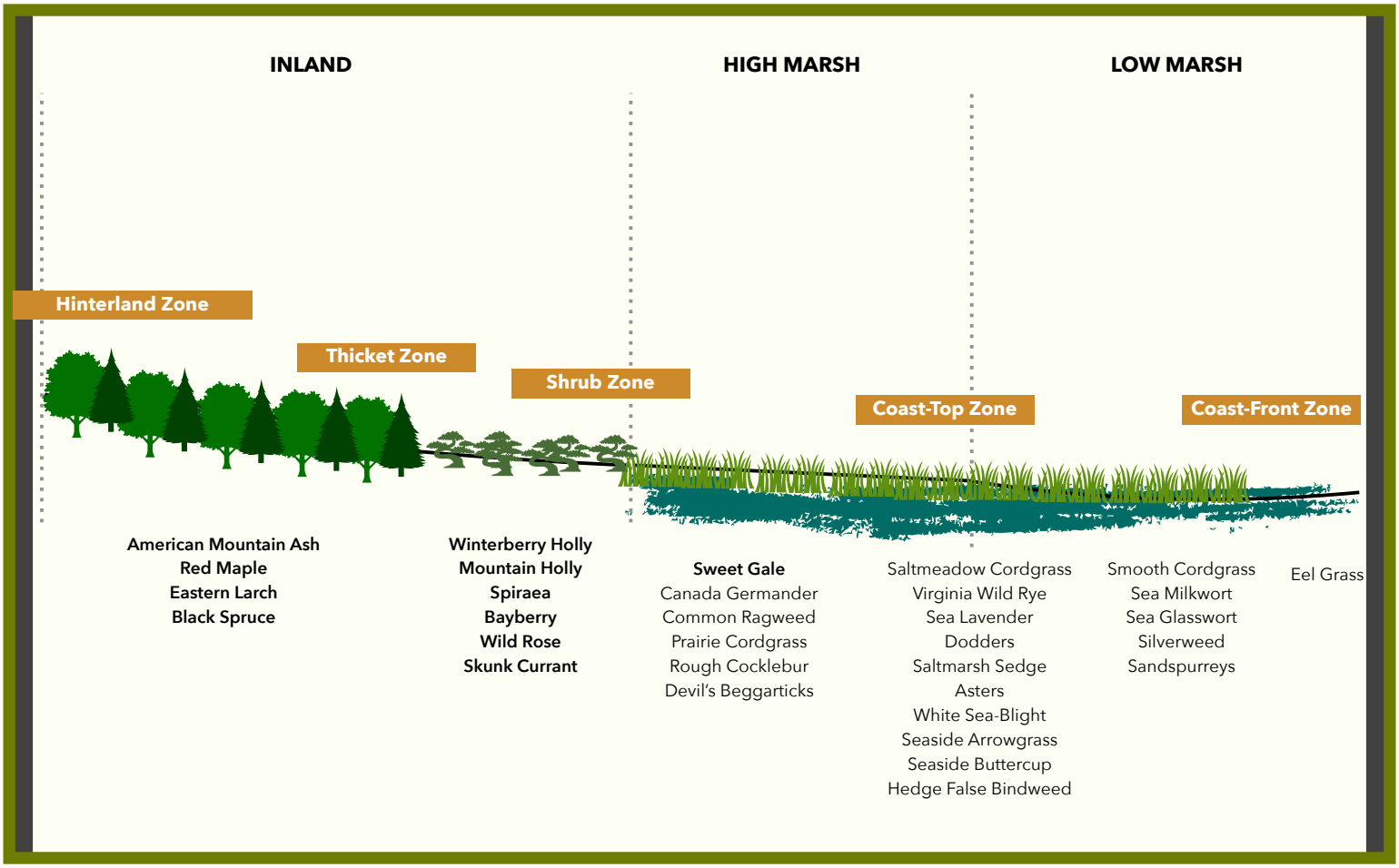
1-COAST-TOP ZONE: Our Island dunes have a diverse coast-top system, that shifts quickly with any changes in soil, as well as slowly, over time, through ecological succession. Younger dunes tend to be dominated by marram grasses, while older dunes will develop a host of secondary dune specialists, while dune slacks are small localized wetlands within the coast-top zone.

2-SHRUB ZONE: Dunes often have huge expanses of shrubs, especially when younger. Often dominated by bayberry, there are a variety of shrubs that will grow in this region, including wild rose, black huckleberry, and junipers.

3-THICKET ZONE: Predominantly coniferous, dryer dunes tends to have white spruce, while wetter dunes can have a mix of balsam fir and black spruce. On our dunes, the thicket zone tends to be small isolated and developing patches or compressed bands abutting the hinterland zone.

4-HINTERLAND ZONE: Another mysterious coastal forest which requires much more research and perhaps a time machine to truly understand. Historical records and some of our more pristine sites suggest some surprising species, such as red oak, white pine, red pine and jack pine. Sites like Greenwich National Park even have sections that predominantly deciduous growing on old dune soils.

ECOLOGICAL WIND ZONATION: LOW PLAINS



LOW PLAIN ECOLOGICAL WIND ZONATION

PEI's low plain shores are often found along calmer coasts and often in our sheltered estuaries. While wind still plays an important role in the habitat's ecology, salty waters tend to be the more dominant marine force. Along these sites, one might think of it as ecological tidal zonation, more akin to our shore-side marine habitats. This is among the reasons why our low plain shores have a high association with salt marsh habitats.

0-BACKSHORE or COAST-FRONT ZONE: Unlike our other coastal habitats, our low plains experience daily tides, and the coast-front zone is trapped underwater regularly. This is an area of halophytic and marine species, such as eel grass and our salty cordgrasses.

1-COAST-TOP ZONE: As the salt marsh elevated and slows tidal waters, the level of soil salt drops, allowing for a variety of semi-halophytic plants to establish.

2-SHRUB ZONE: Again, salt is still a factor, even this far inland, although in much lower quantities. Towards the interior of the salt marsh, shrubs like sweet gale and winterberry holly will grow, slowing tides, floods and winds.

3-THICKET ZONE: Although our dryer low-plain sites can have a wide diversity, our saltier shores tend be dominated by white or black spruce and sometimes larch. Due to lower winds, the trees grow in a much more inland fashion, often not displaying the true "thicket zone" seen along windier coasts.

4-HINTERLAND ZONE: Other than occasional flood events, this zone tends to stay out of the salt and with typically lower winds. This means that the hinterland of our low plain coastal forests are diverse habitats, often highly dependent on land-use history, local seed sources and soil drainage.

COASTAL CLIFF/BLUFF RESTORATION SPECIES

EXPOSURE TYPE: **COASTAL**

COASTAL TYPE: **CLIFF/BLUFF**

COASTAL INTENSITY: **KRUMMHOLZING**

DRAINAGE: **HIGH**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
Black Spruce	*Pinaceae*	*Picea mariana*	S5
Tamarack	*Pinaceae*	*Larix laricina*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
Large-toothed Aspen	*Salicaceae*	*Populus grandidentata*	S4S5
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
Northern Wild Raisin	*Viburnaceae*	*Viburnum cassinoides*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Alleghaney Blackberry	*Rosaceae*	*Rubus allegheniensis*	S4S5
Willow	*Salicaceae*	*Salix spp.*	N/A
Aronia sp	*Rosaceae*	*Aronia sp*	N/A
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Mountain Holly	*Aquifoliaceae*	*Ilex mucronata*	S5
Late Lowbush Blueberry	*Ericaceae*	*Vaccinium angustifolium*	S5
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Sheep Laurel	*Ericaceae*	*Kalmia angustifolia*	S5
Red Osier Dogwood	*Cornaceae*	*Cornus sericea*	S5
Speckled Alder	*Betulaceae*	*Alnus incana*	S5
Green Alder	*Betulaceae*	*Alnus alnobetula*	S4S5
Hawthorn	*Rosaceae*	*Crataegus spp.*	N/A
Bristly Black Currant	*Grossulariaceae*	*Ribes lacustre*	S5
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Wild Strawberry	*Rosaceae*	*Fragaria virginiana*	S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
American Searocket	*Brassicaceae*	*Cakile edentula*	S4S5
Hawkweed spp.	*Asteraceae*	*Hieracium sp*	N/A
Grass-leaved Goldenrod	*Asteraceae*	*Euthamia graminifolia*	S5
Blunt-leaved Sandwort	*Caryophyllaceae*	*Moehringia lateriflora*	S5
Bedstraw	*Rubiaceae*	*Galium sp*	N/A
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Seabeach Sandwort	*Caryophyllaceae*	*Honckenya peploides*	S3S4
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
Common Silverweed	*Rosaceae*	*Potentilla anserina*	S5
Common Evening Primrose	*Onagraceae*	*Oenothera biennis*	S5
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Seaside Plantain	*Plantaginaceae*	*Plantago maritima*	S4S5
Northern Willowherb	*Onagraceae*	*Epilobium ciliatum*	S5
Spotted Jewelweed	*Balsaminaceae*	*Impatiens capensis*	S5
Common Marsh Bedstraw	*Rubiaceae*	*Galium palustre*	S5
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
Yellow Bluebead Lily	*Liliaceae*	*Clintonia borealis*	S5
Three-leaved Rattlesnakeroot	*Asteraceae*	*Nabalus trifoliolatus*	S5
Clover spp.	*Fabaceae*	*Clover spp.*	N/A
Violet Sp.	*Violaceae*	*Viola sp.*	N/A
Hedge False Bindweed	*Convolvulaceae*	*Calystegia sepium*	S5
Swamp Yellow Loosestrife	*Primulaceae*	*Lysimachia terrestris*	S4S5
Pearly Everlasting	*Asteraceae*	*Anaphalis margaritacea*	S5
Common Self-heal	*Lamiaceae*	*Prunella vulgaris*	S5
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
Prairie Cordgrass	*Poaceae*	*Sporobolus michauxianus*	S5
Whorled Wood Aster	*Asteraceae*	*Oclemena acuminata*	S5
Northern Water Horehound	*Lamiaceae*	*Lycopus uniflorus*	S5
One-sided Wintergreen	*Ericaceae*	*Orthilia secunda*	S4S5
Convulsion-Root	Ericaceae	*Monotropa uniflora*	S5
Pink Lady's-Slipper	*Orchidaceae*	*Cypripedium acaule*	S5
Tall Meadow-Rue	*Ranunculaceae*	*Thalictrum pubescens*	S5
Aster spp.	*Asteraceae*	*Symphyotrichum sp*	N/A
Common Ragweed	*Asteraceae*	*Ambrosia artemisiifolia*	S4
Avens	*Rosaceae*	*Geum sp*	N/A
Mad-dog Skullcap	*Lamiaceae*	*Scutellaria lateriflora*	S5
Small-flowered Evening Primrose	*Onagraceae*	*Oenothera parviflora*	S4S5
Spotted Joe Pye Weed	*Asteraceae*	*Eutrochium maculatum*	S5
Gray-stemmed Goldenrod	*Asteraceae*	*Solidago nemoralis*	S4
Sweet White Violet	*Violaceae*	*Viola blanda*	S4S5
Willherb spp.	*Onagraceae*	*Epilobium sp*	N/A
Woodland Cudweed	*Asteraceae*	*Omalotheca sylvatica*	S4
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Sedge Sp.	*Cyperaceae*	*Carex sp.*	N/A
Common Woolly Bulrush	*Cyperaceae*	*Scirpus cyperinus*	S5
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
RUSHES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rush	*Juncaceae*	*Juncus sp*	N/A
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Spinulose Wood Fern	*Dryopteridaceae*	*Dryopteris carthusiana*	S4S5
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5
Bracken Fern	*Dennstaedtiaceae*	*Pteridium aquilinum*	S5
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
Mountain Wood Fern	*Dryopteridaceae*	*Dryopteris campyloptera*	S4
Interrupted Fern	*Osmundaceae*	*Claytosmunda claytoniana*	S5
HORSETAILS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Field Horsetail	*Equisetaceae*	*Equisetum arvense*	S5

