



Barrens Ecosystems in Nova Scotia:

Classification of Heathlands and Related Plant Communities





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Introduction

Barrens Ecosystems in Nova Scotia: Classification of Heathlands and Related Plant Communities is a comprehensive technical guide to the diversity, distribution, composition and environmental determinants of plant communities on barrens in Nova Scotia. It includes technical descriptions of 22 distinct plant communities found across the full ecological and geographic range of barrens in the province. This guide is a companion to the Forest Ecosystem Classification for Nova Scotia (Neily et al. 2011) and to other ecosystem classifications currently in development for the province. We wrote this guide as a tool to support the objectives and activities of land use planners, conservation and restoration practitioners, naturalists, natural resource managers, and scientists.

Barrens are a type of ecosystem characterized by harsh climatic and or edaphic conditions, and by low shrub dominated plant communities. These communities are largely composed of shrub species belonging to the heath family, *Ericaceae*, and the heath-like Crowberry family, *Empetraceae*. In Nova Scotia, barrens have had relatively little study, limiting the availability of scientific information describing their ecological characteristics. Historical literature often only referred to their presence on the landscape and to their low suitability for supporting agriculture and producing timber resources. Consequentially, barrens were assumed to be unproductive and of little economic value. This attitude also extended to perceptions of their conservation and biodiversity values; barrens were usually understood to be species poor and ecologically unremarkable. These knowledge gaps and perceptions have prevented full recognition of the ecological importance of barrens ecosystems in Nova Scotia and hindered relevant landscape and conservation planning efforts. Nova Scotia's barrens are also generally absent from maps depicting the extent and distribution of these ecosystems across Eastern North America.

Since Oberndorfer and Lundholm (2009) published their seminal paper on coastal barrens in Nova Scotia, we have worked to better understand ecological pattern and process on all of Nova Scotia's barrens. Primary

data used in this project included 331 relevé plots, each 25 m² in area. We selected study sites to represent the full breadth of vegetation, edaphic, climatic and topographic conditions across the geographic range of barrens in Nova Scotia. These study sites were distributed from the south of Yarmouth county to St. Paul Island, off the northern tip of Cape Breton. Our surveys included exposed summits of the Cape Breton Highlands, some of which were unexplored by botanists and lichenologists. Plot data were collected from surveys of 173 individual sites, making this the most comprehensive field assessment of these provincial ecosystems (see Figure 1). For coastal barrens, we also surveyed an additional 538 sample plots (1 m² in area) along randomly placed transects, at 20 study sites, to capture variability of the most diverse and widespread types of coastal heathlands. Data we collected from relevé plots included vascular plant, bryophyte and lichen species presence and abundance, plant community structure, mean vegetation height, humus and mineral soil structure and chemistry, and 19 additional environmental variables. Our surveys did not include peatlands or other wet communities dominated by shrub species. While some wetlands share certain floristic and ecological features with barrens, they are generally associated with different environmental conditions and processes.

To determine the most important environmental drivers shaping barrens in Nova Scotia and to produce a classification of the predominant barren plant communities, we analyzed these data using multivariate ordination and clustering statistics, following methods outlined in Porter (2013) and Porter et al. (2015). We named community types described with both a common vernacular name, and a scientific name. The latter names developed following nomenclature standards of the Canadian National Vegetation Classification (CNVC) (CNVC 2020).

Through this project, we collected over one thousand botanical specimens and broadened knowledge of lichen, bryophyte, and vascular plant species found on Nova Scotia's barrens. Between 2010 and 2017, we and our partners discovered several species that

were previously unknown in Nova Scotia (e.g. Macdonald et. al. 2011, Darbyshire et. al. 2017, others). In total, our study inventoried 595 species of vascular plants, bryophytes, and lichens.

We describe 22 distinct associations and summarize data on their characteristic environmental processes and diagnostic species. An association is a discrete, recognizable and relatively uniform plant community type that reflects distinctive environmental conditions (van der Maarel and Franklin 2013, CNVC 2020). As such, associations are useful as a fundamental unit for ecological research, conservation planning, land use management, and climate change monitoring. Where appropriate, we provide a map of sampling locations for each association. A dichotomous key was developed to help users distinguish associations.

We determined that soil moisture and the extent to which sites are exposed to wind and salt spray are among the most important factors responsible for the species composition, structure and distribution of plant communities on barrens in Nova Scotia. Environmental factors that characterize barrens vary widely across the province, transitioning along gradients of latitude, elevation, and distance from the coast.

No classification can be considered comprehensive. Though it may be impossible to capture the full diversity of plant communities present in any given region, our data suggest that the most frequently occurring barrens communities in Nova Scotia are adequately represented within this guide. Additional communities may be identified with further survey.

Barrens found on both the Cape Breton Highlands and on offshore islands of Nova Scotia are among those most likely to be underrepresented in this manual. These regions are also the most overlooked in previous literature, likely because they are less accessible. The highlands are particularly challenging to survey because barrens there are often remote, fringed by dense krummholz, large in area and feature a diverse spectrum of topographic conditions, natural histories, and species assemblages. Though we expended

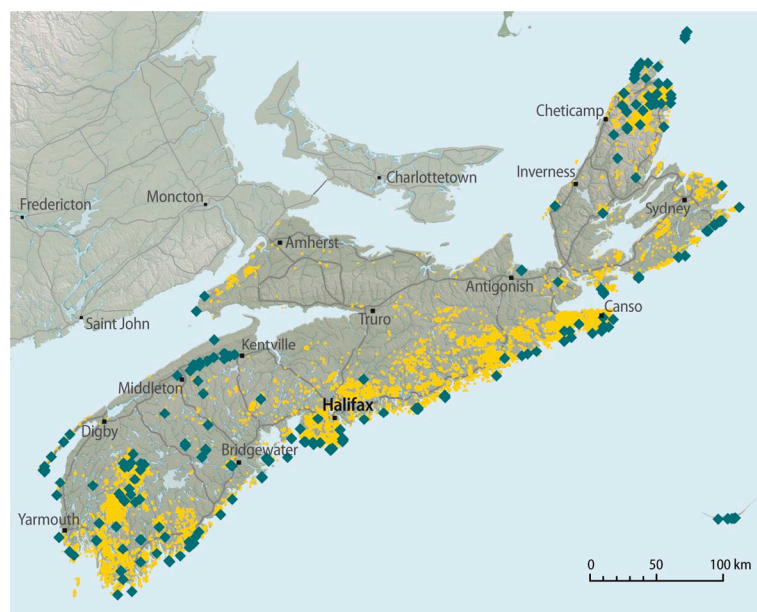


Figure 1. Map of survey sites (green diamonds) employed in this study. Major barrens ecosystems are shown using gold shading.

great effort sampling these areas, we recognize the need for additional research to fully describe the plant communities in these remote and inaccessible locations. A forthcoming classification of alpine ecosystems in Nova Scotia will more adequately summarize these communities.

We also observed considerable variation in the presence of numerous less abundant species within these associations. Despite a recurring set of dominant and or otherwise frequent species, the flora of these communities varies considerably between regions and among sites. Geographic differences in climate and soils and the influence of disturbance, particularly anthropogenic, are all factors driving this variation.

Although discrete boundaries between community types are sometimes clear, vegetation exists along a continuum of varying environmental conditions, species composition, and physiognomy. The existence of gradients and spatial heterogeneity does not however preclude the utility and feasibility of classification. Ecological vegetation classification continues to be widely useful as a tool for facilitating research and communication about plant communities and we hope that this manual proves valuable as a baseline for future work.

Glossary

Abundance – the quantity of a plant species, measured by the percentage of area it occupies

Acadian Forest – predominant natural forest of the Maritime Provinces and northern New England states. Characterized by Red Spruce (*Picea rubens*), Yellow Birch (*Betula alleghaniensis*), Sugar Maple (*Acer saccharum*), Balsam Fir (*Abies balsamea*), and a variety of other tree species. (Rowe 1972, Baldwin et al. 2019, Basquill and Baldwin 2020)

Acidic – having a pH of less than 7; very acidic soils and water are usually interpreted as having a pH of 5 or less

Climatic Affinity – the fidelity plant species have to a particular climatic region, e.g. Alpine, Arctic, Boreal

Alpine – a bioclimatically extreme montane environment. Usually occurring at elevations above a distinct treeline

Arctic – the climatically extreme northern polar region occurring at latitudes north of a distinct treeline

Aspect – the measure of orientation of slope, i.e. its compass direction (Luttmerding et al. 1990)

Association – a discrete, recognizable and relatively uniform plant community type that reflects distinctive environmental conditions (Van der Maarel and Franklin, J. 2013, CNVC 2020)

Barren – an open, generally treeless type of ecosystem dominated by low and or creeping shrubs, forbs or graminoids and maintained by environmental extremes such as wind, salt spray and/or shallow soils (Oberndorfer and Lundholm, 2009)

Bedrock – the solid rock underlying regolith (unconsolidated mantle of weathered rock and soil material) or exposed at the ground surface (CNVC 2020)

Biodiversity – the variety of life, including populations, species, communities, and ecosystems

Bog – a nutrient-poor to very poor wetland type that obtains water entirely from precipitation and develops on 40 or more centimeters of accumulated peat. Bogs are characterized by abundant peat accumulation and moss ground cover, especially of the genus *Sphagnum*. The types of bogs that are most common on Nova Scotia's barrens are those that blanket bedrock in humid, coastal areas, and those that became established in old water bodies and depressions where rainwater accumulates. (Nova Scotia Department of Environment 2017)

Boreal – an area of the Northern hemisphere, characterized by cold snowy winters and a relatively warm growing season. In Nova Scotia, boreal forest occurs in Cape Breton at elevations above 300 m, and in some extreme coastal environments, although some species with boreal climatic affinities are also found at lower elevation.

Bryophyte – the group of small, green, haploid plants that do not employ vascular tissues and are often found in moist microhabitats. Nova Scotia's bryophyte flora includes primarily mosses and liverworts. Hornworts are a less speciose group of bryophytes that are more cryptic than mosses and liverworts.

Canadian National Vegetation Classification (CNVC) – an ecological classification of natural and semi-natural Canadian vegetation. This classification is structured as a hierarchical taxonomy, describing vegetation conditions at different levels of conceptual generalization (CNVC 2020)

Coarse woody material – fallen dead wood that provides habitat and habitat structures for many species. On barrens, coarse woody material is uncommon and may provide habitat for lichen species not found on other substrates.

Constancy (frequency) – percentage of plots in which a species is found (e.g. a species found in 25 of 100 plots has a constancy of 25%); equivalent to "presence" and "frequency of occurrence" (CNVC 2020)

Constancy (frequency) class – a class that groups a specific range of constancy (frequency) values. Adapted from the CNVC (CNVC 2020), the constancy/frequency classes are:

- I 1–20% (very low frequency/constancy)
- II 21–40% (low frequency/constancy)
- III 41–60% (moderate frequency/constancy)
- IV 61–80% (moderately–high frequency/constancy; species in this class are sometimes referred to as being "frequent" or "constant")
- V 81–100% (high frequency/constancy; species in this class are sometimes referred to as being "frequent" or "constant")

Constituent species – any species that contributes to the vegetation of an association, including those species that are not abundant

Dominance – the extent to which a species predominates in a vegetation type because of its abundance (usually cover) (CNVC 2020)

Dominant species – constant species (usually above 60%; constancy class \geq IV) with high percent cover in a vegetation type (CNVC 2020)

Drainage – the length of time it takes for water to be removed from the soil in relation to its supply (Agriculture and Agri-Food Canada 2020)

Dwarf Shrubland – a vegetation community characterized by shrub species that have a prostrate growth form and/or are < 10 cm tall (CNVC 2020)

Dynamic – active changes in the state of an association or ecosystem. In this guide, the term follows the definition provided by Burley and Lundholm (2010), designating dynamic associations as those vegetation types that may be transitioning into other types via ecological succession (often dwarf shrubs > tall shrubs > trees)

Ecosystem – all the organisms in an area and all of the abiotic materials and energy with which they interact (Gurevitch et al. 2002)

Elevation – a measure of the height of land above sea level

Eluviation – soil process where materials from upper layers are carried downward by water percolation. Often results in pale upper soil layers.

Erratic – relatively large boulders that were transported by glaciers (AGS 2001)

Edaphic – pertaining to or strongly influenced by soil characteristics

Epiphyte – a plant or lichen that grows on the surface of another plant

Endemic – a species found only in a limited area (Gurevitch et al. 2002)

Ericaceous – species from the heath family (*Ericaceae*)

Exposure – atmospheric and other climatic conditions, especially wind and salt exposure (Luttmerding et al. 1990)

Exotic species – a species that is outside its native range (Gurevitch et al. 2002) and typically introduced accidentally or deliberately by human activity

Felsenmeer – a field of angular boulders created by frost processes typically found in alpine and arctic conditions; in Nova Scotia these conditions occurred during periglacial climatic time frames

Fen – a nutrient-poor to rich wetland type that obtains water from both precipitation and surface or ground water flow. Fens develop on 40 or more cm of accumulated peat

Folisol – upland organic soil that forms under cool and moist climatic conditions, greater than 40 cm in thickness or 10 cm over bedrock or fragmental material (Canadian Agricultural Services Coordinating Committee 1998)

Forb – a broadleaved herbaceous plant (Gurevitch et al. 2002)

Forest – a vegetation community characterized by tree species > 5 m tall (by CNVC convention), the crowns of which generally form a continuous canopy with typically > 30% cover (by CNVC convention); a large area of tree-dominated stands (CNVC 2020)

Frequency – See “constancy”

Glaciofluvial – deposits and resulting landforms produced by meltwater streams flowing from wasting glacier ice (CNVC 2020)

Graminoid – a narrow-leaved herbaceous plant belonging to the sedge, rush or grass families

Habitat – the kind of environment a population or species generally inhabits, or an area distinguished by its community (Gurevitch et al. 2002)

Halophytic – salt tolerant; halophyte: a plant that is salt tolerant

Heathland, Heath – a vegetation type dominated by low growing shrubs from the heath family (*Ericaceae*, also including *Empetraceae*) (Gurevitch et al. 2002)

Herbaceous plant – a non-woody vascular plant. Includes forbs and graminoids

Humus – organic soil formed by the decay of plant and lichen material by bacteria, fungi and/or insects

Humus form – within this guide humus forms are defined by Green et al. (1993), which differentiates humus forms into three orders: **Mull**, **Moder**, **Mor**. These orders reflect principal differences in the nature and rate of decomposition processes. (See Keys et al. 2011)

Indicator species – species expressing either dominance (fidelity and abundance) or exclusivity to a given association. For this guide, indicator species were determined using Dufrene-Legendre Indicator Species Analysis methodology (Dufrene and Legendre 1997) for associations that were pre-classified by Ward’s Cluster analysis.

Intertidal – the zone affected by daily tides. It extends between mean daily high and low tide marks

Invasive species – a species that is rapidly expanding outside of its native range (Gurevitch et al. 2002), and that causes negative impact to cultural or ecological values, usually by displacing native species

Krummholz – dwarfed Black or White Spruce or Balsam Fir usually under 5 m in height, stunted by extreme wind along the Atlantic coast and across the Cape Breton Highlands of Nova Scotia

Lichen – an organism representing a symbiosis of a fungus and photosynthesizing algae or cyanobacteria

Lithomorphic – pertaining to plants having functional adaptations for living on rock surfaces or in rocky substrates (CNVC 2020)

Macrolichen – lichens that are generally larger and more noticeable than crustose lichens and include the fruticose, foliose, umbilicate, squamulose and filamentous growth forms (Hinds and Hinds 2007)

Microhabitat, microsite – conditions in the immediate surroundings of an individual organism (Gurevitch et al. 2002)



Drosera intermedia
(Spoon-leaved Sundew)

PHOTO: Saint Mary’s University
(Caitlin Porter)

Microtopography – the categorical measure of variability in the surface smoothness or mounding of a site. Categories used within this guide are defined and described by Luttmerring et. al. (1990) and vary based on height, spacing and frequency of surface mounding.

- a. **Smooth** – few or no mounds; surface profile is linear i.e. horizontal or inclined
- b. **Micro-mounded** – mounds are < 0.3 m high
- c. **Slightly mounded** – mounds are 0.3 to 1 m high, and > 7 m apart
- d. **Moderately mounded** – mounds are 0.3 to 1 m high, and 3 to 7 m apart
- e. **Strongly mounded** – mounds are 0.3 to 1 m high, and 1 to 3 m apart
- f. **Severely mounded** – mounds are 0.3 to 1 m high, and 0.3 to 1 m apart
- g. **Extremely mounded** – mounds are > 1 m high, and > 3 m apart
- h. **Ultra-mounded** – mounds are > 1 m high, and < 3 m apart

Moisture regime – ecological moisture regime is a relative scale of the available moisture supply for plant growth.

(adapted from Luttmerring et al. 1990)

1. **Very xeric (very dry)** – water removed extremely rapidly in relation to supply, soil is moist for a negligible time after precipitation
2. **Xeric (dry)** – water removed very rapidly in relation to supply; soil is moist for brief periods following precipitation
3. **Sub-xeric (dry-mesic)** – water removed rapidly in relation to supply; soil is moist for short periods following precipitation
4. **Sub-mesic (mesic-dry)** – water removed readily in relation to supply; water available for moderately short periods following precipitation
5. **Mesic (fresh or moderate)** – water removed somewhat slowly in relation to supply; soil may remain moist for a significant, but sometimes short, period of the year. Available soil moisture reflects climatic inputs.
6. **Sub-hygic (mesic-moist)** – water removed slowly enough to keep the soil wet for a significant part of the growing season; some temporary seepage and possibly mottling below 20 cm
7. **Hygic (moist-wet)** – water removed slowly enough to keep the soil wet for most of the growing season; permanent seepage and mottling, perhaps weak gleying
8. **Sub-hydric (wet)** – water removes slowly enough to keep the water table at or near the surface for most of the year – gleyed mineral or organic soils; permanent seepage less than 30 cm below the surface
9. **Hydric (very wet)** – water removed so slowly that the water table is at or above the soil surface all year – gleyed mineral or organic soils



Vaccinium vitis-idaea
(Foxberry)

PHOTO: L&F (Sean Basquill)

Moose savannah, moose meadow – areas of the Cape Breton Highlands that were formerly boreal forest. These areas were deforested by an intense Spruce Budworm outbreak and persist as a largely grass-dominated ecosystem because natural forest regeneration is suppressed by browsing of the hyperabundant highland moose population.

Niche – fundamental role of a species within an ecosystem

Obligate wetland species – species occurs almost always (estimated probability 99%) under natural conditions in Wetlands (Blaney 2011)

Old Field – abandoned farmlands

Peatland – a type of wetland characterized by at least 40 cm of accumulated peat. Peatlands include both bogs and fens.

Percent cover – a measure of abundance, the percentage of ground area covered by a vertical projection of the crown of the plant onto the ground surface (Luttmerring et al. 1990)

Persistent – a state of relative stability throughout a defined timeframe. In this guide, the term follows the definition described by Burley and Lundholm (2010) (i.e. not transitioning into a different association, especially one with tall shrubs or trees over a 60 to 80 year timeframe; not undergoing marked ecological succession)

Physiognomy – the structure or outward appearance of vegetation or of a plant community as expressed by the dominant growth forms, usually in the upper most stratum. The CNVC recognizes several physiognomy types including forest, woodland, shrubland, forb meadow, dwarf shrubland, and cryptogamic vegetation. (CNVC 2020)

Redoximorphic features – soil colour splotches or characteristics associated with saturation

Reindeer Lichens – fruticose and highly branched lichens of the genus *Cladonia*. Typically occurring on soil or rock substrates

Salt-spray zone – area of the terrestrial environment frequently exposed to saltwater transported from the ocean by wind and wave energy (not inundation)

Shrubland – a vegetation community characterized by shrub species > 10 cm tall (CNVC 2020)

Site – a place, or category of places, considered from an environmental perspective that determines the type and quality of plants that can grow there (CNVC 2020)

Slope – a measure of the gradient of a hillside (Luttmerding et al. 1990)

Slope position, topographic position – describes the relative topographic location of a slope and/or the relative position of a site within a catchment area (Luttmerding et al. 1990). Slope position influences factors that affect or structure terrestrial ecosystems. These include exposure, soil nutrient transport and drainage. Determined according to a categorical scale by Luttmerding et al. (1990):

- a. **Crest** – the generally convex, uppermost portion of a hill. It is usually convex in all directions with no distinct aspect.
- b. **Upper Slope** – the generally convex upper portion of the slope of a hill immediately below the crest. It has a convex surface profile with a specific aspect.
- c. **Middle Slope** – the area of the slope of a hill between the upper slope and lower slope, where the slope profile is generally neither distinctly concave nor convex. It has a straight or somewhat sigmoid surface profile with a specific aspect.
- d. **Lower Slope** – the area toward the base of the slope of a hill. It generally has a concave surface profile with a specific aspect.
- e. **Toe** – the area demarcated from the lower slope by an abrupt decrease in slope gradient. It is often characterized by seepage.
- f. **Depression** – any area that is concave in all directions. It is generally at the base of a meso scale slope (or toe), or in a generally level area.
- g. **Level** – any level meso scale area not adjacent to a meso scale slope (or toe). The surface profile is generally horizontal with no significant aspect.

Species Richness – a measure of diversity, in reference to the number of plant species per unit area. For each unit description we include the mean species richness per area of the sample unit \pm SEM (Standard Error of Mean)

Standard Error of Mean (SEM) – a measure of variability about the mean of a sampled value, this summary statistic is provided where relevant. SEM is defined mathematically as $\text{Standard Deviation} / \sqrt{n-1}$

Subalpine – a montane bioclimatic zone expressing a transition between treeless alpine conditions and treed forest found downslope. Much of Cape Breton Highlands National Park's northern plateau (*sensu Neily et al. 2017*) consists of subalpine vegetation communities.

Substrate – the surface that a plant or lichen grows on. Substrates used by species in this guide include mineral soil, humus, loose stones or rocks, bedrock and dead wood.

Supralittoral – a synonym for supratidal

Supratidal – sometimes called the splash or spray zone, this is the area just landward of most high tides. It is rarely inundated except in extreme tidal and storm events.

Swamp – a type of wetland dominated by woody species (shrub and/or tree species) on saturated mineral soil

Talus – a field of loose stones on the steep slope of a hill formed through mass movement

Wetland – land commonly referred to as a marsh, swamp, fen or bog that either periodically or permanently has a water table at, near, or above the land's surface, or that is saturated with water, and sustains aquatic processes as indicated by the presence of poorly drained soils, hydrophytic vegetation and biological activities adapted to wet conditions (*Nova Scotia Environment Act 2013*)

Woodland – a vegetation community characterized by tree species > 5 m tall (*by CNVC convention*), the crowns of which form a sparse, discontinuous canopy as a result of ecological limitations such as climate, shallow soils, wetlands, etc.; by CNVC convention, woodland canopies are typically between 10% and 30% cover (*CNVC 2020*)

Rhododendron canadense (Rhodora) in bloom across highland heath
PHOTO: Saint Mary's University (Caitlin Porter)



Key to Associations

- 1a** Shrublands dominated by *Rubus spp.* or *Ribes spp.*; **or** site consisting of trees > 2 m height and with > 10% cover; **or** commercial blueberry crops; **or** forest clearcut; **or** moose meadow/savannah; **or** old field; **or** shrub dominated peatlands; **or** shrub dominated swamps ... **not barrens**
- 1b** Vegetation communities not as above **2**
-
- 2a** Severely stunted Black Spruce (*Picea mariana*) and ericaceous shrubs dominant; > 40% cover (i.e. CNVC constancy class ≥ III), vegetation < 2 m height; upper elevations of Cape Breton Highlands
- ... **S6.** *Picea mariana* – *Rhododendron canadense* / *Cladonia stellaris* (*Cladonia stygia*) Shrubland
- 2b** Tree species cover < 40% or absent **3**
-
- 3a** Site a coastal sand dune; vegetation community comprised of dwarf shrubs (*Empetrum spp.* or *Corema conradii*), American Beach Grass (*Ammophila breviligulata*), and other coastal species found on wind-blown sand deposits **4**
- 3b** Site not a coastal sand dune **5**
-
- 4a** Coastal sand dune vegetation dominated by Crowberry species (*Empetrum spp.*)
- ... **DS13.** *Ammophila breviligulata* / *Empetrum nigrum*
Dwarf Shrubland
- 4b** Coastal sand dune vegetation dominated by Broom Crowberry (*Corema conradii*)
- ... **DS14.** *Corema conradii* – *Morella pensylvanica* – *Arctostaphylos uva-ursi* / *Comandra umbellata*
Dwarf Shrubland
-
- 5a** Vegetation dominated by lichens and herbaceous plants, shrubs absent or ≤ 40% (CNVC constancy class II) **6**
- 5b** Vegetation cover consists mainly of shrubs **7**