bayberry, wild rose & white spruce

smooth gooseberry

New York aster & red raspberry

COASTAL CLIFF/BLUFF RESTORATION SPECIES

EXPOSURE TYPE:	COASTAL TYPE:	COASTAL INTENSITY:	DRAINAGE:
COASTAL	**CLIFF/BLUFF**	**KRUMMHOLZING**	**MODERATE**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Creeping Juniper	*Cupressaceae*	*Juniperus horizontalis*	S2S3
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Pink Crowberry	*Ericaceae*	*Empetrum eamesii*	S2S3
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Red Osier Dogwood	*Cornaceae*	*Cornus sericea*	S5
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
Aronia sp	*Rosaceae*	*Aronia sp*	N/A
Northern Wild Raisin	*Viburnaceae*	*Viburnum cassinoides*	S5
Late Lowbush Blueberry	*Ericaceae*	*Vaccinium angustifolium*	S5
Alleghaney Blackberry	*Rosaceae*	*Rubus allegheniensis*	S4S5
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Seaside Plantain	*Plantaginaceae*	*Plantago maritima*	S4S5
Wild Strawberry	*Rosaceae*	*Fragaria virginiana*	S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Blunt-leaved Sandwort	*Caryophyllaceae*	*Moehringia lateriflora*	S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Mountain Cranberry	*Ericaceae*	*Vaccinium vitis-idaea*	S3
Pearly Everlasting	*Asteraceae*	*Anaphalis margaritacea*	S5
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Thin-leaved Orache	*Amaranthaceae*	*Atriplex prostrata*	S4
Downy Goldenrod	*Asteraceae*	*Solidago puberula*	S4S5
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Common Silverweed	*Rosaceae*	*Potentilla anserina*	S5
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Broad-leaved Cattail	*Typhaceae*	*Typha latifolia*	S5
Whorled Wood Aster	*Asteraceae*	*Oclemena acuminata*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Three-leaved Rattlesnakeroot	*Asteraceae*	*Nabalus trifoliolatus*	S5
American Speedwell	*Plantaginaceae*	*Veronica americana*	S4
Common Water Parsnip	*Apiaceae*	*Sium suave*	S5
Aster spp.	*Asteraceae*	*Symphyotrichum sp*	N/A
Three-petaled Bedstraw	*Rubiaceae*	*Galium trifidum*	S4S5
Three-flowered Bedstraw	*Rubiaceae*	*Galium triflorum*	S5
Rough Avens	*Rosaceae*	*Geum laciniatum*	S4
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Hawkweed spp.	*Asteraceae*	*Hieracium sp*	N/A
Small-flowered Evening Primrose	*Onagraceae*	*Oenothera parviflora*	S4S5
Prairie Cordgrass	*Poaceae*	*Sporobolus michauxianus*	S5
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Common Woolly Bulrush	*Cyperaceae*	*Scirpus cyperinus*	S5
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
RUSHES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rush	*Juncaceae*	*Juncus sp*	N/A
Baltic Rush	*Juncaceae*	*Juncus balticus*	S5
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
Spinulose Wood Fern	*Dryopteridaceae*	*Dryopteris carthusiana*	S4S5
Bracken Fern	*Dennstaedtiaceae*	*Pteridium aquilinum*	S5
HORSETAILS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Field Horsetail	*Equisetaceae*	*Equisetum arvense*	S5


wind-blown white spruce


grey birch & bayberry


typical clifftop ground-cover

COASTAL CLIFF/BLUFF RESTORATION SPECIES

EXPOSURE TYPE: **COASTAL**

COASTAL TYPE: **CLIFF/BLUFF**

COASTAL INTENSITY: **KRUMMHOLZING & WINDY**

DRAINAGE: **LOW**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
Black Spruce	*Pinaceae*	*Picea mariana*	S5
Jack Pine	*Pinaceae*	*Pinus banksiana*	S2S3
Tamarack	*Pinaceae*	*Larix laricina*	S5
Eastern White Cedar	*Cupressaceae*	*Thuja occidentalis*	S3S4
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Northern Wild Raisin	*Viburnaceae*	*Viburnum cassinoides*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Sweet Gale	*Myricaceae*	*Myrica gale*	S5
Mountain Holly	*Aquifoliaceae*	*Ilex mucronata*	S5
Late Lowbush Blueberry	*Ericaceae*	*Vaccinium angustifolium*	S5
Sheep Laurel	*Ericaceae*	*Kalmia angustifolia*	S5
Black Huckleberry	*Ericaceae*	*Gaylussacia baccata*	S4S5
Willow	*Salicaceae*	*Salix spp.*	N/A
Common Labrador Tea	*Ericaceae*	*Rhododendron groenlandicum*	S5
Leatherleaf	*Ericaceae*	*Chamaedaphne calyculata*	S4
Rhodora	*Ericaceae*	*Rhododendron canadense*	S5
Pale Bog Laurel	*Ericaceae*	*Kalmia polifolia*	S4
Red Osier Dogwood	*Cornaceae*	*Cornus sericea*	S5
Alleghaney Blackberry	*Rosaceae*	*Rubus allegheniensis*	S4S5
Dwarf Red Raspberry	*Rosaceae*	*Rubus pubescens*	S5
Dwarf Huckleberry	*Ericaceae*	*Gaylussacia bigeloviana*	S3
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Wild Strawberry	*Rosaceae*	*Fragaria virginiana*	S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Blunt-leaved Sandwort	*Caryophyllaceae*	*Moehringia lateriflora*	S5
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Common Silverweed	*Rosaceae*	*Potentilla anserina*	S5
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
Bedstraw	*Rubiaceae*	*Galium sp*	N/A
Clover spp.	*Fabaceae*	*Clover spp.*	N/A
Hawkweed spp.	*Asteraceae*	*Hieracium sp*	N/A
Sea Lyme Grass	*Poaceae*	*Leymus mollis*	S4
Whorled Wood Aster	*Asteraceae*	*Oclemena acuminata*	S5
Seaside Arrowgrass	*Juncaginaceae*	*Triglochin maritima*	S4S5
Sea Milkwort	*Primulaceae*	*Lysimachia maritima*	S4S5
Grass-leaved Goldenrod	*Asteraceae*	*Euthamia graminifolia*	S5
Seaside Plantain	*Plantaginaceae*	*Plantago maritima*	S4S5
Broad-leaved Cattail	*Typhaceae*	*Typha latifolia*	S5
Sea Glasswort	*Amaranthaceae*	*Salicornia maritima*	S4S5
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Pink Lady's-Slipper	*Orchidaceae*	*Cypripedium acaule*	S5
Small Cranberry	*Ericaceae*	*Vaccinium oxycoccos*	S4
Aster spp.	*Asteraceae*	*Symphyotrichum sp*	N/A
Round-leaved Sundew	*Droseraceae*	*Drosera rotundifolia*	S4
Tuberous Grass Pink	*Orchidaceae*	*Calopogon tuberosus*	S3
Common Water Parsnip	*Apiaceae*	*Sium suave*	S5
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
European Wood Sorrel	*Oxalidaceae*	*Oxalis stricta*	S5
Creeping Snowberry	*Ericaceae*	*Gaultheria hispidula*	S5
Three-leaved False Soloman's Seal	*Asparagaceae*	*Maianthemum trifolium*	S4
Eastern Teaberry	*Ericaceae*	*Gaultheria procumbens*	S4S5
Tufted Yellow Loosestrife	*Primulaceae*	*Lysimachia thyrsiflora*	S4S5
Heart-leaved Aster	*Asteraceae*	*Symphyotrichum cordifolium*	S4
Mountain Blue-eyed-grass	*Iridaceae*	*Sisyrinchium montanum*	S5
Common Mare's-Tail	*Plantaginaceae*	*Hippuris vulgaris*	S3S4
Seaside Buttercup	*Ranunculaceae*	*Halerpestes cymbalaria*	S4
Northern Pitcher Plant	*Sarraceniaceae*	*Sarracenia purpurea*	S4
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Sedge Sp.	*Cyperaceae*	*Carex sp.*	N/A
Narrow-leaved Cottongrass	*Cyperaceae*	*Eriophorum angustifolium*	S4
Tussock Cottongrass	*Cyperaceae*	*Eriophorum vaginatum*	S4
Cottongrass sp.	*Cyperaceae*	*Eriophorom sp.*	N/A
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Spinulose Wood Fern	*Dryopteridaceae*	*Dryopteris carthusiana*	S4S5
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5
HORSETAILS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Woodland Horsetail	*Equisetaceae*	*Equisetum sylvaticum*	S5
Field Horsetail	*Equisetaceae*	*Equisetum arvense*	S5

krummholzing black spruce & larch

mountain holly

blue-flag iris

COASTAL CLIFF/BLUFF RESTORATION SPECIES

EXPOSURE TYPE:	COASTAL TYPE:	COASTAL INTENSITY:	DRAINAGE:
COASTAL	**CLIFF/BLUFF**	**WINDY**	**MODERATE**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Highbush Cranberry	*Viburnaceae*	*Viburnum opulus*	S3
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Wild Strawberry	*Rosaceae*	*Fragaria virginiana*	S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Grass-leaved Goldenrod	*Asteraceae*	*Euthamia graminifolia*	S5
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
Common Self-heal	*Lamiaceae*	*Prunella vulgaris*	S5
Common Eelgrass	*Zosteraceae*	*Zostera marina*	S4
Common Evening Primrose	*Onagraceae*	*Oenothera biennis*	S5
Seaside Plantain	*Plantaginaceae*	*Plantago maritima*	S4S5
Blunt-leaved Sandwort	*Caryophyllaceae*	*Moehringia lateriflora*	S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Thin-leaved Orache	*Amaranthaceae*	*Atriplex prostrata*	S4
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Common Silverweed	*Rosaceae*	*Potentilla anserina*	S5
Broad-leaved Cattail	*Typhaceae*	*Typha latifolia*	S5
Aster spp.	*Asteraceae*	*Symphyotrichum sp*	N/A
Northern Willowherb	*Onagraceae*	*Epilobium ciliatum*	S5
Seaside Angelica	*Apiaceae*	*Angelica lucida*	S2S3
Scotch Lovage	*Apiaceae*	*Ligusticum scoticum*	S4
Sea Lyme Grass	*Poaceae*	*Leymus mollis*	S4
Rough Cinquefoil	*Rosaceae*	*Potentilla norvegica*	S4S5
Sea Glasswort	*Amaranthaceae*	*Salicornia maritima*	S4S5
Common Ragweed	*Asteraceae*	*Ambrosia artemisiifolia*	S4
Rough Cocklebur	*Asteraceae*	*Xanthium strumarium*	S4
American Searocket	*Brassicaceae*	*Cakile edentula*	S4S5
Seabeach Sandwort	*Caryophyllaceae*	*Honckenya peploides*	S3S4
Canada Germander	*Lamiaceae*	*Teucrium canadense*	S3S4
Sea Lavender	*Plumbaginaceae*	*Limonium carolinianum*	S4S5
Smooth Cordgrass	*Poaceae*	*Sporobolus alterniflorus*	S4S5
Saltmeadow Cordgrass	*Poaceae*	*Sporobolus pumilus*	S4S5
Climbing False Buckwheat	*Polygonaceae*	*Fallopia scandens*	S3
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Broom Sedge	*Cyperaceae*	*Carex scoparia*	S4S5
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
RUSHES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rush	*Juncaceae*	*Juncus sp*	N/A
Slender Rush	*Juncaceae*	*Juncus tenuis*	S5
Baltic Rush	*Juncaceae*	*Juncus balticus*	S5
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
Spinulose Wood Fern	*Dryopteridaceae*	*Dryopteris carthusiana*	S4S5
Common Lady Fern	*Athyriaceae*	*Athyrium filix-femina*	S5
Common Oak Fern	*Cystopteridaceae*	*Gymnocarpium dryopteris*	S5
Crested Wood Fern	*Dryopteridaceae*	*Dryopteris cristata*	S5
Interrupted Fern	*Osmundaceae*	*Claytosmunda claytoniana*	S5
Mountain Wood Fern	*Dryopteridaceae*	*Dryopteris campyloptera*	S4
Eastern Hay-Scented Fern	*Dennstaedtiaceae*	*Dennstaedtia punctilobula*	S5
HORSETAILS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Woodland Horsetail	*Equisetaceae*	*Equisetum sylvaticum*	S5