Herbaceous Associations

- 6a** Site a bedrock exposure at the oceanic shoreline; located in the upper supralittoral zone (between the upper intertidal zone and supratidal vegetation); plant species mainly halophytic or of arctic or alpine affinity
- ... **H1.** *Plantago maritima* – *Festuca rubra*
Herbaceous Association
- 6b** Site on coastal barrens, typically in depressions but sometimes where seepage occurs on long and/or sigmoidal shaped middle slopes, Cinnamon Fern (*Osmundastrum cinnamomeum*) dominant; > 50% cover (CNVC constancy class ≥ III)
- ... **H2.** *Osmundastrum cinnamomeum* / (*Sphagnum spp.*) Herbaceous Association
- 6c** Herbaceous and lichen dominated vegetation communities on bedrock exposures of inland and high elevation sites ... **not described in this guide**
-
- 7a** Dwarf shrubs, usually with prostrate growth form, dominant; average vegetation height 12 cm but ranging from 4–30 cm in height
- ... **8** **Dwarf Shrubland associations**
- 7b** Low shrubs of upright growth form dominant, except where appressed to the ground by wind, vegetation height > 15 cm; average of 56 cm height but ranging up to 2 m
- ... **19** **Shrubland associations**

Dwarf Shrubland Associations

- 8a** Site permanently saturated, vegetation predominately wetland-associated vascular plants and *Sphagnum* moss species, wetland peat deposit between 20–40 cm thick over bedrock or mineral soil and frequently > 100 cm thick
- ... **Peatlands (not described in guide)**
- 8b** Sites otherwise, not permanently saturated (although **DS4** and **DS5** may be saturated at some sites) **9**

9a Cape Breton Highlands.
Site at elevation > 100 m **10**

9b Site at elevation < 100 m **12**

10a Lowbush Blueberry (*Vaccinium angustifolium*) most abundant species; elevation >250 m, usually > 300 m; > 15% cover. Bunchberry (*Cornus canadensis*) and Reindeer Lichens (*Cladonia spp.*) present

... **DS1.** *Vaccinium angustifolium* – *Vaccinium vitis-idaea* – *Sibbaldia tridentata* / *Cladonia spp.*
Dwarf Shrubland Association

10b *Empetrum spp.* or Alpine Bilberry (*Vaccinium uliginosum*) most abundant species **11**

11a Sites dry; either xeric or subxeric, relatively high elevation; > 200 m, Pink Crowberry (*Empetrum eamesii*) or Purple Crowberry (*Empetrum atropurpureum*) co-dominant with Alpine Bilberry (*Vaccinium uliginosum*) and/or Black Crowberry (*Empetrum nigrum*). Iceland Moss Lichen (*Cetraria islandica*) sometimes present

... **DS2.** *Empetrum eamesii* – *Vaccinium uliginosum* / *Cladonia spp.* – *Cetraria islandica ssp. crispiformis* Dwarf Shrubland Association

11b Sites very xeric to subhygric, elevation > 100 m, Black Crowberry (*Empetrum nigrum*) and *Cladonia spp.* lichens co-dominant

... **DS3.** *Empetrum nigrum* (*Vaccinium boreale*) / *Cladonia spp.* Dwarf Shrubland Association

12a Sites coastal;
usually < 500 m from the shoreline **13**

12b Sites inland;
usually > 500 m from the shoreline **17**

13a Site subhygric to hydric, lower slope, depression or level, *Sphagnum spp.* mosses and/or wetland associated vascular plant species present **14**

13b Site moisture regime very xeric to subhygric, upland organic soils and/or exposed bedrock predominate **15**

14a Black Crowberry (*Empetrum nigrum*) > 40% cover (CNVC constancy class > II), Common Juniper (*Juniperus communis*) < 20% cover (CNVC constancy class I), Black Sedge (*Carex nigra*) < 5% cover (CNVC constancy class I). Tufted Clubrush (*Trichophorum caespitosum*) often present

... **DS4.** *Empetrum nigrum* – *Vaccinium oxycoccos* / *Trichophorum caespitosum* / *Sphagnum spp.*
Dwarf Shrubland Association

14b Black Crowberry (*Empetrum nigrum*) usually dominant, Black Sedge (*Carex nigra*) > 30% cover (CNVC constancy class ≥ I)

... **DS5.** *Empetrum nigrum* / *Carex nigra*
Dwarf Shrubland–Herbaceous Association

14c peatlands (not described in guide)

15a Black Crowberry (*Empetrum nigrum*) singularly dominant

... **DS6.** *Empetrum nigrum* – *Vaccinium vitis-idaea* / *Symphotrichum novi-belgii* / *Cladonia spp.*
Dwarf Shrubland Association

15b Black Crowberry (*Empetrum nigrum*) not singularly dominant **16**

16a Broom Crowberry (*Corema conradii*) and Common Juniper (*Juniperus communis*) co-dominant

... **DS7.** *Corema conradii* – *Juniperus communis* / *Cladonia boryi* Dwarf Shrubland Association

16b Common Juniper (*Juniperus communis*) dominant with frequent but lower levels of Black Crowberry (*Empetrum nigrum*) and Lowbush Blueberry (*Vaccinium angustifolium*), site moisture regime mesic to subxeric, on rocky or stony sites

... **DS8.** *Juniperus communis* – *Empetrum nigrum* / *Cladonia spp.* Dwarf Shrubland

17a	Bearberry (<i>Arctostaphylos uva-ursi</i>) dominant ... DS9. <i>Arctostaphylos uva-ursi</i> – <i>Vaccinium angustifolium</i> Dwarf Shrubland	
17b	Broom Crowberry (<i>Corema conradii</i>) dominant.....	18

18a	Inland site on exposed bedrock ... DS10. <i>Corema conradii</i> – <i>Gaylussacia baccata</i> / <i>Cladonia boryi</i> – <i>Cladonia strepsilis</i> Dwarf Shrubland Association	
18b	Inland site on coarse textured stony till ... DS11. <i>Corema conradii</i> – <i>Arctostaphylos uva-ursi</i> / <i>Cladonia spp.</i> Dwarf Shrubland Association	
18c	Inland site on deep glaciofluvial sand deposits usually without surface or subsurface stones, boulders, or exposed bedrock ... DS12. <i>Corema conradii</i> (<i>Hudsonia ericoides</i>) / <i>Cladonia arbuscula ssp. squarrosa</i> Dwarf Shrubland Association	

Shrubland Associations

19a	Huckleberry (<i>Gaylussacia spp.</i>) dominant.....	20
19b	Huckleberry (<i>Gaylussacia spp.</i>) not dominant	21

20a	Black Huckleberry (<i>Gaylussacia baccata</i>) dominant, sites xeric to hydric ... S1. <i>Gaylussacia baccata</i> – <i>Kalmia angustifolia</i> / <i>Pteridium aquilinum</i> Shrubland Association	
20b	Dwarf Huckleberry (<i>Gaylussacia bigelovania</i>) dominant, sites mesic to hydric, typically found within 10 km of the coast ... S2. <i>Gaylussacia bigelovania</i> – <i>Juniperus communis</i> – <i>Rhododendron groenlandicum</i> Shrubland Association	

21a	Co-dominated by several (26) shrub species, including: False holly (<i>Ilex mucronata</i>), Sheep Laurel (<i>Kalmia angustifolia</i>), Wild Raisin (<i>Viburnum nudum</i>), Rhodora (<i>Rhododendron canadense</i>), Black Huckleberry (<i>Gaylussacia baccata</i>) and Inkberry (<i>Ilex glabra</i>) ... S3. <i>Ilex mucronata</i> – <i>Aronia melanocarpa</i> Shrubland Association	
21b	Shrubland dominated by Sheep Laurel (<i>Kalmia angustifolia</i>)	22

22a	Sites usually between 100–500 m elevation, in the Cape Breton Highlands ... S4. <i>Kalmia angustifolia</i> – <i>Vaccinium angustifolium</i> / <i>Cladonia stellaris</i> Shrubland Association	
22b	Sites not in the Cape Breton Highlands	23

23	Sites inland usually > 1 km from the coast, but sometimes closer ... S5. <i>Kalmia angustifolia</i> – <i>Rhododendron canadense</i> / <i>Pteridium aquilinum</i> – <i>Gaultheria procumbens</i> Shrubland Association	
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Sample Fact Sheet

A unique identifier for the Association

Common name of the Association is listed first, followed by the scientific name (adapted from CNVC 2020).

DS3. Black Crowberry / Reindeer Lichen Highland Barren

Empetrum nigrum (*Vaccinium boreale*) / *Cladonia* spp.

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	28.4 (±3.7)
Vegetation Height (cm)	6.3 (±0.5)
Indicator Species	<i>Empetrum</i>
Sample size (n)	7
Conservation Status Rank	TBD

Summary of survey effort, key vegetation features, and conservation status rank

Concept

Empetrum nigrum (*Vaccinium boreale*) / *Cladonia* spp. Dwarf Shrubland Association occurs on prominent, extremely exposed, middle, upper and crests of slopes in the Cape Breton Highlands. Sites are found at elevations exceeding 100 m and located within 5 km of the coast. Black Crowberry (*Empetrum nigrum*) and Reindeer Lichens (*Cladonia* spp.) predominate. This association is similar to unit DS2; the latter association is more common at higher elevations and is usually found on larger expanses of surface *Cladonia* spp. shrubland is highland barren with blackberry.

Conceptual description of the Association – its “essence” as conceived by the concept authors / peer review panel. Includes synoptic statements about characteristic features of vegetation using both common and scientific names, environment, dynamics and range. May include reference to generalized age, seral stage, abundance, and patch size where these are relevant details. (adapted from CNVC 2020)

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		361.9 (±48.1)	460	127
Slope Gradient (%)		5.0 (±3.0)	19.4	0
Distance to coast (m)		5.9 (±2.4)	> 15.1	0.76
Exposed Substrate				
Bedrock	28.6	7.9 (±5.5)	30	0
Rock (cobble, boulder, etc.)	42.9	7.7 (±5.6)	35	0
Woody material	0	0	0	0
Mineral soil	0	0	0	0
Organic soil	57.1	1.3 (±0.9)		
Surface water	0	0		

Tabular summaries of site and soil characteristics as calculated from the constituent plot data for the Association (adapted from CNVC 2020)

	Frequency (%)
Exposure	extremely exposed (100)
Slope Position	crest (42.9), middle slope (42.9)
Microtopography	micro mounded (28.6), severely micro mounded (14.3), smooth (14.3), missing data (42.9)
Moisture Regime	very xeric (14.3), xeric (42.9), subxeric (14.3), hygric (14.3)
Aspect	north (28.6), none (14.3), west (14.3), missing data (42.9)

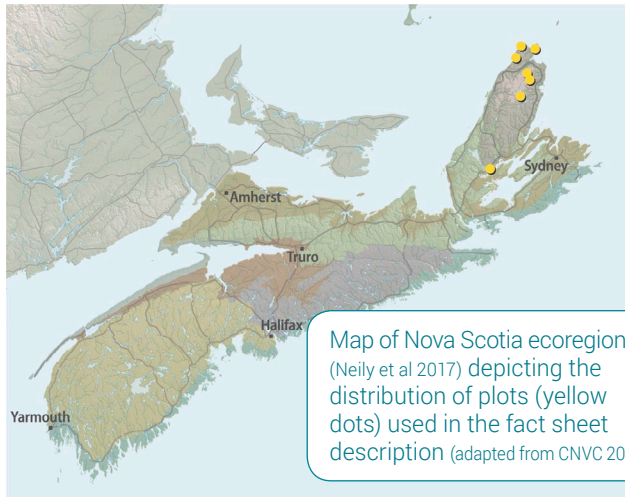
Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	14.5 (±6.5)	40	0.5

	Frequency (%)
Humus form	hemimor (42.9), humimor (42.9), missing data (14.3)