balsam fir saplings

black chokeberry

baltic rush

COASTAL DUNE RESTORATION SPECIES

EXPOSURE TYPE:	COASTAL TYPE:	COASTAL INTENSITY:	DRAINAGE:
COASTAL	**DUNE**	**KRUMMHOLZING**	**HIGH**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
Black Spruce	*Pinaceae*	*Picea mariana*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
Northern Wild Raisin	*Viburnaceae*	*Viburnum cassinoides*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Common Bearberry	*Ericaceae*	*Arctostaphylos uva-ursi*	S3
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Sweet Gale	*Myricaceae*	*Myrica gale*	S5
Mountain Holly	*Aquifoliaceae*	*Ilex mucronata*	S5
Late Lowbush Blueberry	*Ericaceae*	*Vaccinium angustifolium*	S5
Sheep Laurel	*Ericaceae*	*Kalmia angustifolia*	S5
Woolly Beach-heath	*Cistaceae*	*Hudsonia tomentosa*	S3
Canada Fly Honeysuckle	*Caprifoliaceae*	*Lonicera canadensis*	S5
Pinebarren Golden Heather	*Cistaceae*	*Hudsonia ericoides*	S2
Creeping Juniper	*Cupressaceae*	*Juniperus horizontalis*	S2S3
Speckled Alder	*Betulaceae*	*Alnus incana*	S5
Green Alder	*Betulaceae*	*Alnus alnobetula*	S4S5
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Wild Strawberry	*Rosaceae*	*Fragaria virginiana*	S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Blunt-leaved Sandwort	*Caryophyllaceae*	*Moehringia lateriflora*	S5
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
Common Eelgrass	*Zosteraceae*	*Zostera marina*	S4
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
American Searocket	*Brassicaceae*	*Cakile edentula*	S4S5
Yellow Bluebead Lily	*Liliaceae*	*Clintonia borealis*	S5
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Common Evening Primrose	*Onagraceae*	*Oenothera biennis*	S5
Thin-leaved Orache	*Amaranthaceae*	*Atriplex prostrata*	S4
Common Silverweed	*Rosaceae*	*Potentilla anserina*	S5
Scotch Lovage	*Apiaceae*	*Ligusticum scoticum*	S4
Saltmeadow Cordgrass	*Poaceae*	*Sporobolus pumilus*	S4S5
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
Three-leaved Rattlesnakeroot	*Asteraceae*	*Nabalus trifoliolatus*	S5
Bedstraw	*Rubiaceae*	*Galium sp*	N/A
One-flowered Wintergreen	*Ericaceae*	*Moneses uniflora*	S3
Violet Sp.	*Violaceae*	*Viola sp.*	N/A
Clover spp.	*Fabaceae*	*Clover spp.*	N/A
Hawkweed spp.	*Asteraceae*	*Hieracium sp*	N/A
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Sea Lyme Grass	*Poaceae*	*Leymus mollis*	S4
Sea Lavender	*Plumbaginaceae*	*Limonium carolinianum*	S4S5
Smooth Cordgrass	*Poaceae*	*Sporobolus alterniflorus*	S4S5
Mountain Cranberry	*Ericaceae*	*Vaccinium vitis-idaea*	S3
Whorled Wood Aster	*Asteraceae*	*Oclemena acuminata*	S5
Small Enchanter's Nightshade	*Onagraceae*	*Circaea alpina*	S5
Turion Duckweed	*Araceae*	*Lemna turionifera*	S4S5
Shinleaf	*Ericaceae*	*Pyrola elliptica*	S5
Seaside Arrowgrass	*Juncaginaceae*	*Triglochin maritima*	S4S5
Sea Milkwort	*Primulaceae*	*Lysimachia maritima*	S4S5
Grass-leaved Goldenrod	*Asteraceae*	*Euthamia graminifolia*	S5

flagging white spruce

bearberry, hudsonias & lichens

Seaside Plantain	*Plantaginaceae*	*Plantago maritima*	S4S5
Broad-leaved Cattail	*Typhaceae*	*Typha latifolia*	S5
Northern Willowherb	*Onagraceae*	*Epilobium ciliatum*	S5
Sea Glasswort	*Amaranthaceae*	*Salicornia maritima*	S4S5
Seabeach Sandwort	*Caryophyllaceae*	*Honckenya peploides*	S3S4
Canada Germander	*Lamiaceae*	*Teucrium canadense*	S3S4
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Prairie Cordgrass	*Poaceae*	*Sporobolus michauxianus*	S5
One-sided Wintergreen	*Ericaceae*	*Orthilia secunda*	S4S5
Hedge False Bindweed	*Convolvulaceae*	*Calystegia sepium*	S5
Northern Water Horehound	*Lamiaceae*	*Lycopus uniflorus*	S5
Convulsion-Root	*Ericaceae*	*Monotropa uniflora*	S5
White Goldenrod	*Asteraceae*	*Solidago bicolor*	S4
Swamp Yellow Loosestrife	*Primulaceae*	*Lysimachia terrestris*	S4S5
White Sea-blite	*Amaranthaceae*	*Suaeda maritima*	S4S5
Devil's Beggarticks	*Asteraceae*	*Bidens frondosa*	S5
Canada Horseweed	*Asteraceae*	*Erigeron canadensis*	S5
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
RUSHES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rush	*Juncaceae*	*Juncus sp*	N/A
Baltic Rush	*Juncaceae*	*Juncus balticus*	S5
Black-Grass Rush	*Juncaceae*	*Juncus gerardi*	S4
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Spinulose Wood Fern	*Dryopteridaceae*	*Dryopteris carthusiana*	S4S5
Bracken Fern	*Dennstaedtiaceae*	*Pteridium aquilinum*	S5
Common Oak Fern	*Cystopteridaceae*	*Gymnocarpium dryopteris*	S5
Mountain Wood Fern	*Dryopteridaceae*	*Dryopteris campyloptera*	S4
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
HORSETAILS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Woodland Horsetail	*Equisetaceae*	*Equisetum sylvaticum*	S5

COASTAL DUNE RESTORATION SPECIES

EXPOSURE TYPE:	COASTAL TYPE:	COASTAL INTENSITY:	DRAINAGE:
COASTAL	**DUNE**	**WINDY**	**HIGH**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
Eastern White Pine	*Pinaceae*	*Pinus strobus*	S3S4
Black Spruce	*Pinaceae*	*Picea mariana*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
Northern Red Oak	*Fagaceae*	*Quercus rubra*	S3S4
American Beech	*Fagaceae*	*Fagus grandifolia*	S3S4
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
Northern Wild Raisin	*Viburnaceae*	*Viburnum cassinoides*	S5
Mountain Holly	*Aquifoliaceae*	*Ilex mucronata*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Late Lowbush Blueberry	*Ericaceae*	*Vaccinium angustifolium*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Sweet Gale	*Myricaceae*	*Myrica gale*	S5
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Woolly Beach-heath	*Cistaceae*	*Hudsonia tomentosa*	S3
Sheep Laurel	*Ericaceae*	*Kalmia angustifolia*	S5
Canada Fly Honeysuckle	*Caprifoliaceae*	*Lonicera canadensis*	S5
Spreading Dogbane	*Apocynaceae*	*Apocynum androsaemifolium*	S4
Red Osier Dogwood	*Cornaceae*	*Cornus sericea*	S5
Bristly Dewberry	*Rosaceae*	*Rubus hispidus*	S4
Alleghaney Blackberry	*Rosaceae*	*Rubus allegheniensis*	S4S5
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Wild Strawberry	*Rosaceae*	*Fragaria virginiana*	S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
American Searocket	*Brassicaceae*	*Cakile edentula*	S4S5
Hawkweed spp.	*Asteraceae*	*Hieracium sp*	N/A
Grass-leaved Goldenrod	*Asteraceae*	*Euthamia graminifolia*	S5
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Blunt-leaved Sandwort	*Caryophyllaceae*	*Moehringia lateriflora*	S5
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Yellow Bluebead Lily	*Liliaceae*	*Clintonia borealis*	S5
Three-leaved Rattlesnakeroot	*Asteraceae*	*Nabalus trifoliolatus*	S5
Bedstraw	*Rubiaceae*	*Galium sp*	N/A
Clover spp.	*Fabaceae*	*Clover spp.*	N/A
Violet Sp.	*Violaceae*	*Viola sp.*	N/A
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Seabeach Sandwort	*Caryophyllaceae*	*Honckenya peploides*	S3S4
Shinleaf	*Ericaceae*	*Pyrola elliptica*	S5
Mountain Cranberry	*Ericaceae*	*Vaccinium vitis-idaea*	S3
White Sea-blite	*Amaranthaceae*	*Suaeda maritima*	S4S5
Hedge False Bindweed	*Convolvulaceae*	*Calystegia sepium*	S5
Swamp Yellow Loosestrife	*Primulaceae*	*Lysimachia terrestris*	S4S5
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
Pearly Everlasting	*Asteraceae*	*Anaphalis margaritacea*	S5
Common Self-heal	*Lamiaceae*	*Prunella vulgaris*	S5
Eyebright	*Orobanchaceae*	*Euphrasia sp.*	N/A
Common Pipsissewa	*Ericaceae*	*Chimaphila umbellata*	S4
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Sedge Sp.	*Cyperaceae*	*Carex sp.*	N/A
Seabeach Sedge	*Cyperaceae*	*Carex silicea*	S4
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
Wavy Hairgrass	*Poaceae*	*Avenella flexuosa*	S4
Canada Blue Grass	*Poaceae*	*Poa compressa*	N/A
Wavy Hairgrass	*Poaceae*	*Avenella flexuosa*	S4
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Bracken Fern	*Dennstaedtiaceae*	*Pteridium aquilinum*	S5
HORSETAILS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Field Horsetail	*Equisetaceae*	*Equisetum arvense*	S5

dry sandy soils and white spruce

common pipsissewa & mountain cranberry

sand loving earthstar fungi

COASTAL DUNE RESTORATION SPECIES

EXPOSURE TYPE: **COASTAL**

COASTAL TYPE: **DUNE**

COASTAL INTENSITY: **KRUMMHOLZING & WINDY**

DRAINAGE: **MODERATE**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
Black Spruce	*Pinaceae*	*Picea mariana*	S5
White Spruce	*Pinaceae*	*Picea glauca*	S5
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
Jack Pine	*Pinaceae*	*Pinus banksiana*	S2S3
Red Pine	*Pinaceae*	*Pinus resinosa*	S2
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
White Ash	*Oleaceae*	*Fraxinus americana*	S2S3
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Sugar Maple	*Sapindaceae*	*Acer saccharum*	S4
Northern Red Oak	*Fagaceae*	*Quercus rubra*	S3S4
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Black Huckleberry	*Ericaceae*	*Gaylussacia baccata*	S4S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Common Bearberry	*Ericaceae*	*Arctostaphylos uva-ursi*	S3
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
Woolly Beach-heath	*Cistaceae*	*Hudsonia tomentosa*	S3
Broom Crowberry	*Ericaceae*	*Corema conradii*	S2S3
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Northern Wild Raisin	*Viburnaceae*	*Viburnum cassinoides*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Late Lowbush Blueberry	*Ericaceae*	*Vaccinium angustifolium*	S5
Sheep Laurel	*Ericaceae*	*Kalmia angustifolia*	S5
Pink Crowberry	*Ericaceae*	*Empetrum eamesii*	S2S3
Western Poison Ivy	*Anacardiaceae*	*Toxicodendron radicans var. rydbergii*	S4
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Sweet Gale	*Myricaceae*	*Myrica gale*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Mountain Holly	*Aquifoliaceae*	*Ilex mucronata*	S5
Canada Fly Honeysuckle	*Caprifoliaceae*	*Lonicera canadensis*	S5
Common Labrador Tea	*Ericaceae*	*Rhododendron groenlandicum*	S5
Willow	*Salicaceae*	*Salix spp.*	N/A
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Hawthorn	*Rosaceae*	*Crataegus spp.*	N/A
Pinebarren Golden Heather	*Cistaceae*	*Hudsonia ericoides*	S2
Canada Yew	*Taxaceae*	*Taxus canadensis*	S4
Alternate-leaved Dogwood	*Cornaceae*	*Cornus alternifolia*	S4
Beaked Hazel	*Betulaceae*	*Corylus cornuta*	S5
Mountain Maple	*Sapindaceae*	*Acer spicatum*	S5
Leatherleaf	*Ericaceae*	*Chamaedaphne calyculata*	S4
Rhodora	*Ericaceae*	*Rhododendron canadense*	S5
Spreading Dogbane	*Apocynaceae*	*Apocynum androsaemifolium*	S4
Pale Bog Laurel	*Ericaceae*	*Kalmia polifolia*	S4
Highbush Cranberry	*Viburnaceae*	*Viburnum opulus*	S3
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
American Searocket	*Brassicaceae*	*Cakile edentula*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
American Cow Wheat	*Orobanchaceae*	*Melampyrum lineare*	S4S5
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Sea Milkwort	*Primulaceae*	*Lysimachia maritima*	S4S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Common Eelgrass	*Zosteraceae*	*Zostera marina*	S4
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
Pink Lady's-Slipper	*Orchidaceae*	*Cypripedium acaule*	S5
Small Cranberry	*Ericaceae*	*Vaccinium oxycoccos*	S4
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Scotch Lovage	*Apiaceae*	*Ligusticum scoticum*	S4
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Hawkweed spp.	*Asteraceae*	*Hieracium sp*	N/A
Yellow Bluebead Lily	*Liliaceae*	*Clintonia borealis*	S5

flagging white spruce

Marsh Skullcap	*Lamiaceae*	*Scutellaria galericulata*	S4S5
Trailing Arbutus	*Ericaceae*	*Epigaea repens*	S4
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Common Silverweed	*Rosaceae*	*Potentilla anserina*	S5
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Three-leaved Rattlesnakeroot	*Asteraceae*	*Nabalus trifoliolatus*	S5
Seaside Arrowgrass	*Juncaginaceae*	*Triglochin maritima*	S4S5
Thin-leaved Orache	*Amaranthaceae*	*Atriplex prostrata*	S4
Saltmeadow Cordgrass	*Poaceae*	*Sporobolus pumilus*	S4S5
Sea Lavender	*Plumbaginaceae*	*Limonium carolinianum*	S4S5
Whorled Wood Aster	*Asteraceae*	*Oclemena acuminata*	S5
Tall Meadow-Rue	*Ranunculaceae*	*Thalictrum pubescens*	S5
Smooth Cordgrass	*Poaceae*	*Sporobolus alterniflorus*	S4S5
Tuberous Grass Pink	*Orchidaceae*	*Calopogon tuberosus*	S3
Saltmarsh Sandspurrey	*Caryophyllaceae*	*Spergularia salina*	S4
Rough Cocklebur	*Asteraceae*	*Xanthium strumarium*	S4
Seabeach Sandwort	*Caryophyllaceae*	*Honckenya peploides*	S3S4
Three-petaled Bedstraw	*Rubiaceae*	*Galium trifidum*	S4S5
Three-flowered Bedstraw	*Rubiaceae*	*Galium triflorum*	S5
Bedstraw	*Rubiaceae*	*Galium sp*	N/A
Aster spp.	*Asteraceae*	*Symphyotrichum sp*	N/A
Common Ragweed	*Asteraceae*	*Ambrosia artemisiifolia*	S4
Shinleaf	*Ericaceae*	*Pyrola elliptica*	S5
Round-leaved Sundew	*Droseraceae*	*Drosera rotundifolia*	S4
Bastard's Toadflax	*Santalaceae*	*Comandra umbellata*	S3
Spotted Jewelweed	*Balsaminaceae*	*Impatiens capensis*	S5
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Mountain Cranberry	*Ericaceae*	*Vaccinium vitis-idaea*	S3
Common Evening Primrose	*Onagraceae*	*Oenothera biennis*	S5
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
Turion Duckweed	*Araceae*	*Lemna turionifera*	S4S5
Avens	*Rosaceae*	*Geum sp*	N/A
One-flowered Wintergreen	*Ericaceae*	*Moneses uniflora*	S3
Sea Lyme Grass	*Poaceae*	*Leymus mollis*	S4
Small Enchanter's Nightshade	*Onagraceae*	*Circaea alpina*	S5
Canada Horseweed	*Asteraceae*	*Erigeron canadensis*	S5
Slender Ladies'-tresses	*Orchidaceae*	*Spiranthes lacera*	S4
Common Cow Parsnip	*Apiaceae*	*Heracleum maximum*	S4
Nodding Trillium	*Melanthiaceae*	*Trillium cernuum*	S4
Fireweed	*Onagraceae*	*Chamaenerion angustifolium*	S5
Cucumber Root	*Liliaceae*	*Medeola virginiana*	S3S4
Large False Solomon's Seal	*Asparagaceae*	*Maianthemum racemosum*	S4
Maryland Sanicle	*Apiaceae*	*Sanicula marilandica*	S3S4
Herb Robert	*Geraniaceae*	*Geranium robertianum*	S4
Broad-leaved Enchanter's Nightshade	*Onagraceae*	*Circaea canadensis*	S2S3
Bristly Sarsaparilla	*Araliaceae*	*Aralia hispida*	S4
Loesel's Twayblade	*Orchidaceae*	*Liparis loeselii*	S3
Atriplex	*Amaranthaceae*	*Atriplex sp.*	N/A
Large-leaved Aster	*Asteraceae*	*Eurybia macrophylla*	S3
Common Water Parsnip	*Apiaceae*	*Sium suave*	S5
Greater Water Dock	*Polygonaceae*	*Rumex britannica*	S5
Seaside Spurge	*Euphorbiaceae*	*Euphorbia polygonifolia*	S2S3
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Sedge Sp.	*Cyperaceae*	*Carex sp.*	N/A
Common Woolly Bulrush	*Cyperaceae*	*Scirpus cyperinus*	S5
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
RUSHES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rush	*Juncaceae*	*Juncus sp*	N/A
Canada Rush	*Juncaceae*	*Juncus canadensis*	S4
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
Bracken Fern	*Dennstaedtiaceae*	*Pteridium aquilinum*	S5
Mountain Wood Fern	*Dryopteridaceae*	*Dryopteris campyloptera*	S4
Interrupted Fern	*Osmundaceae*	*Claytosmunda claytoniana*	S5
Common Oak Fern	*Cystopteridaceae*	*Gymnocarpium dryopteris*	S5
New York Fern	*Thelypteridaceae*	*Parathelypteris noveboracensis*	S5
Northern Beech Fern	*Thelypteridaceae*	*Phegopteris connectilis*	S5
Eastern Hay-Scented Fern	*Dennstaedtiaceae*	*Dennstaedtia punctilobula*	S5
CLUBMOSSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Round-branched Tree-clubmoss	*Lycopodiaceae*	*Dendrolycopodium dendroideum*	S5
Northern Bog Clubmoss	*Lycopodiaceae*	*Lycopodiella inundata*	S3
Hickey's Tree-clubmoss	*Lycopodiaceae*	*Dendrolycopodium hickeyi*	S3
Running Clubmoss	*Lycopodiaceae*	*Lycopodium clavatum*	S4S5

COASTAL DUNE RESTORATION SPECIES

EXPOSURE TYPE:	COASTAL TYPE:	COASTAL INTENSITY:	DRAINAGE:
COASTAL	**DUNE**	**KRUMMHOLZING & WINDY**	**LOW**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
Eastern White Cedar	*Cupressaceae*	*Thuja occidentalis*	S3S4
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
Balsam Poplar	*Salicaceae*	*Populus balsamifera*	S3
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Creeping Juniper	*Cupressaceae*	*Juniperus horizontalis*	S2S3
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Sweet Gale	*Myricaceae*	*Myrica gale*	S5
Red Osier Dogwood	*Cornaceae*	*Cornus sericea*	S5
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Common Bearberry	*Ericaceae*	*Arctostaphylos uva-ursi*	S3
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rough Cocklebur	*Asteraceae*	*Xanthium strumarium*	S4
Small-flowered Evening Primrose	*Onagraceae*	*Oenothera parviflora*	S4S5
Blunt-leaved Sandwort	*Caryophyllaceae*	*Moehringia lateriflora*	S5
Seabeach Sandwort	*Caryophyllaceae*	*Honckenya peploides*	S3S4
Spotted Joe Pye Weed	*Asteraceae*	*Eutrochium maculatum*	S5
Three-petaled Bedstraw	*Rubiaceae*	*Galium trifidum*	S4S5
Three-flowered Bedstraw	*Rubiaceae*	*Galium triflorum*	S5
Bastard's Toadflax	*Santalaceae*	*Comandra umbellata*	S3
Eastern Burnweed	*Asteraceae*	*Erechtites hieraciifolius*	S4
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Thin-leaved Orache	*Amaranthaceae*	*Atriplex prostrata*	S4
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Spotted Jewelweed	*Balsaminaceae*	*Impatiens capensis*	S5
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Pearly Everlasting	*Asteraceae*	*Anaphalis margaritacea*	S5
Marsh Cinquefoil	*Rosaceae*	*Comarum palustre*	S4
Marsh Vetchling	*Fabaceae*	*Lathyrus palustris*	S4S5
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Saltmeadow Cordgrass	*Poaceae*	*Sporobolus pumilus*	S4S5
Mountain Cranberry	*Ericaceae*	*Vaccinium vitis-idaea*	S3
Large-leaved Goldenrod	*Asteraceae*	*Solidago macrophylla*	S2
Procumbent Pearlwort	*Caryophyllaceae*	*Sagina procumbens*	S4
Perennial Evening Primrose	*Onagraceae*	*Oenothera perennis*	S4
Tierra del Fuego Dock	*Polygonaceae*	*Rumex fueginus*	S4
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Saltmarsh Bulrush	*Cyperaceae*	*Bolboschoenus maritimus*	S4
Dwarf Spikerush	*Cyperaceae*	*Eleocharis parvula*	S4
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5