A typical stand- or landscape-level photograph of the Association (adapted from CNVC 2020)

McEvoy's Barren, Victoria County. PHOTO: L&F (Sean Basquill)



Map of Nova Scotia ecoregions (Neily et al 2017) depicting the distribution of plots (yellow dots) used in the fact sheet description (adapted from CNVC 2020)

Figure 6. Survey sites for DS3. Black Crowberry / Reindeer Lichen Highland Dwarf Shrubland Association (n=7)

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Abies balsamea</i>	42.9	0.8 (±0.8)
<i>Sorbus americana</i>	42.9	trace
<i>Picea glauca</i>	28.6	3.6 (±3.8)
<i>Betula cordifolia</i>	28.6	0.1 (±0.1)
Shrubs		
<i>Empetrum nigrum</i>	100	34.7 (±5.6)
<i>Vaccinium angustifolium</i>	71.4	3.7 (±1.9)
<i>Cornus canadensis</i>	71.4	1.5 (±0.9)
<i>Kalmia angustifolia</i>	71.4	
<i>Vaccinium vitis-idaea</i>	57.1	
<i>Vaccinium boreale</i>	57.1	
<i>Sibbaldia tridentata</i>	42.9	
<i>Viburnum nudum</i>	42.9	
<i>Rhododendron canadense</i>	42.9	
<i>Ilex mucronata</i>	42.9	
<i>Aronia melanocarpa</i>	28.6	
<i>Empetrum eamesii</i>	28.6	
<i>Rhododendron groenlandicum</i>	28.6	
<i>Juniperus communis</i>	28.6	
Herbaceous Plants		
<i>Maianthemum canadense</i>	71.4	0.1 (±0.1)
<i>Melampyrum lineare</i>	42.9	0.1
<i>Avenella flexuosa</i>	28.6	trace
Lichens		
<i>Cladonia stellaris</i>	71.4	2.9 (±1.2)
<i>Cladonia uncialis</i> ssp. <i>uncialis</i>	71.4	0.6 (±0.3)
<i>Cladonia rangiferina</i>	57.1	7.3 (±7.7)
<i>Cladonia arbuscula</i> ssp. <i>mitis</i>	57.1	2.4 (±1.6)
<i>Cladonia crispata</i>	57.1	0.1 (±0.1)
<i>Cladonia stygia</i>	57.1	0.1 (±0.1)
<i>Cladonia coccifera</i>	57.1	trace
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	42.9	1.9 (±1.5)
<i>Cladonia oricola</i>	42.9	0.1 (±0.1)
<i>Cladonia gracilis</i> ssp. <i>gracilis</i>	42.9	trace
<i>Cladonia wainioi</i>	28.6	0.3 (±0.2)
<i>Cetraria islandica</i> ssp. <i>crispiformis</i>	28.6	0.2 (±0.2)
<i>Cladonia squamosa</i>	28.6	trace
Bryophytes		
<i>Racomitrium lanuginosum</i>	57.1	3 (±1.6)
<i>Pleurozium schreberi</i>	42.9	0.2 (±0.2)
<i>Dicranum scoparium</i>	28.6	0.1

Plant and lichen species that are present in > 20% of the Association's constituent plots are included in the stratum summaries. (adapted from CNVC 2020)

Environment

Empetrum nigrum (*Vaccinium* Shrubland Association occurs on middle, upper and crests of s Highlands. Sites are found at m, and most frequently 5 km inland. Humus and mineral so stony; exposed bedrock and surface stones are common. Humus is typically exposed in patches, from wind and/or frost disturbance. This association occurs over a range of moisture regimes from very xeric to hygric.

Description of habitat and ecological process relationships characteristic of the Association (e.g. typical climatic, soil/site, or disturbance drivers) (adapted from CNVC 2020)

Vegetation

Black Crowberry (*Empetrum nigrum*) is the dominant shrub species of this association. Dwarfed trees are sometimes

Vegetation characteristics including common, dominant and diagnostic species, typical community structure and physiognomy, seral stage, patch size, etc. (adapted from CNVC 2020).

and with nearby krummholz or with downslope along sequence. Typical bush Blueberry (*Vaccinium vitis-idaea*) and Sheep are often present. *Vaccinium boreale*) are also common. The herb layer is reduced and contains few species.

are also common. The herb layer is reduced and contains few species.

Synoptic description of the geographic range of the Association in Nova Scotia, including representative sites. Known or projected range extension beyond the plot coverage in other Atlantic provinces of Canada is provided. (adapted from CNVC 2020).

Distribution

This association is limited to the Cape Breton Highlands at elevations greater than 100 m above sea level (see Figure 6).

Representative Sites

Inverness County: Humes River Wilderness Area, Pollett's Cove – Aspy Fault Wilderness Area
Antigonish County: Lake of Islands
 Cape Breton Highlands National plateau around Cheticamp Lake

Province	Present	Note
NB	X	rare
PEI	–	absent
NL	X	common

Related Associations

DS3 is almost identical to *Empetrum nigrum* heath found in Newfoundland where it has a complex successional history (Meades pers. comm. 2020).

A list of published associations from Canada that share similar floristic characteristics to the Association being described (adapted from CNVC 2020)



Association Fact Sheets

Herbaceous

Dwarf Shrubland

Shrubland



H

H1. Seaside Plantain Rocky Coastal Shoreline

Plantago maritima–*Festuca rubra*

Herbaceous Association

Species Richness (spp/1 m ²)	8.9 (±1.33)
Indicator Species	<i>Plantago maritima</i>
Sample size (n)	8
Conservation Status Rank	TBD

Concept

This association consists of discontinuous terrestrial vegetation in the narrow upper supralittoral zone (i.e. between the upper intertidal limit and continuous uplands barrens vegetation). It is characterized by specialist plant species capable of survival in shoreline rock crevices where little soil accumulates, and salt spray is frequent. The association is common along much of Nova Scotia's rocky Atlantic shore.

Environment

The association occurs in a coastal microclimate, characterized by persistent fog and cool temperatures. Sites are frequently exposed to salt spray and wave

Site Characteristics		Frequency (%)	Mean (±SEM)	max	min
Elevation (m)			3.6 (±0.8)	21	0
Slope Gradient (%)			22.5 (±4.0)	90	0
Distance to coast (m)			22.1 (±6.1)	182.3	0.5
Exposed Substrate					
Bedrock	100		86.7 (±0.4)	100	22.2
Woody material	–		–	–	–
Mineral soil	13.3		4.4 (±0.2)	55.6	0
Organic soil	10		1.1 (±0.1)	22.2	0
Surface water	3.3		1.1 (±0.1)	33.3	0
Soil Features			Mean (±SEM)	max	min
Root Restriction Depth (cm)			1.1 (±0.8)	24	0

wash-over, especially during storms. The community is found above the upper intertidal zone and is not regularly inundated with seawater but is sometimes encased in ice during the winter months. Soils are regularly eroded by marine and aeolian processes including wave wash-over. Thus, soil only accumulates in rock crevices, where it rarely exceeds 10 cm in thickness. These soils

Light Point, Digby County PHOTO: L&F (Sean Basquill)



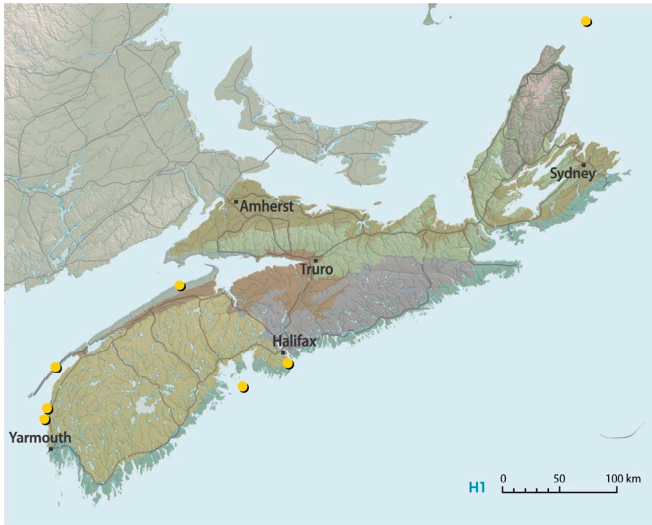


Figure 2. Survey sites for H1. **Seaside Plantain Rocky Coastal Shoreline** Herbaceous Association (n=8)

typically consist of densely rooted and gravelly humus. Compared with coastal Black Crowberry (*Empetrum nigrum*) dominated associations (e.g. DS6) soils of this community usually have more than twice the salinity and may be more than ten times as saline (i.e. 50,000–100,000 mg/m² of sodium compared with 10,000–20,000 mg/m²).

Vegetation

Vegetation is sparse and intermittent. Typically, only small patches of halophytic herbaceous plants persist. The most frequent and abundant species is Seaside Plantain (*Plantago maritima*), while Red Fescue (*Festuca rubra*), Seaside Goldenrod (*Solidago sempervirens*), and New York Aster (*Symphotrichum novi-belgii*) are less abundant but relatively common among sites. Scotch Lovage (*Ligusticum scoticum*) and Sea Lavender

Plantago maritima (Seaside Plantain) PHOTO: L&F (Sean Basquill)



Vegetation	Frequency (%)	Cover (%) (±SEM)
Shrubs		
<i>Morella pensylvanica</i>	25	2.0 (±2.0)
Herbaceous Plants		
<i>Plantago maritima</i>	87.5	21.8 (±9.6)
<i>Festuca rubra</i>	62.5	4.5 (±2.8)
<i>Solidago sempervirens</i>	62.5	1.4 (±0.8)
<i>Symphotrichum novi-belgii</i>	62.5	0.9 (±0.5)
<i>Lathyrus japonicus</i>	37.5	0.1 (±0.1)
<i>Sonchus arvensis</i>	37.5	0.03 (±0.02)
<i>Ligusticum scoticum</i>	25	0.4 (±0.4)
<i>Potentilla anserina ssp. anserina</i>	25	0.1 (±0.1)
<i>Achillea borealis</i>	25	0.02 (±0.01)
<i>Cerastium fontanum</i>	25	trace

(*Limonium carolinianum*) are restricted to pockets of deeper soil; Common Harebell (*Campanula intercedens*) may be present and is conspicuous when in flower. Several provincially rare vascular plants, including Scurvy-grass (*Cochlearia tridactylites*), Knotted Pearlwort (*Sagina nodosa ssp. borealis*), and, far less commonly, Field Locoweed (*Oxytropis campestris*) can occur within this association. Larger soil islands, embedded in this association, are less frequently exposed to wave action and may provide habitat for shrubs and stunted trees.

Bryophyte collections from this association may include Seaside Grimmia (*Schistidium maritimum*) and Frizzled Pin-cushion moss (*Ulota phyllantha*). Diversity and abundance of bryophytes increases with the presence of freshwater seepage and sheltering microtopographic conditions, but these microhabitats have not been comprehensively inventoried for bryophytes. Macrolichens are uncommon.

Distribution

The H1 association is widespread along exposed rocky oceanic shorelines on the outer Atlantic coast of Nova Scotia, including the Bay of Fundy.

Similar Associations – In Newfoundland, an analogous boreal association, lacking temperate species such as *Morella pensylvanica*, occurs on near-shore coastal headlands. (Meades pers. comm. 2020).

Province	Present	Notes
NB	X	common
PEI	X	rare
NL	?	not confirmed

H2. Cinnamon Fern Wet Coastal Barren

Osmundastrum cinnamomeum / (*Sphagnum* spp.)

Herbaceous Association

Species Richness (spp/1 m ²)	14.1 (±1.42)
Indicator Species	<i>Osmundastrum cinnamomeum</i>
Sample size (n)	11
Conservation Status Rank	TBD

Site Characteristics		Mean (±SEM)	max	min
Elevation (m)		12.1 (±2.7)	35	3
Slope Gradient (%)		3.3 (±2.0)	25	0
Distance to coast (m)		232.5 (±34.7)	430.1	80.1
Exposed Substrate	no exposed substrates			
	<i>Frequency (%)</i>			
Exposure	exposed (100)			
Slope Position	depression (60), middle slope (30), lower slope (10)			
Microtopography	severely mounded (40), extremely mounded (30), micro-mounded (10), slightly mounded (10), missing data (10)			
Moisture Regime	subhygric, hygric (unknown proportions)			
Aspect	none (90), north; south; east; west (10)			
Soil Features		Mean (±SEM)	max	min
Root Restriction Depth (cm)		47.5 (±12.8)	200	13.3

Concept

This association occurs on coastal sites in depressions, often along long slopes where seepage is present, and/or where impeded drainage results in moist to wet soil conditions. Cinnamon Fern (*Osmundastrum cinnamomeum*) heavily dominates the association. Constituent species primarily include Northern Bayberry (*Morella pensylvanica*) and shrubs from the heath family. There is sometimes abundant *Sphagnum* moss cover.