coastal balsam poplar


rough cocklebur


bastard's toadflax

COASTAL LOW PLAIN RESTORATION SPECIES

EXPOSURE TYPE:	COASTAL TYPE:	COASTAL INTENSITY:	DRAINAGE:
COASTAL	**LOW PLAIN**	**ALL**	**LOW**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
Black Spruce	*Pinaceae*	*Picea mariana*	S5
Tamarack	*Pinaceae*	*Larix laricina*	S5
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
Red Spruce	*Pinaceae*	*Picea rubens*	S5
Eastern White Cedar	*Cupressaceae*	*Thuja occidentalis*	S3S4
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Black Ash	*Oleaceae*	*Fraxinus nigra*	S2
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
White Ash	*Oleaceae*	*Fraxinus americana*	S2S3
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Western Poison Ivy	*Anacardiaceae*	*Toxicodendron radicans var. rydbergii*	S4
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Sweet Gale	*Myricaceae*	*Myrica gale*	S5
Northern Wild Raisin	*Viburnaceae*	*Viburnum cassinoides*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Speckled Alder	*Betulaceae*	*Alnus incana*	S5
Black Huckleberry	*Ericaceae*	*Gaylussacia baccata*	S4S5
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Red Osier Dogwood	*Cornaceae*	*Cornus sericea*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Mountain Holly	*Aquifoliaceae*	*Ilex mucronata*	S5
Late Lowbush Blueberry	*Ericaceae*	*Vaccinium angustifolium*	S5
Sheep Laurel	*Ericaceae*	*Kalmia angustifolia*	S5
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Canada Fly Honeysuckle	*Caprifoliaceae*	*Lonicera canadensis*	S5
Common Labrador Tea	*Ericaceae*	*Rhododendron groenlandicum*	S5
Dwarf Red Raspberry	*Rosaceae*	*Rubus pubescens*	S5
Shining Rose	*Rosaceae*	*Rosa nitida*	S4
Bristly Dewberry	*Rosaceae*	*Rubus hispidus*	S4
Dwarf Huckleberry	*Ericaceae*	*Gaylussacia bigeloviana*	S3
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Prairie Cordgrass	*Poaceae*	*Sporobolus michauxianus*	S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
Common Silverweed	*Rosaceae*	*Potentilla anserina*	S5
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Three-leaved Rattlesnakeroot	*Asteraceae*	*Nabalus trifoliolatus*	S5
Seaside Arrowgrass	*Juncaginaceae*	*Triglochin maritima*	S4S5
Canada Germander	*Lamiaceae*	*Teucrium canadense*	S3S4
White Sea-blite	*Amaranthaceae*	*Suaeda maritima*	S4S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
Thin-leaved Orache	*Amaranthaceae*	*Atriplex prostrata*	S4
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Saltmeadow Cordgrass	*Poaceae*	*Sporobolus pumilus*	S4S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Sea Lavender	*Plumbaginaceae*	*Limonium carolinianum*	S4S5
Whorled Wood Aster	*Asteraceae*	*Oclemena acuminata*	S5
Hedge False Bindweed	*Convolvulaceae*	*Calystegia sepium*	S5
Tall Meadow-Rue	*Ranunculaceae*	*Thalictrum pubescens*	S5
Mad-dog Skullcap	*Lamiaceae*	*Scutellaria lateriflora*	S5
Smooth Cordgrass	*Poaceae*	*Sporobolus alterniflorus*	S4S5
Sea Milkwort	*Primulaceae*	*Lysimachia maritima*	S4S5
Sea Glasswort	*Amaranthaceae*	*Salicornia maritima*	S4S5
Tuberous Grass Pink	*Orchidaceae*	*Calopogon tuberosus*	S3
Saltmarsh Sandspurrey	*Caryophyllaceae*	*Spergularia salina*	S4
Seaside Buttercup	*Ranunculaceae*	*Halerpestes cymbalaria*	S4
Rough Cocklebur	*Asteraceae*	*Xanthium strumarium*	S4
Seabeach Sandwort	*Caryophyllaceae*	*Honckenya peploides*	S3S4
Three-petaled Bedstraw	*Rubiaceae*	*Galium trifidum*	S4S5
Three-flowered Bedstraw	*Rubiaceae*	*Galium triflorum*	S5
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Tierra del Fuego Dock	*Polygonaceae*	*Rumex fueginus*	S4
Common Eelgrass	*Zosteraceae*	*Zostera marina*	S4
American Searocket	*Brassicaceae*	*Cakile edentula*	S4S5
Bedstraw	*Rubiaceae*	*Galium sp*	N/A
Seaside Plantain	*Plantaginaceae*	*Plantago maritima*	S4S5
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
Clover spp.	*Fabaceae*	*Clover spp.*	N/A
Broad-leaved Cattail	*Typhaceae*	*Typha latifolia*	S5
Northern Water Horehound	*Lamiaceae*	*Lycopus uniflorus*	S5
Swamp Yellow Loosestrife	*Primulaceae*	*Lysimachia terrestris*	S4S5
Pink Lady's-Slipper	*Orchidaceae*	*Cypripedium acaule*	S5
Small Cranberry	*Ericaceae*	*Vaccinium oxycoccos*	S4
Aster spp.	*Asteraceae*	*Symphyotrichum sp*	N/A
Common Ragweed	*Asteraceae*	*Ambrosia artemisiifolia*	S4
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Scotch Lovage	*Apiaceae*	*Ligusticum scoticum*	S4
Shinleaf	*Ericaceae*	*Pyrola elliptica*	S5
Round-leaved Sundew	*Droseraceae*	*Drosera rotundifolia*	S4
Rough Bedstraw	*Rubiaceae*	*Galium asprellum*	S4S5
European Wood Sorrel	*Oxalidaceae*	*Oxalis stricta*	S5
Creeping Snowberry	*Ericaceae*	*Gaultheria hispidula*	S5
Three-leaved False Soloman's Seal	*Asparagaceae*	*Maianthemum trifolium*	S4
Eastern Teaberry	*Ericaceae*	*Gaultheria procumbens*	S4S5
Tufted Yellow Loosestrife	*Primulaceae*	*Lysimachia thyrsiflora*	S4S5
White Fringed Orchid	*Orchidaceae*	*Platanthera blephariglottis*	S3S4
Dodder	*Convolvulaceae*	*Cuscuta sp.*	N/A
Virginia Wild Rye	*Poaceae*	*Elymus virginicus*	S2S3
Fringed Black Bindweed	*Polygonaceae*	*Fallopia cilinodis*	S4
Northern Pitcher Plant	*Sarraceniaceae*	*Sarracenia purpurea*	S4
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Sedge Sp.	*Cyperaceae*	*Carex sp.*	N/A
Bladder Sedge	*Cyperaceae*	*Carex intumescens*	S4S5
Common Woolly Bulrush	*Cyperaceae*	*Scirpus cyperinus*	S5
Tawny Cottongrass	*Cyperaceae*	*Eriophorum virginicum*	S4
Saltmarsh Bulrush	*Cyperaceae*	*Bolboschoenus maritimus*	S4
Chaffy Sedge	*Cyperaceae*	*Carex paleacea*	S4S5
Hardstem Bulrush	*Cyperaceae*	*Schoenoplectus acutus*	S4
Black-girdled Bulrush	*Cyperaceae*	*Scirpus atrocinctus*	S4S5
Dark-green Bulrush	*Cyperaceae*	*Scirpus atrovirens*	S1
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
Bluejoint Reed Grass	*Poaceae*	*Calamagrostis canadensis*	S5
Red Fescue	*Poaceae*	*Festuca rubra*	S5
Foxtail Barley	*Poaceae*	*Hordeum jubatum*	S4
RUSHES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Baltic Rush	*Juncaceae*	*Juncus balticus*	S5
Rush	*Juncaceae*	*Juncus sp*	N/A
Canada Rush	*Juncaceae*	*Juncus canadensis*	S4
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Spinulose Wood Fern	*Dryopteridaceae*	*Dryopteris carthusiana*	S4S5
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
Bracken Fern	*Dennstaedtiaceae*	*Pteridium aquilinum*	S5
HORSETAILS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Woodland Horsetail	*Equisetaceae*	*Equisetum sylvaticum*	S5

ESTUARY CLIFF/BLUFF RESTORATION SPECIES

EXPOSURE TYPE:	COASTAL TYPE:	COASTAL INTENSITY:	DRAINAGE:
ESTUARY	**CLIFF/BLUFF**	**ALL**	**ALL**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
Large-toothed Aspen	*Salicaceae*	*Populus grandidentata*	S4S5
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Beaked Hazel	*Betulaceae*	*Corylus cornuta*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Hawkweed spp.	*Asteraceae*	*Hieracium sp*	N/A
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
Common Eelgrass	*Zosteraceae*	*Zostera marina*	S4
Common Evening Primrose	*Onagraceae*	*Oenothera biennis*	S5
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Wild Strawberry	*Rosaceae*	*Fragaria virginiana*	S5
Bedstraw	*Rubiaceae*	*Galium sp*	N/A
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
Violet Sp.	*Violaceae*	*Viola sp.*	N/A
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Bracken Fern	*Dennstaedtiaceae*	*Pteridium aquilinum*	S5


American mountain ash


rough stem goldenrod


Belmont Provincial Park

ESTUARY LOW PLAIN RESTORATION SPECIES

EXPOSURE TYPE:	COASTAL TYPE:	COASTAL INTENSITY:	DRAINAGE:
ESTUARY	**LOW PLAIN**	**ALL**	**ALL**

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
White Spruce	*Pinaceae*	*Picea glauca*	S5
Black Spruce	*Pinaceae*	*Picea mariana*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Pin Cherry	*Rosaceae*	*Prunus pensylvanica*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Northern Red Oak	*Fagaceae*	*Quercus rubra*	S3S4
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
White Ash	*Oleaceae*	*Fraxinus americana*	S2S3
Sugar Maple	*Sapindaceae*	*Acer saccharum*	S4
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
Beaked Hazel	*Betulaceae*	*Corylus cornuta*	S5
Northern Wild Raisin	*Viburnaceae*	*Viburnum cassinoides*	S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Sweet Gale	*Myricaceae*	*Myrica gale*	S5
Red Raspberry	*Rosaceae*	*Rubus idaeus*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Smooth Gooseberry	*Grossulariaceae*	*Ribes hirtellum*	S5
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Late Lowbush Blueberry	*Ericaceae*	*Vaccinium angustifolium*	S5
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Sheep Laurel	*Ericaceae*	*Kalmia angustifolia*	S5
Woolly Beach-heath	*Cistaceae*	*Hudsonia tomentosa*	S3
Canada Fly Honeysuckle	*Caprifoliaceae*	*Lonicera canadensis*	S5
Spreading Dogbane	*Apocynaceae*	*Apocynum androsaemifolium*	S4
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Common Bearberry	*Ericaceae*	*Arctostaphylos uva-ursi*	S3
Black Huckleberry	*Ericaceae*	*Gaylussacia baccata*	S4S5
Broom Crowberry	*Ericaceae*	*Corema conradii*	S2S3
Western Poison Ivy	*Anacardiaceae*	*Toxicodendron radicans var. rydbergii*	S4
Canada Yew	*Taxaceae*	*Taxus canadensis*	S4
Alternate-leaved Dogwood	*Cornaceae*	*Cornus alternifolia*	S4
Mountain Maple	*Sapindaceae*	*Acer spicatum*	S5
Dwarf Red Raspberry	*Rosaceae*	*Rubus pubescens*	S5
Shining Rose	*Rosaceae*	*Rosa nitida*	S4
Staghorn Sumac	*Anacardiaceae*	*Rhus typhina*	S3
Leatherleaf	*Ericaceae*	*Chamaedaphne calyculata*	S4
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Sea Lavender	*Plumbaginaceae*	*Limonium carolinianum*	S4S5
Sea Milkwort	*Primulaceae*	*Lysimachia maritima*	S4S5
Broad-leaved Cattail	*Typhaceae*	*Typha latifolia*	S5
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Hairy Flat-top White Aster	*Asteraceae*	*Doellingeria umbellata*	S5
Wild Sarsaparilla	*Araliaceae*	*Aralia nudicaulis*	S5
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
Hedge False Bindweed	*Convolvulaceae*	*Calystegia sepium*	S5
Whorled Wood Aster	*Asteraceae*	*Oclemena acuminata*	S5
Common Ragweed	*Asteraceae*	*Ambrosia artemisiifolia*	S4
White Sea-blite	*Amaranthaceae*	*Suaeda maritima*	S4S5
Canada Germander	*Lamiaceae*	*Teucrium canadense*	S3S4
Bunchberry	*Cornaceae*	*Cornus canadensis*	S5
Prairie Cordgrass	*Poaceae*	*Sporobolus michauxianus*	S5
Scotch Lovage	*Apiaceae*	*Ligusticum scoticum*	S4
Seaside Arrowgrass	*Juncaginaceae*	*Triglochin maritima*	S4S5
Smooth Cordgrass	*Poaceae*	*Sporobolus alterniflorus*	S4S5
Sea Glasswort	*Amaranthaceae*	*Salicornia maritima*	S4S5
Saltmarsh Sandspurrey	*Caryophyllaceae*	*Spergularia salina*	S4
American Beach Grass	*Poaceae*	*Calamagrostis brevilugulata*	S4S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
American Searocket	*Brassicaceae*	*Cakile edentula*	S4S5
Hawkweed spp.	*Asteraceae*	*Hieracium sp*	N/A
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
Common Eelgrass	*Zosteraceae*	*Zostera marina*	S4
Common Silverweed	*Rosaceae*	*Potentilla anserina*	S5
Common Evening Primrose	*Onagraceae*	*Oenothera biennis*	S5