Environment

This association occurs in wet depressions on coastal barrens. It is found in small patches closely tracking topographic patterns, often occurring as linear shaped channels on slopes with a moderate grade, or on ledges of middle slopes with a sigmoidal shape. Conditions are moist from underground seepage and/or aboveground flow. Soils are typically dominated by poorly developed

humus that is densely rooted with thick rhizomes and roots over impenetrable bedrock or stony, mineral till over bedrock. Soil thickness varies from 13 cm to over 2 m in depth. This association occurs on coastal sites outside of the direct influence of salt spray; typically farther than 100 m from the ocean shoreline. Growing substrates are rarely exposed due to dense rooting and leaf litter.

Duncan's Cove Nature Reserve, Halifax County

PHOTO: Saint Mary's University (Caitlin Porter)



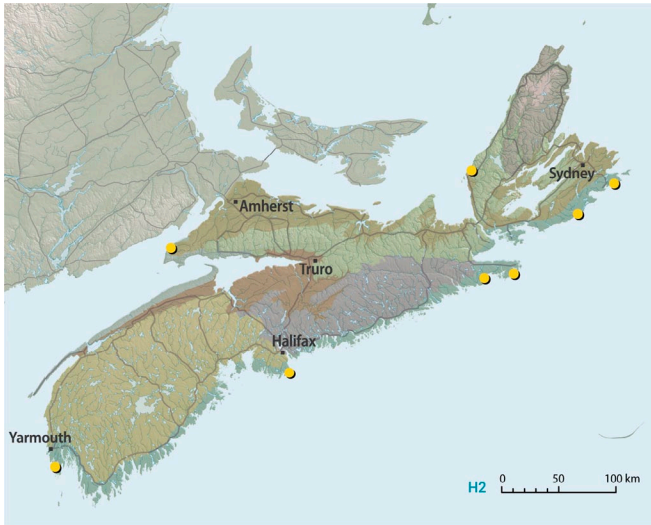


Figure 3. Survey sites for H2. Cinnamon Fern Wet Coastal Barren Herbaceous Association (n=11)

Vegetation

Vegetation of this association is characterized by dense Cinnamon Fern (*Osmundastrum cinnamomeum*), which may approach 100% cover. Understory vegetation may be sparse where leaf litter accumulates.

Northern Bayberry (*Morella pensylvanica*) is the only shrub species occurring frequently but a number of others show low to moderate constancy. These include: Large Cranberry (*Vaccinium macrocarpon*), Lowbush Blueberry (*Vaccinium angustifolium*), and Rhodora (*Rhododendron canadense*), among others. Herbaceous vascular plants with low to moderate constancy include: Bluejoint (*Calamagrostis canadensis*), Rough Goldenrod (*Solidago rugosa*), Bracken Fern (*Pteridium*



Barrens soil with strong redoximorphic features

PHOTO: L&F
(Sean Basquill)

Vegetation	Frequency (%)	Cover (%) (±SEM)
Shrubs		
<i>Morella pensylvanica</i>	63.7	19.7 (±8.4)
<i>Vaccinium macrocarpon</i>	45.5	7.3 (±4.0)
<i>Rhododendron canadense</i>	45.5	1.0 (±0.6)
<i>Rosa virginiana</i>	36.4	6.9 (±5.7)
<i>Vaccinium angustifolium</i>	36.4	1.9 (±1.5)
<i>Rhododendron groenlandicum</i>	36.4	0.3 (±0.2)
<i>Chamaedaphne calyculata</i>	27.3	10.9 (±7.7)
<i>Larix laricina</i>	27.3	4.0 (±3.8)
<i>Picea mariana</i>	27.3	3.7 (±2.9)
<i>Viburnum nudum</i>	27.3	1.5 (±1.4)
<i>Aronia x prunifolia</i>	27.3	1.3 (±0.9)
<i>Kalmia angustifolia</i>	27.3	1.1 (±0.8)
<i>Ilex mucronata</i>	27.3	0.2 (±0.1)
Herbaceous Plants		
<i>Osmundastrum cinnamomeum</i>	100	37.3 (±9.1)
<i>Calamagrostis canadensis</i>	36.4	10.4 (±7.8)
<i>Solidago rugosa</i>	36.4	1.9 (±1.9)
<i>Pteridium aquilinum</i>	36.4	1.9 (±1.9)
<i>Symphytotrichum novi-belgii</i>	36.4	0.5 (±0.3)
<i>Iris versicolor</i>	36.4	0.1 (±0.1)
<i>Cornus canadensis</i>	27.3	0.7 (±0.5)
<i>Doellingeria umbellata</i>	27.3	0.7 (±0.2)
<i>Lysimachia borealis</i>	27.3	0.05 (±0.03)

aquilinum), and Blue Flag Iris (*Iris versicolor*). Peat Mosses (*Sphagnum spp.*) are not always present but they are typically abundant when and where they occur. Bryophyte diversity and abundance may be greater than reported.

Distribution

The H2 association occurs primarily along the outer Atlantic coast of mainland Nova Scotia.

Representative Sites

Guysborough County: Canso Coastal Barrens

Halifax County: Prospect High Head, Duncan's Cove Nature Reserve

Related Associations – A similar boreal association occurs in Newfoundland where it typically includes diagnostic levels of Sweet Gale (*Myrica gale*); temperate species are absent.

(Meades pers. comm. 2020)

Province	Present	Notes
NB	X	common
PEI	X	common
NL	?	likely common but unconfirmed

DS

DS1. Lowbush Blueberry Highland Heath

Vaccinium angustifolium – *Vaccinium vitis-idaea* – *Sibbaldia tridentata* / *Cladonia* spp.

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	24.0 (±2.9)
Indicator Species	<i>Vaccinium angustifolium</i> <i>Avenella flexuosa</i> <i>Rubus idaeus</i> <i>Sorbus americana</i>
Sample size (n)	10
Conservation Status Rank	TBD

Concept

The *Vaccinium angustifolium* – *Vaccinium vitis-idaea* – *Sibbaldia tridentata* / *Cladonia* spp. Dwarf Shrubland Association typically occurs on extremely exposed slopes in the northwestern Cape Breton Highlands close to the coast. While heavily dominated by Lowbush Blueberry (*Vaccinium angustifolium*), Bunchberry (*Cornus canadensis*), Foxberry (*Vaccinium vitis-idaea*), and *Cladonia* lichens are also consistently present. Small clumps of windswept trees are often scattered sparsely throughout. This association is the only highland barren heavily dominated by lowbush blueberry.

Environment

This association is only known from extremely exposed sites at elevations of 200–400 m in northwest Inverness County. It occurs on the crests of hill summits, may be associated with talus or felsenmeer rock formations on upper slopes, or on upper and middle slopes directly facing the ocean. Although these sites are exposed to coastal winds, they are typically situated 400 m to 1 km from the shoreline, beyond the reach of most salt spray.

Soils are thin (14 cm average) and consisting of poorly decomposed humus over stone and/or bedrock. Exposed rock and bedrock outcrops may be substantial. Sites are underlain by Pollett's Cove River Gneiss, although our study found no general relationships between bedrock type and vegetation community variability. Sites are relatively dry; moisture regime ranges from xeric to mesic, most frequently sub-mesic. Evidence of historical fire was present at some sites.

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		311.6 (±17.3)	367	259
Slope Gradient (%)		26.6 (±9.4)	78.1	0
Distance to coast		736.6 m (±102.5 m)	1.1 km	438.4 m
Exposed Substrate				
Bedrock	30	3.8 (±2.8)	20	0
Rock (cobble, boulder, etc.)	60	12.9 (±6.6)	40	0
Woody material	30	0.7 (±0.7)	5	0
Mineral soil	0	0	0	0
Organic soil	10	0.4 (±0.4)	3	0
Surface water	0	0	0	0

	Frequency (%)
Exposure	extreme (100)
Slope Position	middle slope (40), upper slope (30), crest (30)
Microtopography	micro-mounded (50), missing data (50)
Moisture Regime	submesic (40), subxeric (30), xeric (20), mesic (10)
Aspect	southwest (40), none (30), northeast (10), west (10), north (10)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	13.8 (±4.9)	36	3

	Frequency (%)
Humus form	Hemimor (50), Fibrimor (30), missing data (20)



Pollett's Cove – Aspy Fault Wilderness Area, Inverness County

PHOTO: Saint Mary's University (Caitlin Porter)

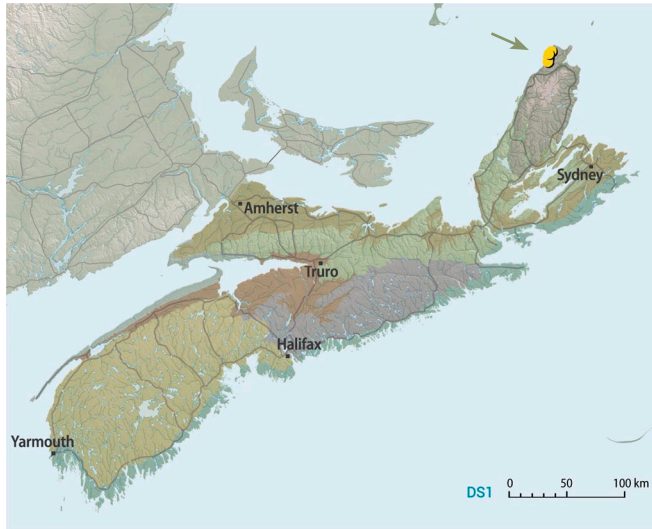


Figure 4. Survey sites for **DS1. Lowbush Blueberry Highland Heath Dwarf Shrubland Association** (n=10)

Vegetation

Flora of this plant community is dominated by Lowbush Blueberry (*Vaccinium angustifolium*). Bunchberry (*Cornus canadensis*) is consistently present and usually abundant. Foxberry (*Vaccinium vitis-idaea*) and Three-toothed Cinquefoil (*Sibbaldia tridentata*) are frequent and can also be abundant.

Sparse and usually stunted trees are frequently present, especially White Spruce (*Picea glauca*) and Balsam Fir (*Abies balsamea*). American Mountain Ash (*Sorbus americana*) is considered an indicator species of this association, although it occurs with relatively low constancy.

Herbaceous plants are diverse but sparse. The most frequently occurring herbs include Wild Lily-of-the-Valley (*Maianthemum canadense*), Three-leaved Rattlesnake Root (*Nabalus trifoliolatus*), Downy Goldenrod (*Solidago puberula*), Silverrod (*Solidago bicolor*), Whorled Wood Aster (*Oclemena acuminata*) and Common Harebell (*Campanula intercedens*). Wavy Hair Grass (*Avenella flexuosa*) is frequently present. This association is one of few occurring on barrens that occasionally support Goldthread (*Coptis trifolia*) and Red Raspberry (*Rubus idaeus*).

Reindeer Lichens (*Cladonia spp.*) are notable in this association. Grey Reindeer Lichen (*Cladonia rangiferina*) is the most frequent and abundant of macrolichen species. Other moderately frequent species include Reindeer Lichen (*Cladonia arbuscula ssp. squarrosa*), Thorn Cladonia (*Cladonia uncialis*), and Star-tipped Reindeer Lichen (*Cladonia stellaris*). Two additional macrolichen species are often present and reflective of coastal climatic conditions: Newfoundland Lichen (*Cladonia terrae-novae*) and Coast Reindeer Lichen (*Cladonia oricola*). See Vegetation table for other lichens sometimes present. The most common bryophyte here is Common Broom Moss (*Dicranum scoparium*).