American mountain ash

Seaside Plantain	*Plantaginaceae*	*Plantago maritima*	S4S5
Northern Willowherb	*Onagraceae*	*Epilobium ciliatum*	S5
Spotted Jewelweed	*Balsaminaceae*	*Impatiens capensis*	S5
Wild Lily-of-The-Valley	*Asparagaceae*	*Maianthemum canadense*	S5
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Northern Starflower	*Primulaceae*	*Lysimachia borealis*	S5
Yellow Bluebead Lily	*Liliaceae*	*Clintonia borealis*	S5
Swamp Yellow Loosestrife	*Primulaceae*	*Lysimachia terrestris*	S4S5
Pearly Everlasting	*Asteraceae*	*Anaphalis margaritacea*	S5
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
Turion Duckweed	*Araceae*	*Lemna turionifera*	S4S5
Pink Lady's-Slipper	*Orchidaceae*	*Cypripedium acaule*	S5
Small Cranberry	*Ericaceae*	*Vaccinium oxycoccos*	S4
Marsh Skullcap	*Lamiaceae*	*Scutellaria galericulata*	S4S5
Tall Meadow-Rue	*Ranunculaceae*	*Thalictrum pubescens*	S5
Aster spp.	*Asteraceae*	*Symphyotrichum sp*	N/A
Avens	*Rosaceae*	*Geum sp*	N/A
Small-flowered Evening Primrose	*Onagraceae*	*Oenothera parviflora*	S4S5
Marsh Vetchling	*Fabaceae*	*Lathyrus palustris*	S4S5
Small Forget-Me-Not	*Boraginaceae*	*Myosotis laxa*	S4
American Water Horehound	*Lamiaceae*	*Lycopus americanus*	S4S5
Fraser's St. John's-wort	*Hypericaceae*	*Hypericum fraseri*	S5
Willherb spp.	*Onagraceae*	*Epilobium sp*	N/A
Twinflower	*Caprifoliaceae*	*Linnaea borealis*	S5
Saltmeadow Cordgrass	*Poaceae*	*Sporobolus pumilus*	S4S5
Sea Lyme Grass	*Poaceae*	*Leymus mollis*	S4
Small Enchanter's Nightshade	*Onagraceae*	*Circaea alpina*	S5
American Cow Wheat	*Orobanchaceae*	*Melampyrum lineare*	S4S5
Trailing Arbutus	*Ericaceae*	*Epigaea repens*	S4
Three-petaled Bedstraw	*Rubiaceae*	*Galium trifidum*	S4S5
Three-flowered Bedstraw	*Rubiaceae*	*Galium triflorum*	S5
Common Cow Parsnip	*Apiaceae*	*Heracleum maximum*	S4
Nodding Trillium	*Melanthiaceae*	*Trillium cernuum*	S4
Fireweed	*Onagraceae*	*Chamaenerion angustifolium*	S5
Cucumber Root	*Liliaceae*	*Medeola virginiana*	S3S4
Large False Solomon's Seal	*Asparagaceae*	*Maianthemum racemosum*	S4
Maryland Sanicle	*Apiaceae*	*Sanicula marilandica*	S3S4
Herb Robert	*Geraniaceae*	*Geranium robertianum*	S4
Broad-leaved Enchanter's Nightshade	*Onagraceae*	*Circaea canadensis*	S2S3
Large-leaved Aster	*Asteraceae*	*Eurybia macrophylla*	S3
Tufted Yellow Loosestrife	*Primulaceae*	*Lysimachia thyrsiflora*	S4S5
Fringed Black Bindweed	*Polygonaceae*	*Fallopia cilinodis*	S4
Seaside Angelica	*Apiaceae*	*Angelica lucida*	S2S3
Rough Cinquefoil	*Rosaceae*	*Potentilla norvegica*	S4S5
Canadian Mint	*Lamiaceae*	*Mentha canadensis*	S4S5
Jack-in-the-pulpit	*Araceae*	*Arisaema triphyllum*	S4
Red Baneberry	*Ranunculaceae*	*Actaea rubra*	S4
Rose Twisted-stalk	*Liliaceae*	*Streptopus lanceolatus*	S4
Saline Saltbush	*Amaranthaceae*	*Atriplex dioica*	S4
Large Toothwort	*Brassicaceae*	*Cardamine maxima*	S1
Beach Pinweed	*Cistaceae*	*Lechea maritima*	S2
Pinweed sp.	*Cistaceae*	*Lechea sp.*	N/A
Common Bedstraw	*Rubiaceae*	*Galium aparine*	S1
Wild Strawberry	*Rosaceae*	*Fragaria virginiana*	S5
Calico Aster	*Asteraceae*	*Symphyotrichum lateriflorum*	S5
Large Cranberry	*Ericaceae*	*Vaccinium macrocarpon*	S4S5
SEDGES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Saltmarsh Bulrush	*Cyperaceae*	*Bolboschoenus maritimus*	S4
GRASSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Grass Spp.	*Poaceae*	*Grass Spp.*	N/A
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Interrupted Fern	*Osmundaceae*	*Claytosmunda claytoniana*	S5
Cinnamon Fern	*Osmundaceae*	*Osmundastrum cinnamomeum*	S5
Mountain Wood Fern	*Dryopteridaceae*	*Dryopteris campyloptera*	S4
Bracken Fern	*Dennstaedtiaceae*	*Pteridium aquilinum*	S5
Evergreen Wood Fern	*Dryopteridaceae*	*Dryopteris intermedia*	S5
Spinulose Wood Fern	*Dryopteridaceae*	*Dryopteris carthusiana*	S4S5
Common Oak Fern	*Cystopteridaceae*	*Gymnocarpium dryopteris*	S5
New York Fern	*Thelypteridaceae*	*Parathelypteris noveboracensis*	S5
Northern Beech Fern	*Thelypteridaceae*	*Phegopteris connectilis*	S5
Eastern Hay-Scented Fern	*Dennstaedtiaceae*	*Dennstaedtia punctilobula*	S5
Ostrich Fern	*Onocleaceae*	*Matteuccia struthiopteris*	S4
Christmas Fern	*Dryopteridaceae*	*Polystichum acrostichoides*	S2S3
CLUBMOSSES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Running Clubmoss	*Lycopodiaceae*	*Lycopodium clavatum*	S4S5
HORSETAILS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Field Horsetail	*Equisetaceae*	*Equisetum arvense*	S5

RESTORATION CASE STUDY: DALVAY

Old Dalvay Parking Lot Restoration Site, Year Two, PEI National Park

The decommissioned Dalvay parking area in the PEI National Park was the very first restoration trial site. 2022's post-tropical storm Fiona caused heavy damage across the province, but our northern shores were particularly hard-hit. Areas with heavy development in the National Park saw substantial erosion and coastal flooding. The Dalvay parking area lost tens of meters of shoreline, destroying almost 50% of the paved lot. Rather than repair the infrastructure, the site was decommissioned and prepared for planting, although this resulted in a barren coastal lot with very poor soils composed of too much shale.

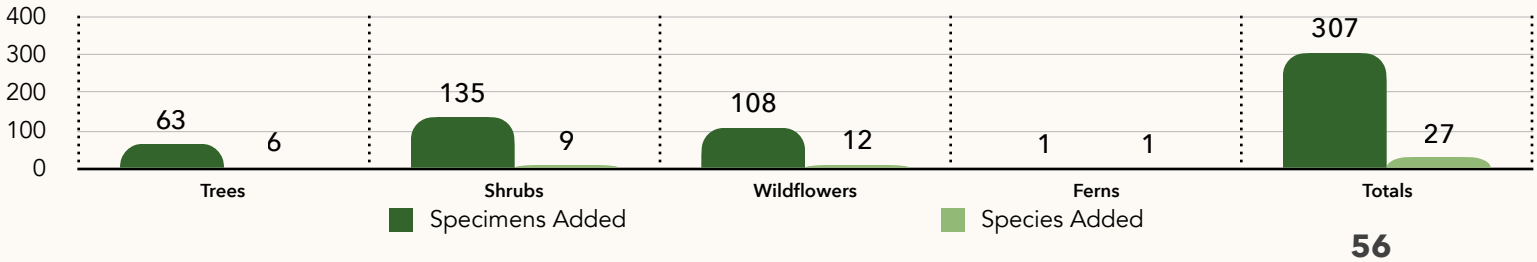
Planting took place in the late spring of 2023. Mulching was limited to a very low quantity due to public concerns of mulch fuelling wildfires and the very public setting. The restoration strategy aimed at mimicking natural sites, particularly concerning planting density and placement. Six dense planting areas were created, bordered by logs to improve water retention and wind exposure. These krummholz gardens were set back from the cliff's edge to ensure adequate time for specimen establishment before new storm events could cause more damage. Each bed was planted with a variety species and specimen types, with forbs and wildflowers placed closest to the shore, then shrubs, and finally trees towards the inland section of each bed.

PEI NATIONAL PARK DALVAY SITE INFO

Shore Exposure: Coastal
Coastal Type: Dune/Cliff
Coastal Forest Category: Primary
Planting Season: Late Spring
Restoration Goals: Afforestation
Soil Quality: Very Poor

Watering: None
Mulching: Very Low
Tree Wraps: None
Tree Caging: None
Tree Staking: None

PEI National Park: Old Dalvay Parking Area



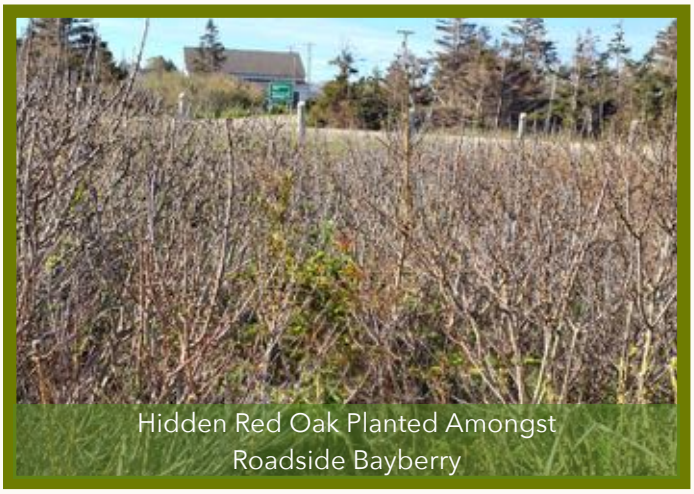
RESTORATION CASE STUDY: DALVAY

Although trees at this site fared very poorly, with many dying by the second growing season, some of the most sheltered specimens have begun the process of wind-pruning and krummholz shaping.

In addition to the krummholz gardens, a number of specimens were planted alongside the Gulf Shore Parkway, amongst the wetter sections of the ditch as well as amongst the bayberry bordering the road. Other plants were inserted along the western existing krummholz vegetation, often singular trial species such as bush honeysuckle, cinnamon fern, and American mountain ash.

Despite best laid plans, this planting site had a number of challenges. Firstly, site soil remediation resulting in a very poor planting medium. Composed of too much shale and gravel, this decommissioned area likely has issues with soil drainage, aeration, and nutrient availability. Secondly, appropriate specimen availability was also a challenge. Although smaller specimens were sought out, they were not available at the time of planting. This resulted in 1-2 foot trees and shrub specimens being used, rather than the smaller sizing that was planned. Finally, as previously mentioned, quantities of mulch applied were substandard.

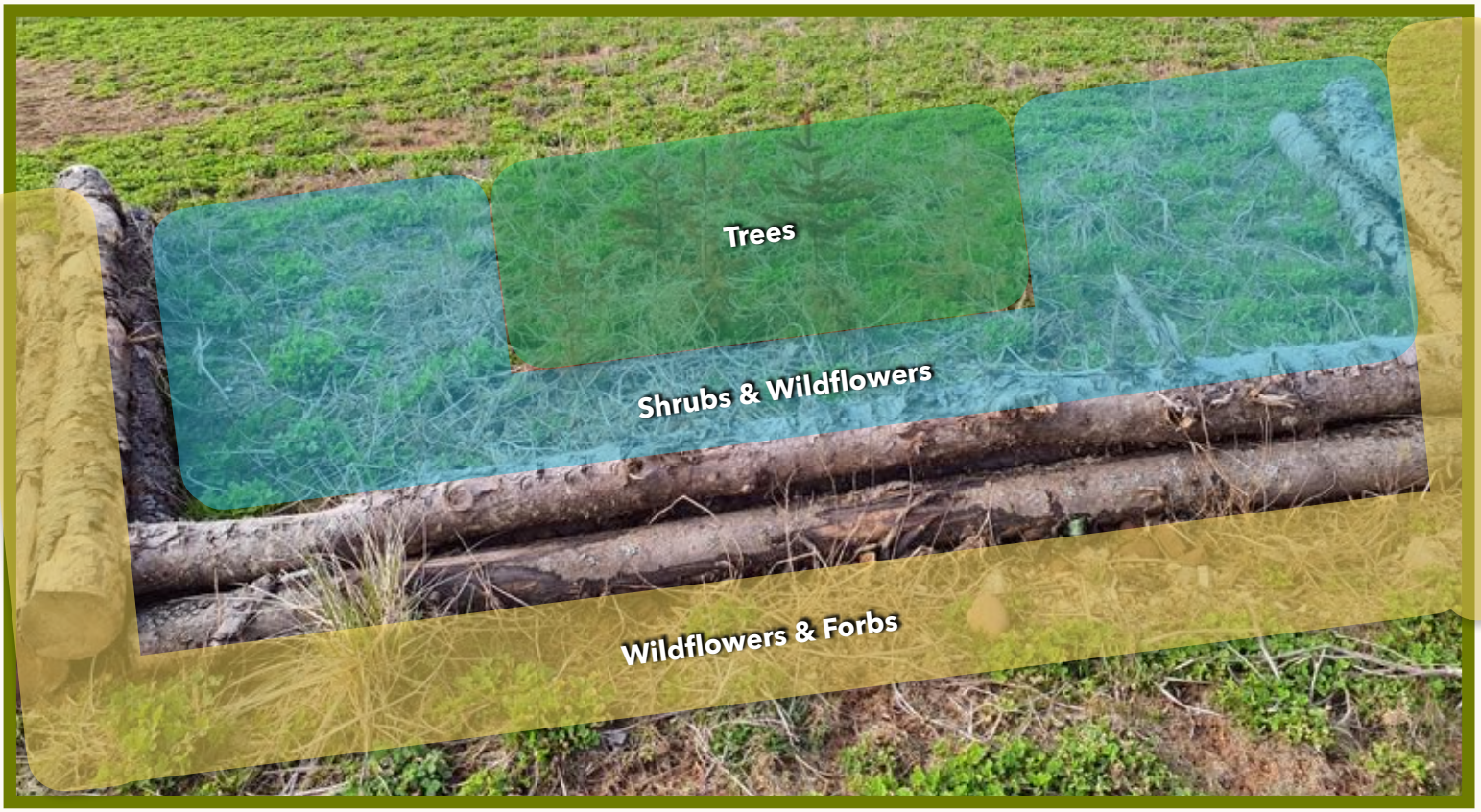
The results of this planting have been mixed although exceedingly informative. Most of the white spruce planted in the krummholz beds have fared poorly, with most dying by the second season. Those few that survived have experience more than 75% die-back, showcasing these these specimens were too large and mature, as hypothesized.