Vegetation

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Picea glauca</i>	60.0	4.9 (±2.8)
<i>Abies balsamea</i>	40.0	1.6 (±1.0)
<i>Sorbus americana</i>	40.0	trace

Shrubs

<i>Vaccinium angustifolium</i>	100	37.6 (±6.3)
<i>Cornus canadensis</i>	100	14.9 (±3.1)
<i>Vaccinium vitis-idaea</i>	80.0	5.4 (±3.9)
<i>Sibbaldia tridentata</i>	60.0	2.4 (±1.4)
<i>Empetrum nigrum</i>	50.0	2.0 (±1.1)
<i>Prunus pensylvanica</i>	20.0	trace
<i>Rubus idaeus</i>	20.0	trace
<i>Ilex mucronata</i>	20.0	trace
<i>Aronia melanocarpa</i>	20.0	trace
<i>Alnus alnobetula</i>	20.0	0.2 (±0.1)

Herbaceous Plants

<i>Maianthemum canadense</i>	60.0	0.2 (±0.1)
<i>Avenella flexuosa</i>	60.0	0.2 (±0.1)
<i>Nabalus trifoliolatus</i>	60.0	0.2 (±0.1)
<i>Solidago puberula</i>	50.0	0.4 (±0.3)
<i>Solidago bicolor</i>	40.0	trace
<i>Oclemena acuminata</i>	40.0	0.4 (±0.4)
<i>Campanula intercedens</i>	40.0	0.1 (±0.1)
<i>Coptis trifolia</i>	20.0	trace
<i>Agrostis scabra</i>	20.0	0.1 (±0.1)
<i>Aralia nudicaulis</i>	20.0	trace

Lichens

<i>Cladonia rangiferina</i>	60.0	6.3 (±4.6)
<i>Cladonia arbuscula ssp. squarrosa</i>	60.0	1.0 (±0.7)
<i>Cladonia stellaris</i>	50.0	1.0 (±0.7)
<i>Cladonia uncialis ssp. uncialis</i>	50.0	0.5 (±0.2)
<i>Cladonia boryi</i>	40.0	0.5 (±0.3)
<i>Cladonia terrae-novae</i>	40.0	0.1 (±0.1)
<i>Cladonia gracilis ssp. gracilis</i>	40.0	0.1 (±0.1)
<i>Cladonia oricola</i>	30.0	0.1 (±0.1)
<i>Cetraria aculeata</i>	30.0	0.4 (±0.3)
<i>Sphaerophorus globosus</i>	20.0	0.1 (±0.1)

Bryophytes

<i>Dicranum scoparium</i>	50.0	0.7 (±0.7)
<i>Dicranum montanum</i>	40.0	0.6 (±0.7)
<i>Polytrichum juniperinum</i>	40.0	0.1 (±0.1)
<i>Pleurozium schreberi</i>	30.0	0.3 (±0.1)

Distribution

Northwestern Inverness County, Cape Breton

Representative sites –

Inverness County: Pollett's Cove–Aspy Fault Wilderness Area (e.g. High Capes, South Delaney's Brook)

Related Associations – A similar *Vaccinium angustifolium* heath is described from insular Newfoundland, where it is considered an unstable condition arising from natural or prescribed fire in more stable heaths

Province	Present	Notes
NB	X	uncommon
PEI	–	absent
NL	X	common

(typically dominated by *Empetrum spp.*)
(Meades pers. comm. 2020)

DS2. Pink Crowberry – Alpine Bilberry Highland Barren

Empetrum eamesii – *Vaccinium uliginosum* / *Cladonia* spp. – *Cetraria islandica* ssp. *crispiformis* Dwarf Shrubland Association

Species Richness (spp/25 m ²)	34.8 (±3.2)
Vegetation Height (cm)	5.9 (±1.4)
Indicator Species	<i>Vaccinium uliginosum</i> <i>Ochrolechia frigida</i> <i>Vaccinium boreale</i> <i>Cetraria islandica</i> <i>Racomitrium lanuginosum</i> <i>Larix laricina</i>
Sample size (n)	5
Conservation Status Rank	TBD

Concept

This alpine association occurs in the Cape Breton Highlands, typically within 10 km from the coast, on extremely exposed and prominent topography at or above 200 m in elevation. The association is dominated by Pink Crowberry (*Empetrum eamesii*), Alpine Bilberry (*Vaccinium uliginosum*) and Black Crowberry (*Empetrum nigrum*); Purple Crowberry (*Empetrum atropurpureum*) is sometimes present. Vegetation is sparse with substantial areas of exposed bedrock, loose rock, and open soil; particles of weathered bedrock are common on the ground surface. The association is similar to

Cape Breton Highlands National Park, Victoria County

PHOTO: L&F (Sean Basquill)



Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		369 (±34.7)	408	246
Slope Gradient (%)		15.0 (±10.1)	48.8	0
Distance to coast (m)		5.6 (±1.5)	9.7	1
Exposed Substrate				
Bedrock	60	18.3 (±12.7)	55	0
Rock (cobble, boulder, etc.)	40	8.4 (±8.8)	40	0
Woody material	20	0.2 (±0.2)	0.8	0
Mineral soil	40	9.4 (±8.7)	40	0
Organic soil	100	4.2 (±3.1)	15	0.5
Surface water	0	0	0	0

	Frequency (%)
Exposure	extremely exposed (100)
Slope Position	crest (40), middle slope (40), upper slope (20)
Microtopography	micro mounded (60), ultra mounded (20), missing data (20)
Moisture Regime	xeric (60), subxeric (40)
Aspect	west (40), northeast (20), missing data (40)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	14.5 (±5)	23	0

	Frequency (%)
Humus form	Hemimor (40), missing data (60)

unit DS3 which usually occurs at slightly lower elevations, in more sheltered areas with less exposed bedrock. It is the only type of highland barren with prominent levels of Pink Crowberry.

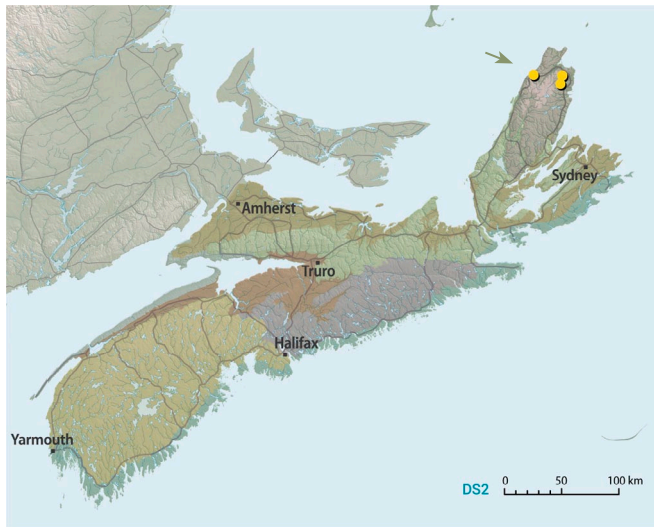


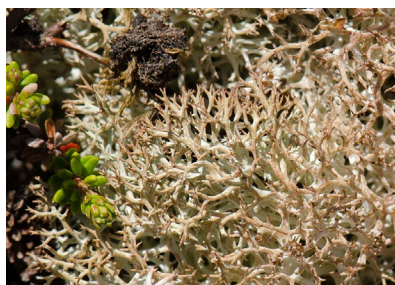
Figure 5. Survey sites for **DS2. Pink Crowberry – Alpine Bilberry Highland Barren Dwarf Shrubland Association** (n=5)

Environment

This association is restricted to the Cape Breton Highlands region. It occurs on prominent and extremely exposed middle, upper and crest slope positions. Sites are usually more than 300 m in elevation, and rarely at elevations as low as 240 m. Most occurrences are situated within 10 km from the ocean or on prominent summits of the interior highlands.

Climatic conditions at higher elevations of the highlands are the most severe in Nova Scotia. The region is regularly exposed to strong winds, including “Les Suêtes” which have been recorded at speeds exceeding 200 km/hr. The climate is very humid with persistent fog and/or cloud cover, and frequent precipitation. The growing season is relatively short with long, cold winters; snow persists late in spring.

Vegetation is discontinuous. Humus, mineral soil, bedrock and surface rocks are frequently exposed. Soils consist of humus over coarse-grained mineral soil. Freezing and thawing processes are apparent in the mixing of soil horizons and in local microtopography. Moisture regime is dry, from xeric to subxeric.



Cladonia wainioi
(False Reindeer Lichen)
Regionally rare boreal-arctic/alpine species

PHOTO: L&F (Sean Basquill)

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Picea mariana</i>	60	0.5 (±0.3)
<i>Larix laricina</i>	40	1.2 (±1.3)
<i>Picea glauca</i>	20	0.6 (±0.7)
<i>Betula populifolia</i>	20	0.2 (±0.2)
<i>Betula papyrifera</i>	20	trace
Shrubs		
<i>Empetrum eamesii</i>	100	10.7 (±5.7)
<i>Vaccinium uliginosum</i>	80	14.9 (±7.9)
<i>Empetrum nigrum</i>	80	11.9 (±7.1)
<i>Vaccinium angustifolium</i>	60	0.3 (±0.2)
<i>Vaccinium boreale</i>	60	0.1 (±0.1)
<i>Vaccinium vitis-idaea</i>	60	0.1 (±0.1)
<i>Kalmia angustifolia</i>	60	trace
<i>Rhododendron canadense</i>	40	0.2 (±0.2)
<i>Kalmia polifolia</i>	20	0.1 (±0.2)
<i>Juniperus communis</i>	20	0.1 (±0.1)
<i>Prunus pensylvanica</i>	20	0.1 (±0.1)
<i>Gaultheria procumbens</i>	20	trace
<i>Rhododendron groenlandicum</i>	20	trace
<i>Morella pensylvanica</i>	20	trace
Herbaceous Plants		
<i>Trichoporum cespitosum</i>	40	0.3 (±0.2)
<i>Maianthemum canadense</i>	40	0.1 (±0.1)
<i>Melampyrum lineare</i>	40	trace
<i>Solidago bicolor</i>	20	0.1 (±0.1)
<i>Avenella flexuosa</i>	20	trace
<i>Cornus canadensis</i>	20	trace
<i>Danthonia spicata</i>	20	trace
<i>Lechea intermedia</i>	20	trace
Lichens		
<i>Cladonia arbuscula ssp. mitis</i>	100	0.3 (±0.2)
<i>Cladonia stygia</i>	80	1.5 (±1.5)
<i>Cladonia boryi</i>	80	1.1 (±0.8)
<i>Cladonia uncialis ssp. uncialis</i>	80	0.2 (±0.1)
<i>Cetraria islandica ssp. crispiformis</i>	80	0.2 (±0.1)
<i>Cladonia crispata</i>	80	0.1 (±0.1)
<i>Pycnothelia papillaria</i>	80	trace
<i>Ochrolechia frigida</i>	60	0.1 (±0.1)
<i>Cetraria aculeata</i>	60	trace
<i>Cladonia coccifera</i>	60	trace
<i>Cladonia stellaris</i>	40	0.6 (±0.7)
<i>Cladonia wainioi</i>	40	0.1 (±0.1)
<i>Ochrolechia androgyna</i>	20	0.1 (±0.2)
<i>Bryoria nadvornikiana</i>	20	0.1 (±0.1)
<i>Cetraria laevigata</i>	20	0.1 (±0.1)
<i>Cladonia rangiferina</i>	20	trace
<i>Platismatia glauca</i>	20	trace
<i>Sphaerophorus fragilis</i>	20	trace
<i>Hypogymnia krogiae</i>	20	trace
<i>Cladonia pyxidata</i>	20	trace
<i>Cladonia arbuscula ssp. squarrosa</i>	20	trace
<i>Cladonia oricola</i>	20	trace
<i>Cladonia gracilis</i>	20	trace
Bryophytes		
<i>Racomitrium lanuginosum</i>	60	3.5 (±2.4)
<i>Ptilidium ciliare</i>	60	0.1 (±0.1)
<i>Anastrophyllum minutum</i>	20	trace
<i>Polytrichum piliferum</i>	20	trace
<i>Gymnocolea inflata</i>	20	trace
<i>Dicranum polysetum</i>	20	trace

Vegetation

Vegetation is dominated by Pink Crowberry (*Empetrum eamesii*) and Alpine Bilberry (*Vaccinium uliginosum*). Black Crowberry (*Empetrum nigrum*) is a co-dominant species at some sites. Purple Crowberry (*Empetrum atropurpureum*) is also known from this association but this species was not captured in our survey. The shrubs Lowbush Blueberry (*Vaccinium angustifolium*), Northern Blueberry (*Vaccinium boreale*), Foxberry (*Vaccinium vitis-idaea*), and Sheep Laurel (*Kalmia angustifolia*) frequently occur in low abundance. At some sites, this association supports provincially rare species with arctic and alpine affinities, such as Diapensia (*Diapensia lapponica*) and Alpine azalea (*Kalmia procumbens*). Dwarfed Black Spruce (*Picea mariana*) or Tamarack (*Larix laricina*) are sometimes abundant, particularly in the transition zones between krummholz and dwarf shrubland.

Non-woody vascular plants are not typically abundant, but the herb layer can consist of a range of species. The most frequent herbaceous plants of this association include Deer-grass (*Trichophorum cespitosum*) and Northern Starflower (*Maianthemum canadense*).



Larix laricina (Tamarack), a boreal species PHOTO: L&F (Sean Basquill)

Reindeer Lichens and Iceland moss Lichens are common, especially Green Reindeer Lichen (*Cladonia arbuscula ssp. mitis*), Black-footed Reindeer Lichen (*Cladonia stygia*), Fishnet Lichen (*Cladonia boryi*), Thorn Cladonia (*Cladonia uncialis*), Iceland Moss Lichen (*Cetraria islandica ssp. crispiformis*) and Organ Pipe Lichen (*Cladonia crispata*). Woolly Fringe Moss (*Racomitrium lanuginosum*) can be abundant. Arctic Saucer Lichen (*Ochrolechia frigida*) is relatively more common within this association in comparison with other units.

Distribution

In Nova Scotia, the DS2 association is limited to the Cape Breton Highlands and usually occurs at elevations above 300 m and rarely as low as 240 m. Most occurrences are situated within 10 km from the ocean or on prominent summits of the interior highlands (see Figure 5).

Representative Sites

Victoria County: Halfway Lake, Mica Hill (Cape Breton Highlands National Park);
Inverness County: Robert's Mountain

Related Associations

Alpine Heaths of Newfoundland (Meades 1983); Alpine Lichen Barren (Ahti 1959)

A similar association occurs in Newfoundland where it is defined as Alpine Heath; in this province Lapland Diapensia (*Diapensia lapponica*) occurs more consistently as part of the association and is considered diagnostic. Most inland sites in

Province	Present	Notes
NB	–	absent
PEI	–	absent
NL	X	common

Newfoundland are 300–400 meters above sea level, although some locations are at sea level on extremely exposed coastlines (Meades pers. comm. 2020).

DS3. Black Crowberry / Reindeer Lichen Highland Barren

Empetrum nigrum (*Vaccinium boreale*) / *Cladonia* spp.

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	28.4 (±3.7)
Vegetation Height (cm)	6.3 (±0.5)
Indicator Species	<i>Empetrum nigrum</i>
Sample size (n)	7
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		361.9 (±48.1)	460	127
Slope Gradient (%)		5.0 (±3.0)	19.4	0
Distance to coast (m)		5.9 (±2.4)	> 15.1	0.76
Exposed Substrate				
Bedrock	28.6	7.9 (±5.5)	30	0
Rock (cobble, boulder, etc.)	42.9	7.7 (±5.6)	35	0
Woody material	0	0	0	0
Mineral soil	0	0	0	0
Organic soil	57.1	1.3 (±0.9)	5	0
Surface water	0	0	0	0

Concept

Empetrum nigrum (*Vaccinium boreale*) / *Cladonia* spp. Dwarf Shrubland Association occurs on prominent, extremely exposed, middle, upper and crests of slopes in the Cape Breton Highlands. Sites are found at elevations exceeding 100 m and usually located within 5 km of the coast. Black Crowberry (*Empetrum nigrum*) and Reindeer Lichens (*Cladonia* spp.) predominate. This association is similar to unit DS2; the latter association is more common at higher elevations and is usually found on more exposed summits with larger expanses of surface bedrock. *Empetrum nigrum* / *Cladonia* spp. shrubland is the most common type of highland barren with abundant levels of Black Crowberry.

	Frequency (%)
Exposure	extremely exposed (100)
Slope Position	crest (42.9), middle slope (42.9) upper slope (14.3)
Microtopography	micro mounded (28.6), severely mounded (14.3), smooth (14.3), missing data (42.9)
Moisture Regime	very xeric (14.3), xeric (42.9), subxeric (14.3), submesic (14.3), hygric (14.3)
Aspect	north (28.6), none (14.3), west (14.3), missing data (42.9)

Environment

Empetrum nigrum (*Vaccinium boreale*) / *Cladonia* spp. Dwarf Shrubland Association occurs on prominent, extremely exposed middle, upper and crests of slopes in the Cape Breton Highlands. Sites are found at elevations exceeding 100 m, and most frequently located within 5 km of the coast but also occur further inland on the interior highlands plateau. The association is sometimes present as small patches embedded within stunted highland forest (S6. Black Spruce Highland Heath) or in other types of highland barren. It may cover large areas on prominent summits.

Humus and mineral soils are typically thin and stony; exposed bedrock and surface stones are common. Humus is typically exposed in patches, from wind and/or frost disturbance. This association occurs over a range of moisture regimes from very xeric to hygric.

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	14.5 (±6.5)	40	0.5
	Frequency (%)		
Humus form	hemimor (42.9), humimor (42.9), missing data (14.3)		



McEvoy's Barren,
Victoria County
PHOTO: L&F (Sean Basquill)

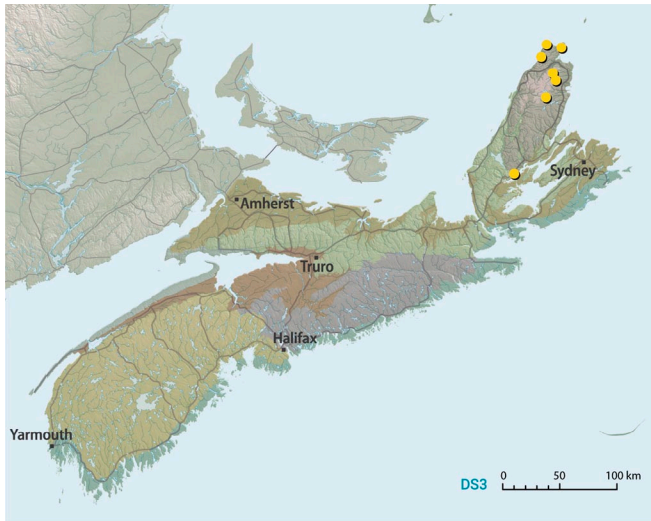


Figure 6. Survey sites for **DS3. Black Crowberry / Reindeer Lichen Highland Barren Dwarf Shrubland Association** (n=7)

Vegetation

Black Crowberry (*Empetrum nigrum*) is the dominant shrub species of this association. Dwarfed trees are sometimes present, especially in association with nearby krummholz or with forest edges found downslope along an elevational toposequence. Characteristic shrubs including Lowbush Blueberry (*Vaccinium angustifolium*) and Sheep Laurel (*Kalmia angustifolia*) are often present. Foxberry (*Vaccinium vitis-idaea*) and Northern Blueberry (*Vaccinium boreale*) are also common.

The herb layer is reduced and contains few species; the most frequently occurring include Bunchberry (*Cornus canadensis*) and Wild Lily-of-The-Valley (*Maianthemum canadense*). Lichens are abundant and diverse. Reindeer Lichens (*Cladonia spp.*) co-dominate the association. The most frequently encountered Reindeer Lichen species include Star-tipped Reindeer Lichen (*Cladonia stellaris*), Thorn Cladonia (*Cladonia uncialis ssp. uncialis*), and Grey Reindeer Lichen (*Cladonia rangiferina*). Organ Pipe Lichen (*Cladonia crispata*), Black-footed Reindeer Lichen (*Cladonia stygia*) and Eastern Boreal Pixie-cup Lichen (*Cladonia coccifera*) are typically present in trace quantities. Woolly Fringe Moss (*Racomitrium lanuginosum*) is typically present and can be abundant.

This association often contains provincially rare and uncommon lichen and shrub species. It is one of few that commonly supports lichen species such as False Reindeer Lichen (*Cladonia wainioi*), that are absent or scarce elsewhere in Nova Scotia.

Vegetation

	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Abies balsamea</i>	42.9	0.8 (±0.8)
<i>Sorbus americana</i>	42.9	trace
<i>Picea glauca</i>	28.6	3.6 (±3.8)
<i>Betula cordifolia</i>	28.6	0.1 (±0.1)

Shrubs

<i>Empetrum nigrum</i>	100	34.7 (±5.6)
<i>Vaccinium angustifolium</i>	71.4	3.7 (±1.9)
<i>Cornus canadensis</i>	71.4	1.5 (±0.9)
<i>Kalmia angustifolia</i>	71.4	0.9 (±0.5)
<i>Vaccinium vitis-idaea</i>	57.1	6.3 (±3.4)
<i>Vaccinium boreale</i>	57.1	2.4 (±2.3)
<i>Sibbaldia tridentata</i>	42.9	1.6 (±0.9)
<i>Viburnum nudum</i>	42.9	1.5 (±1.5)
<i>Rhododendron canadense</i>	42.9	0.4 (±0.3)
<i>Ilex mucronata</i>	42.9	0.3 (±0.3)
<i>Aronia melanocarpa</i>	28.6	0.2 (±0.2)
<i>Empetrum eamesii</i>	28.6	0.1 (±0.2)
<i>Rhododendron groenlandicum</i>	28.6	0.1 (±0.1)
<i>Juniperus communis</i>	28.6	trace

Herbaceous Plants

<i>Maianthemum canadense</i>	71.4	0.1 (±0.1)
<i>Melampyrum lineare</i>	42.9	0.1
<i>Avenella flexuosa</i>	28.6	trace

Lichens

<i>Cladonia stellaris</i>	71.4	2.9 (±1.2)
<i>Cladonia uncialis ssp. uncialis</i>	71.4	0.6 (±0.3)
<i>Cladonia rangiferina</i>	57.1	7.3 (±7.7)
<i>Cladonia arbuscula ssp. mitis</i>	57.1	2.4 (±1.6)
<i>Cladonia crispata</i>	57.1	0.1 (±0.1)
<i>Cladonia stygia</i>	57.1	0.1 (±0.1)
<i>Cladonia coccifera</i>	57.1	trace
<i>Cladonia arbuscula ssp. squarrosa</i>	42.9	1.9 (±1.5)
<i>Cladonia oricola</i>	42.9	0.1 (±0.1)
<i>Cladonia gracilis ssp. gracilis</i>	42.9	trace
<i>Cladonia boryi</i>	28.6	0.4 (±0.3)
<i>Cladonia wainioi</i>	28.6	0.3 (±0.2)
<i>Cetraria islandica ssp. crispiformis</i>	28.6	0.2 (±0.2)
<i>Cladonia squamosa</i>	28.6	trace

Bryophytes

<i>Racomitrium lanuginosum</i>	57.1	3 (±1.6)
<i>Pleurozium schreberi</i>	42.9	0.2 (±0.2)
<i>Dicranum scoparium</i>	28.6	0.1

Distribution

The DS3 association is limited to the Cape Breton Highlands at elevations greater than 100 m above sea level (see Figure 6).

Representative Sites

Inverness County: Humes River Wilderness Area, Pollett's Cove – Aspy Fault Wilderness Area; **Victoria County:** Lake of Islands in Cape Breton Highlands National Park, plateau around Cheticamp Lake

Province	Present	Notes
NB	X	rare
PEI	–	absent
NL	X	common

Related Associations

DS3 is almost identical to *Empetrum nigrum* heath found in Newfoundland where it has a complex successional history (Meades pers. comm. 2020).

DS4. Black Crowberry Wet Coastal Barren

Empetrum nigrum – *Vaccinium oxycoccos* / *Trichophorum cespitosum* / *Sphagnum* spp.

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	23.2 (±3.7)
Vegetation Height (cm)	10.1 (±3.9)
Indicator Species	<i>Empetrum nigrum</i> <i>Sphagnum</i> spp. **
Sample size (n)	5
Conservation Status Rank	TBD

** *Sphagnum* spp. were not statistically significant as indicator species in our statistical analyses. However, the genus can be helpful for recognizing this association in the field.