Hidden Red Oak Planted Amongst Roadside Bayberry

Forbs & Wildflowers had the highest survival rates

RESTORATION CASE STUDY: DALVAY



Shrub species generally fared much better, although many were over-sized specimens which experienced ample die-back. Despite these challenges, most shrub specimens remained living by the second season, although most survived via root or stump sprouting, or only showed growth from the lowest and most sheltered buds.

The wildflowers, ferns, and forbs all had much better survival rates, with the majority found during monitoring. These specimens were better sized for the site conditions, but were also planted in the most exposed locales.

A number of woody specimens were heavily browsed by snowshoe hard during their second winter, although not as prolifically as other nearby restoration sites.

Despite the mixed results of this restoration trial, a number of valuable lessons have been learned. Afforestation sites often have increased restoration challenges, such as poor soils and extremely exposed conditions. Natural patterns of ecological succession are critical to mimic at these kinds of sites. Woody specimens benefit greatly from established vegetative ground-cover and shelter, improving water availability and reducing the effects of harsh winds. Specimen sizing/aging is also another critical consideration, as more mature plants experience much more shock when settling into these harsh conditions, while required more resources to survive and thrive.


Stump Sprouting Wild Rose


Cinnamon Fern in Wet Ditch, Year Two

SPECIES LIST

FORESTED PRIORITY PLACE	Coastal Forests & Krummholz
PROJECT TITLE:	Restoring Our Coastal Sheild
SITE:	Dalvay PEI NP

BIODIVERSITY

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Northern Red Oak	*Fagaceae*	*Quercus rubra*	S3S4
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Beaked Hazel	*Betulaceae*	*Corylus cornuta*	S5
Willow	*Salicaceae*	*Salix spp.*	N/A
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Northern Bush Honeysuckle	*Caprifoliaceae*	*Diervilla lonicera*	S4
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Grass-leaved Goldenrod	*Asteraceae*	*Euthamia graminifolia*	S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Herb Robert	*Geraniaceae*	*Geranium robertianum*	S4
Mountain Blue-eyed-grass	*Iridaceae*	*Sisyrinchium montanum*	S5
Starry False Solomon's Seal	*Asparagaceae*	*Maianthemum stellatum*	S3
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
Beach Pea	*Fabaceae*	*Lathyrus japonicus*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Male Fern	*Dryopteridaceae*	*Dryopteris filix-mas*	S1

RESTORATION CASE STUDY: CABLEHEAD EAST

INT Perret-MacKinnon Restoration Site, Cablehead, PEI

Stewarded by the Island Nature Trust, the Perret-MacKinnon property is located in Cablehead East, along the north shore. Previously under agricultural production for the first half of the 20th century, farming ceased by the mid 1960's. Since then, the property was left fallow, save for some limited mowed areas. Since then, this high-wind coastal area regenerated naturally, with densest initial white spruce colonization occurring more than 100m from the shore, with forbs and shrubs pioneering the windiest areas. Over the last 60 years, the white spruce have advanced towards the shore, resulting in increasingly deformed specimens due to harsher winds. The spruce could only establish in these harsh conditions due to the natural spread of coastal shrubs and wildflowers, incrementally slowing winds.

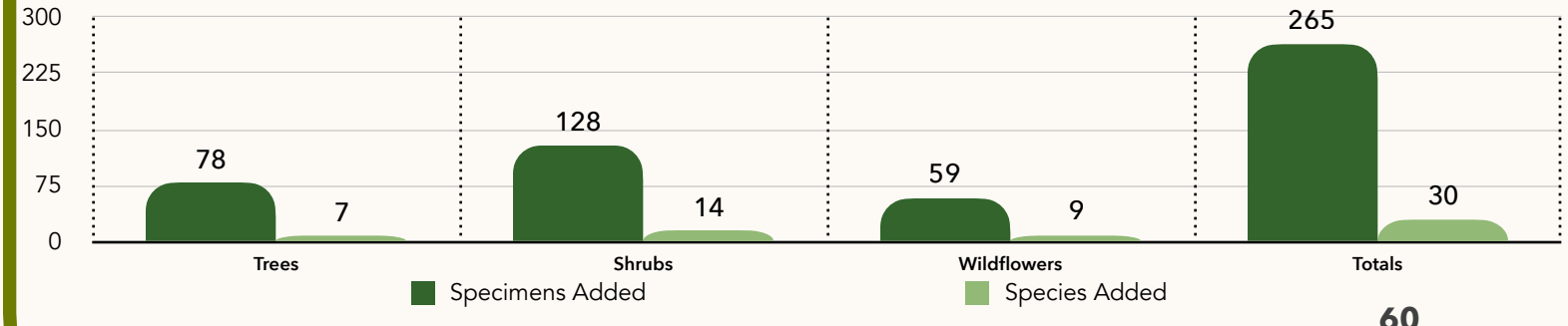
It was also apparent during field assessment that, despite its agricultural history, this site had some small remnant population of typical coastal krummholzing flora, as uncommon and rare species such as black crowberry, our native junipers, and even bastard's toadflax were found. The last species is a holdover from a time when this section of coast had much sandier backshore, as seen in the 1935 historic aerial photos.

INT PERRET-MACKINNON SITE INFO

Shore Exposure: Coastal
Coastal Type: Cliff/Bluff
Coastal Forest Category: Primary
Planting Season: Late Spring
Restoration Goals: Enhancement

Watering: None
Mulching: Medium
Tree Wraps: None
Tree Caging: None
Tree Staking: None

Island Nature Trust: Perret-MacKinnon Property



RESTORATION CASE STUDY: CABLEHEAD EAST

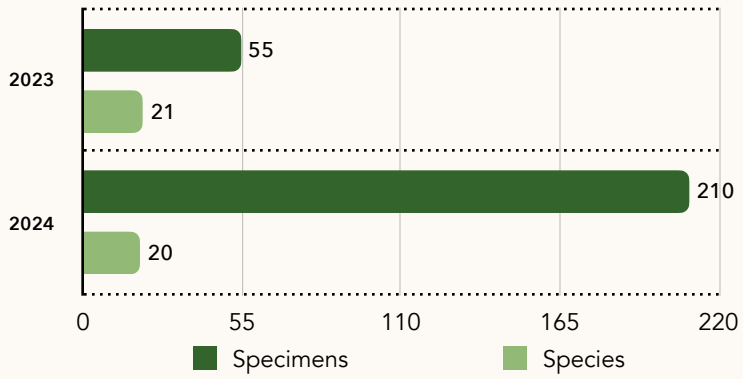
Specific specimen placement mimicked natural patterns of ecological wind zonation as seen across other study sites. For example, spruce were predominantly planted inland from developing shrub thickets in an effort to increase survival.

A unique restoration site due to its land-use history and advanced ecological succession, this area was enhanced in both the 2023 and 2024 seasons of the project. In addition to its more developed ecology, different planting strategies were used compared to the Dalvay site. Tree specimens were planted in scattered groups, primarily on the leeward side of the shrub zone. Some few were placed in more exposed areas, such in the less protected, crowberry dominated coast-top zone, as well as amongst heavy marram grass areas. Shrub species were planted in clumps of three, with the toughest species like bayberry placed in the coast-top and shrub zones. Less tolerant species, such as spiraea and aronia were planted along the edge of the thicket zone. A number of later successional species were planted amongst the larger white spruce, such as bush honeysuckle, sugar maple, white birch, and red oak.

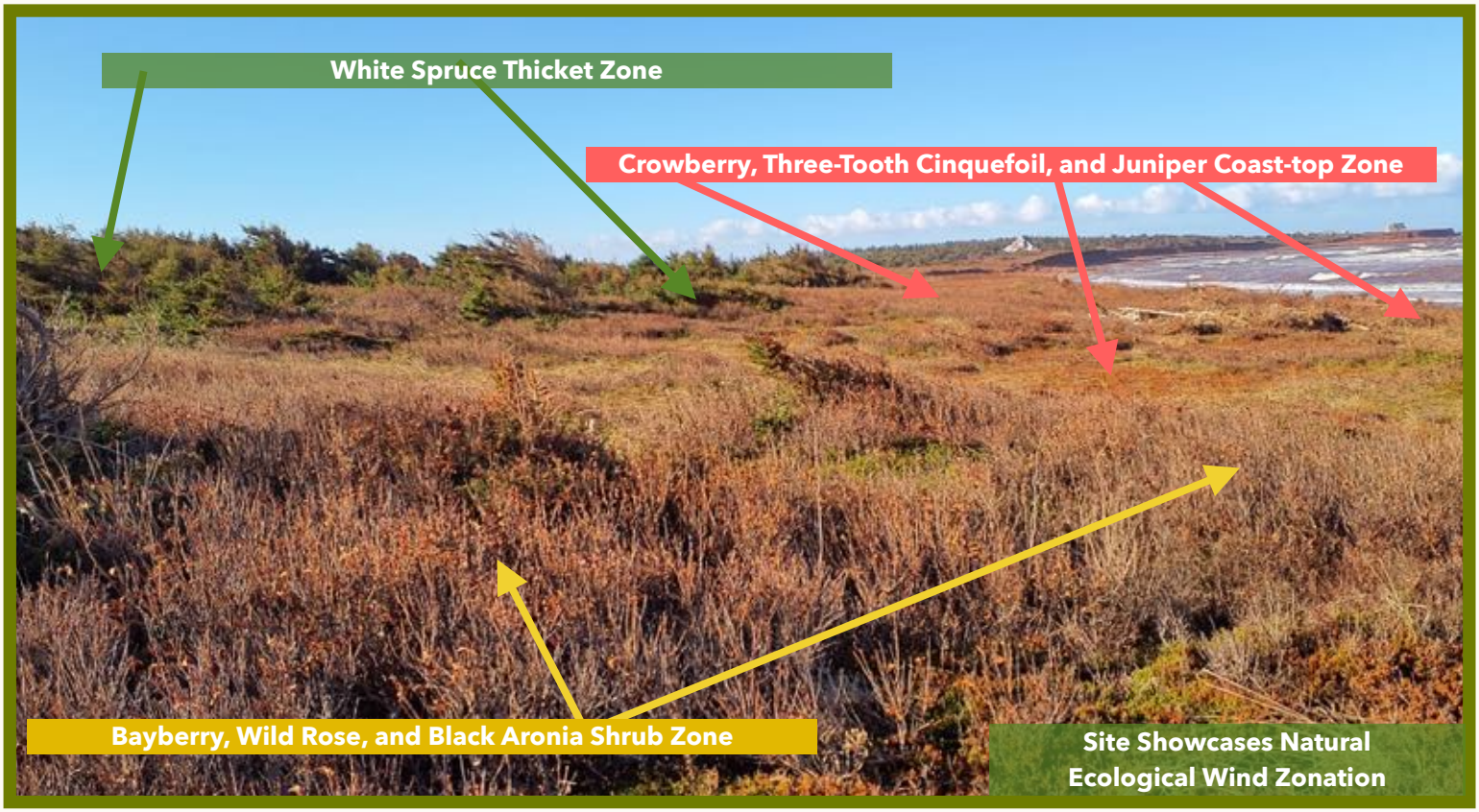
Experimental Sugar Maple planted amongst established white spruce, Year Two

Exposed White Spruce, Year Two
Yellow Circle: Krummholzing Growth
Red Circle: Stem Die-Back

INT Perret MacKinnon Restoration By Year



RESTORATION CASE STUDY: CABLEHEAD EAST



This site has yielded higher success rates than the Dalvay site in the National Park. Much of this increased success is likely due to the advanced ecological succession of the site. Better soils and much more vegetative cover alone would greatly benefit new plantings during their establishment stage. In addition to these site strengths, the established vegetative variety created many wind-sheltered nooks, making nuanced specimen placement easier.

Despite these benefits, the 2023 plantings had similar issues with specimen sizing and availability as other plantings from that season. Spruce and other tree species averaged two feet in height rather than the desired one foot or less. Some shrub specimens were also two feet or taller, exposing more surface area to desiccating winds. Access was also more a challenge for this site compared to those in the National Park, involving a 100 ft walk through dense bayberry, thorny rose, and the occasional wasp nest, to the planting site.

Although the 2023 plantings fared much better than those at Dalvay, no results have been gathered on the better-sized 2024 plantings. Over 75% of the tree species planted in 2023 were found to be living in 2024, although it is expected some will not survive into 2025. Shrub and wildflower species predominantly survived, although many experience substantial die-back, often re-sprouting from root stock.

Although many survived, exposed spruce still experienced heavy die-back after their first Winter.

Conservation Guardians Helping with Restoration

SPECIES LIST

FORESTED PRIORITY PLACE	Coastal Forests & Krummholz
PROJECT TITLE:	Restoring Our Coastal Sheild
SITE:	INT Perret-Mackinnon

BIODIVERSITY

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
White Spruce	*Pinaceae*	*Picea glauca*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Sugar Maple	*Sapindaceae*	*Acer saccharum*	S4
Northern Red Oak	*Fagaceae*	*Quercus rubra*	S3S4
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Serviceberry	*Rosaceae*	*Amelanchier sp*	N/A
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Northern Bush Honeysuckle	*Caprifoliaceae*	*Diervilla lonicera*	S4
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Staghorn Sumac	*Anacardiaceae*	*Rhus typhina*	S3
Hawthorn	*Rosaceae*	*Crataegus spp.*	N/A
Black Crowberry	*Ericaceae*	*Empetrum nigrum*	S3
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Creeping Juniper	*Cupressaceae*	*Juniperus horizontalis*	S2S3
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
New York Aster	*Asteraceae*	*Symphyotrichum novi-belgii*	S5
Herb Robert	*Geraniaceae*	*Geranium robertianum*	S4
Mountain Blue-eyed-grass	*Iridaceae*	*Sisyrinchium montanum*	S5
Downy Goldenrod	*Asteraceae*	*Solidago puberula*	S4S5
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
Three-toothed Cinquefoil	*Rosaceae*	*Sibbaldia tridentata*	S3
NON-NATIVE WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Common Yarrow	*Asteraceae*	*Achillea millefolium*	SNA

Restoration Planting, 2023, with Island Nature Trust Staff & Conservation Guardians

RESTORATION CASE STUDY: STANHOPE

Stanhope Restoration Site, PEI National Park

The Stanhope restoration site is located in the PEI National Park, and was initially surveyed during the 2021 season of this project. Similar to the Dalvay site, this area was heavy-hit by post tropical storm Fiona in 2022. Prior to decommissioning, it was home to a playground, a small building, as well as beach access and accompanying infrastructure. Unlike Dalvay, this site is surrounded on all non-marine sides by established krummholzing white spruce, as well as smaller pockets of marram grass and tight bands of bayberry.

The planning and plantings at Stanhope were part of the 2024 season of this project, incorporating lesson learned from previous restoration sites. The main planting area was a shore-side exposed area recently re-soiled after infrastructure removal. In addition, three decommissioned paths were also planted as secondary areas.

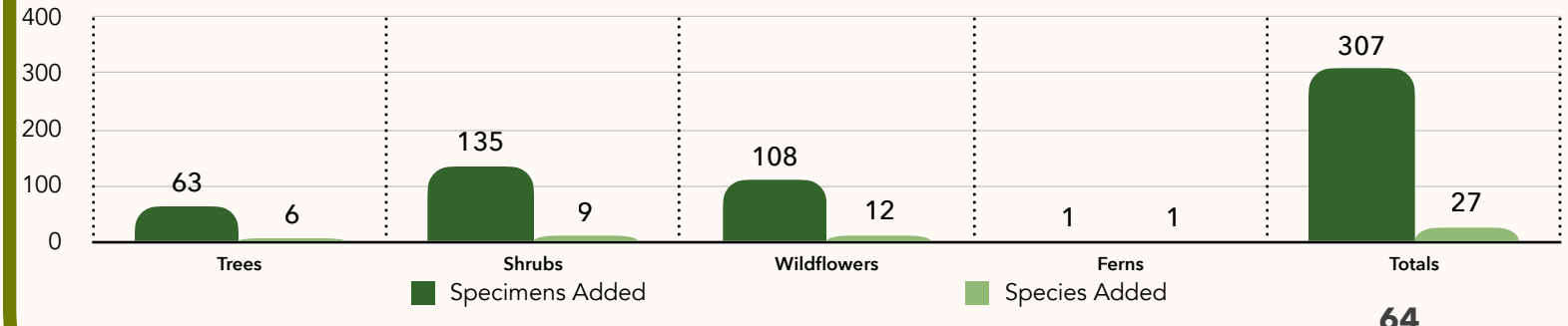
Again, the krummholz garden strategy was employed with a number of amendments to improve specimen survival and health.

PEI NATIONAL PARK STANHOPE SITE INFO

Shore Exposure: Coastal
Coastal Type: Dune/Cliff
Coastal Forest Category: Primary
Planting Season: Late Spring
Restoration Goals: Afforestation

Watering: None
Mulching: Heavy
Tree Wraps: None
Tree Caging: None
Tree Staking: None

PEI National Park: Decommissioned Stanhope Playground Area



RESTORATION CASE STUDY: STANHOPE

The Stanhope Restoration Site Included Planting Decommissioned Paths through Established Krummholz, providing the opportunity to experiment with native species which require more shelter.

After the poor success of tree species at the Dalvay site, it was decided to specialize the krummholz gardens towards favouring species which thrive in specific ecological wind zones. Horizontal coast-top gardens were planted with predominantly wildflowers and forbs closest to marine winds. Further inland, shrub gardens were planted, with wind-resistant bayberry and wild rose closest to the coast. More diver shrub gardens with smaller proportions of white spruce were planted in the most inland row of krummholz gardens, mimicking a transition between shrub and thicket zone. More white spruce were planted amongst the thin bands of developed bayberry, again copying wild specimens observed thriving during fieldwork. Although to early for comprehensive results, initial monitoring during March 2025 suggested much higher survival rates and reduced die-back across the white spruce on-site.

Thriving Shoreside White Spruce Planted Amongst Marram Grass, Year Two

The 3 secondary plantings areas all had differing conditional qualities. The eastern path was the most sheltered and included a small area with poorer drainage. The central path was shadier and dryer due to its orientation towards coastal winds. The western path transitioned into sand dune habitat, losing the protection of established white spruce. Each allowed for a variety of different species for restoration trials.

This site did see heavy snowshoe hare browse damage over the course of its first winter, suggesting tree wraps may benefit plantings with established krummholz shelter.

Sites with Better Habitat had Ample Snowshoe Hare Browsing

RESTORATION CASE STUDY: STANHOPE

Learning from past efforts, White Spruce were primarily planted in areas of established Shrub Zone. These specimens experienced less browning and die-back after their first winter.

Although the plantings at this site cannot be conclusively assessed until the 2025 project season, initial spring visit suggest much better survival rates amongst all species than some of the 2023 sites. This is likely due to a number of reasons, including better species sizing/maturity and placement. Additionally the Stanhope site a number of other advantages. Soils, post-decommissioning, were of better quality than sites such as Dalvay. Approximately 40-50% of this site include areas where soils were relatively undisturbed by all the post-Fiona infrastructure work. More wood mulch was used at this site for all specimens, as this site is shielded from public view.

With better planning, placement, as well as other ecological boons, it is expected that these initially positive results will carry forward as the plantings truly establish on-site during the 2025 growing season.

Young common juniper coping with shifting sands

Better specimen placement at Stanhope, has led to better survival rates and healthier plants after their first winter.

SPECIES LIST

FORESTED PRIORITY PLACE	Coastal Forests & Krummholz
PROJECT TITLE:	Restoring Our Coastal Sheild
SITE:	Stanhope PEI NP

BIODIVERSITY

CONIFEROUS TREES	FAMILY	SCIENTIFIC NAME	SRANK
Balsam Fir	*Pinaceae*	*Abies balsamea*	S5
Red Spruce	*Pinaceae*	*Picea rubens*	S5
White Spruce	*Pinaceae*	*Picea glauca*	S5
DECIDUOUS TREES	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Maple	*Sapindaceae*	*Acer rubrum*	S5
Paper Birch	*Betulaceae*	*Betula papyrifera*	S5
Trembling Aspen	*Salicaceae*	*Populus tremuloides*	S5
American Mountain Ash	*Rosaceae*	*Sorbus americana*	S5
Gray Birch	*Betulaceae*	*Betula populifolia*	S5
Northern Red Oak	*Fagaceae*	*Quercus rubra*	S3S4
SHRUBS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Red Osier Dogwood	*Cornaceae*	*Cornus sericea*	S5
Common Winterberry	*Aquifoliaceae*	*Ilex verticillata*	S5
Skunk Currant	*Grossulariaceae*	*Ribes glandulosum*	S5
Chokecherry	*Rosaceae*	*Prunus virginiana*	S5
White Meadowsweet	*Rosaceae*	*Spiraea alba*	S5
Red Elderberry	*Viburnaceae*	*Sambucus racemosa*	S5
Northern Bayberry	*Myricaceae*	*Morella pensylvanica*	S5
Virginia Rose	*Rosaceae*	*Rosa virginiana*	S5
Northern Bush Honeysuckle	*Caprifoliaceae*	*Diervilla lonicera*	S4
Black Chokeberry	*Rosaceae*	*Aronia melanocarpa*	S4S5
Staghorn Sumac	*Anacardiaceae*	*Rhus typhina*	S3
Common Juniper	*Cupressaceae*	*Juniperus communis*	S3
Creeping Juniper	*Cupressaceae*	*Juniperus horizontalis*	S2S3
WILDFLOWERS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Rough-stemmed Goldenrod	*Asteraceae*	*Solidago rugosa*	S5
Northern Willowherb	*Onagraceae*	*Epilobium ciliatum*	S5
Canada Goldenrod	*Asteraceae*	*Solidago canadensis*	S5
Harlequin Blue Flag	*Iridaceae*	*Iris versicolor*	S5
Red Baneberry	*Ranunculaceae*	*Actaea rubra*	S4
Herb Robert	*Geraniaceae*	*Geranium robertianum*	S4
Mountain Blue-eyed-grass	*Iridaceae*	*Sisyrinchium montanum*	S5
Cut-Leaved Coneflower	*Asteraceae*	*Rudbeckia laciniata*	S2
Seaside Goldenrod	*Asteraceae*	*Solidago sempervirens*	S4S5
American Beach Grass	*Poaceae*	*Calamagrostis breviligulata*	S4S5
Canada Anemone	*Ranunculaceae*	*Anemonastrum canadense*	S1
FERNS	**FAMILY**	**SCIENTIFIC NAME**	**SRANK**
Sensitive Fern	*Onocleaceae*	*Onoclea sensibilis*	S5
Braun's Holly Fern	*Dryopteridaceae*	*Polystichum braunii*	S1

Hidden white spruce planted and sheltered amongst bayberry shrub zone band

CONCLUSION

Gary Schneider amazed by the Pituamkek Coastal Forest, PEI National Park Reserve

PEI's coastal forests are special and diverse places. Despite their history of ecological degradation, they still showcase an impressive variety of habitats and native species. The few mature sites left on PEI showcase even more complexity and biological diversity. These habitats were likely much more common across the province, as supported by numerous historic records as well as small remnant populations found during this project.

Even though our coastal habitats come in a variety of forms, from our clifftop krummholzing spruce forests, to our recovering dune systems, to our swampy salty shores, they are growing under constant coastal forces of winds and waves, shifting sands, spraying salt, and generally creating harsh growing conditions. When cleared or damaged, these habitats have a difficult and slower ecological recovery than our more inland areas, especially when lacking native seed sources.

Healthy coastal habitats provide innumerable and poorly understood benefits across the province, from decreasing shoreline erosion to sheltering inland infrastructure to providing nesting grounds and food for resident and migrating species. Not only that, but these coastal habitats are woven into the identity and economy of PEI. Whether slowly providing nutrients to our shellfisheries, powering our tourism industry, or providing unequaled places of recreation and relaxation, our culture and community are a direct result of these amazing places.

Our planet is undergoing climatic changes, increasing the power and frequency of high-wind events, causing even more coastal erosion, flooding and wind damage. As the last few storm events, such as Dorian and Fiona, showed us, denuded coastal areas are extremely vulnerable to these gales. Not only that, but without this coastal shield, our inland habitats, towns, bridges and roads are left exposed to these wild winds, causing untold damage inland.

These coastal forests and their intrinsically linked and associated habitats act together, creating a wind-resilient habitat, securing our shores and sheltering our land. It is critical that we come to understand, appreciate and, most importantly, restore these habitats to ensure the future environmental, cultural, and economic health of our wonderful Island for the challenging times that we face.