Concept

This association is characterized by coastal sites with soils that are wet for a significant part of the growing season. It is conceptually similar to DS5. Black Crowberry (*Empetrum nigrum*) is the dominant species.

Environment

This association occurs on glacial till at coastal sites that are wet for a significant part of the growing season; moisture regime is typically subhygric or hygric. The association is located on lower slopes, level topography and in depressions. Some sites are subject to salt spray. Soils consist of humus over coarse textured mineral soil.

St. Paul Island, Victoria County PHOTO: L&F (Sean Basquill)



Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		5.8 (±1.75)	10	1
Slope Gradient (%)		6.2 (±3.8)	18.5	0
Distance to coast (m)		87.9 (±30.6)	193.6	N/A
Exposed Substrate				
Bedrock	20	0.8 (±0.9)	4	0
Rock (cobble, boulder, etc.)	0	0	0	0
Woody material	0	0	0	0
Mineral soil	20	trace	0.4	0
Organic soil	0	0	0	0
Surface water	20	0.5 (±0.5)	2	0

	Frequency (%)
Exposure	exposed (100)
Slope Position	lower slope (60), depression (20), level (20)
Microtopography	micro mounded (40), slightly mounded (40), moderately mounded (20)
Moisture Regime	hygric (60), sub hygric (40)
Aspect	southwest (40), northwest (20), none (40)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	26.3 (±2.2)	21	30

	Frequency (%)
Humus form	Hydromor (20), Humimor (40), Fibrimor (20), missing data (20)

Excessively stony soils or shallow bedrock impede drainage and restrict rooting. Open water sometimes accumulates in small pools. Edaphic indicators of wet growing conditions may include wetland peat horizons and/or redoximorphic features of persistent seepage.

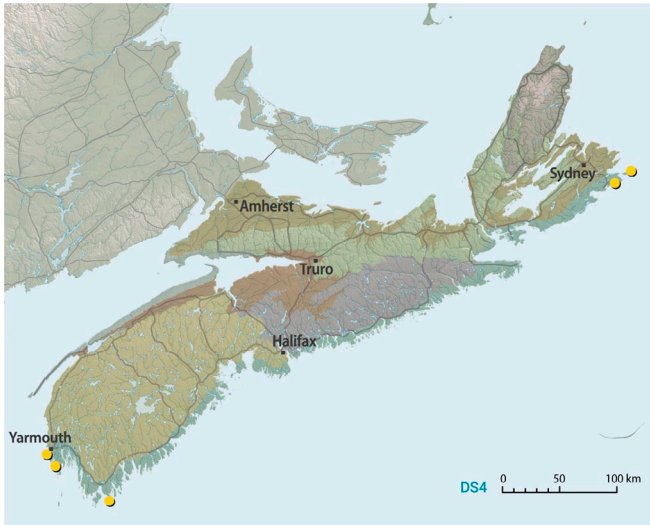


Figure 7. Survey sites for **DS4. Black Crowberry Wet Coastal Barren Dwarf Shrubland Association** (n=5)

Vegetation

The association is characterized by dominance of Black Crowberry (*Empetrum nigrum*) and by the co-occurrence of both wetland plants and species characteristic of drier habitats. The most frequently occurring shrubs include Small Cranberry (*Vaccinium oxycoccos*), Northern Bayberry (*Morella pensylvanica*), Dwarf Huckleberry (*Gaylussaccia bigeloviana*), Common Juniper (*Juniperus communis*), Sheep Laurel (*Kalmia angustifolia*), and Lowbush Blueberry (*Vaccinium angustifolium*). Some sedges are typical of this association and can be locally abundant. Tufted Clubrush (*Trichophorum cespitosum*) is the most common sedge and may be especially conspicuous at some sites. Tussock Sedge (*Carex stricta*) also frequently co-occurs.

A floristic feature that distinguishes this association from more mesic communities dominated by *Empetrum spp.*, is the presence and higher relative abundance of Peat Mosses (*Sphagnum spp.*). Wetland associated species including bog laurel (*Kalmia polifolia*), Northern Pitcher Plant (*Sarracenia purpurea*), and Tawny Cottongrass (*Eriophorum virginicum*) are sometimes present. Drier microsites of exposed bedrock or shallow stones contribute to habitat heterogeneity and commonly support additional species such as Three-toothed Cinquefoil (*Sibbaldia tridentata*) and Reindeer Lichens (*Cladonia spp.*).

Vegetation

	Frequency (%)	Cover (%) (±SEM)
Shrubs		
<i>Empetrum nigrum</i>	100	58.4 (±9.2)
<i>Morella pensylvanica</i>	100	9.4 (±4.2)
<i>Juniperus communis</i>	100	7.8 (±6.3)
<i>Kalmia angustifolia</i>	60	4.3 (±4.4)
<i>Sibbaldia tridentata</i>	80	3.5 (±3.8)
<i>Gaylussaccia bigeloviana</i>	60	1.4 (±1.1)
<i>Vaccinium angustifolium</i>	60	1.2 (±0.8)
<i>Vaccinium oxycoccos</i>	60	0.6 (±0.5)
<i>Kalmia polifolia</i>	40	1.2 (±0.8)
<i>Vaccinium macrocarpon</i>	40	0.8 (±0.9)
<i>Gaultheria procumbens</i>	40	0.6 (±0.7)
<i>Rhododendron groenlandicum</i>	40	0.5 (±0.4)
<i>Aronia x prunifolia</i>	40	0.2 (±0.2)
<i>Vaccinium vitis-idaea</i>	40	0.2 (±0.2)
<i>Cornus canadensis</i>	20	1 (±1.1)
<i>Aronia melanocarpa</i>	20	0.4 (±0.5)
<i>Viburnum nudum</i>	20	0.4 (±0.4)
<i>Rosa carolina</i>	20	0.2 (±0.2)
<i>Rubus hispidus</i>	20	0.2 (±0.2)
Herbaceous Plants		
<i>Trichophorum cespitosum</i>	60	4.4 (±3.4)
<i>Carex stricta</i>	40	1.2 (±1.3)
<i>Danthonia spicata</i>	40	1 (±1.1)
<i>Osmundastrum cinnamomeum</i>	40	0.4 (±0.5)
<i>Agrostis scabra</i>	40	0.1 (±0.2)
<i>Iris versicolor</i>	40	0.1 (±0.1)
<i>Avenella flexuosa</i>	40	trace
<i>Eriophorum virginicum</i>	20	4 (±4)
<i>Sarracenia purpurea</i>	20	2.4 (±2.7)
<i>Carex nigra</i>	20	1.5 (±1.5)
<i>Festuca rubra</i>	20	0.8 (±0.9)
<i>Juncus brevicaudatus</i>	20	0.4 (±0.5)
<i>Maianthemum canadense</i>	20	0.1 (±0.2)
Lichens		
<i>Cladonia arbuscula ssp. mitis</i>	20	6.2 (±7.0)
<i>Cladonia terrae-novae</i>	20	0.4 (±0.5)
Bryophytes		
<i>Sphagnum fuscum</i>	40	1.02 (±1.1)
<i>Sphagnum flavicomans</i>	40	0.5 (±0.4)
<i>Sphagnum capillaceum</i>	40	0.4 (±0.3)
<i>Sphagnum papillosum</i>	20	5.6 (±6.3)
<i>Sphagnum bartlettianum</i>	20	0.6 (±0.7)
<i>Sphagnum fallax</i>	20	0.3 (±0.3)

Distribution

Low elevation coastal barrens along the outer Atlantic Coast of Nova Scotia (see Figure 7).

DS4 is conceptually similar to the *Empetrum-Myrica* boreal heath in Newfoundland, which lacks southern species and supports Sweet Gale (*Myrica gale*) not Northern Bayberry (*Morella pensylvanica*), as a dominant shrub (Meades pers. comm. 2020)

Province	Present	Notes
NB	X	uncommon
PEI	X	rare
NL	X	only boreal expressions

Related Associations

Empetretum Sphagnetosum, Newfoundland (Meades 1983)

DS5. Black Crowberry / Black Sedge Wet Coastal Barren – Meadow

Empetrum nigrum / *Carex nigra*

Dwarf Shrubland – Herbaceous Association

Species Richness (spp/25 m ²)	15.0 (±3.6)
Indicator Species	<i>Empetrum nigrum</i> <i>Carex nigra</i>
Sample size (n)	7
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		8 (±1.3)	14	4
Slope Gradient (%)		13.8 (±8.1)	57.7	0
Distance to coast (m)		78.1 (±18.7)	171.1	30.3
Exposed Substrate				
Bedrock	14.3	0.7 (±0.8)	5	0
Rock (cobble, boulder, etc.)	71.4	3.1 (±1.5)	10	0
Woody material	0	0	0	0
Mineral soil	71.4	7.9 (±3.3)	20	0
Organic soil	71.4	44.4 (±16.9)	80	0
Surface water	0	0	0	0

	Frequency (%)
Exposure	exposed (71), moderately exposed (29)
Slope Position	depression (43), midslope (43), lower slope (14.3)
Microtopography	micro mounded (43), slightly mounded (43), missing data (14)
Moisture Regime	mesic (71), hygric (14), subhydryc (14), hydryc (14)
Aspect	northwest (29), southwest (14), west (14), southeast (14), southwest (14), northeast (14), none (14)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	Missing data		
	Frequency (%)		
Humus form	Hydromor (14), hemimor (14), missing data (71)		

Concept

This association occurs in wet depressional sites on coastal barrens. It is co-dominated by Black Crowberry (*Empetrum nigrum*) and Black Sedge (*Carex nigra*) along the Atlantic coast of Nova Scotia. It is similar to unit DS4, a wet shrubland heavily dominated by Black Crowberry.

Environment

This association occurs on low elevation coastal barrens in depressions where water accumulates. Sites are often channel-like depressions running parallel with lengthy slopes. Moisture regime is typically hygric, and some sites are even more saturated, with hydryc soil. Soil depth varies. Exposed rock and bedrock are sometimes present. Sites are located almost exclusively within 100 m of the ocean shoreline.

Taylor Head Provincial Park, Halifax County

PHOTO: Saint Mary's University (Caitlin Porter)



Vegetation

Vegetation of this association is characterized by the co-dominance of Black Crowberry (*Empetrum nigrum*) and Black Sedge (*Carex nigra*). Large Cranberry (*Vaccinium macrocarpon*), Northern Bayberry (*Morella pensylvanica*)

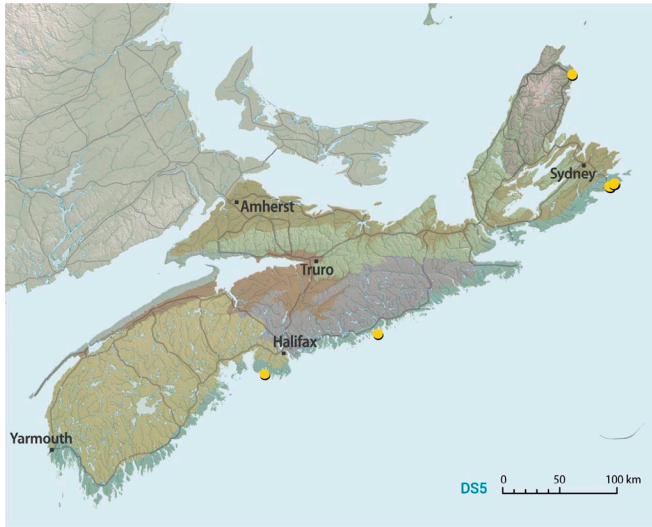


Figure 8. Survey sites for **DS5. Black Crowberry / Black Sedge Wet Coastal Barren – Meadow Dwarf Shrubland Association** (n=7)

and Common Juniper (*Juniperus communis*) are frequently present with lesser abundance. The shrubs Purple Chokeberry (*Aronia x prunifolia*), Foxberry (*Vaccinium vitis-idaea*), Lowbush Blueberry (*Vaccinium angustifolium*), and Three-toothed Cinquefoil (*Sibbaldia tridentata*) sometimes occur in drier microsites.

The most common herbaceous species include New York Aster (*Symphyotrichum novi-belgii*), Three-leaved Rattlesnake Root (*Nabalus trifoliolatus*) and Wild Lily-of-the-Valley (*Maianthemum canadense*). Wetland plants such as Cloudberry (*Rubus chamaemorus*), Spatulate-leaved Sundew (*Drosera intermedia*), and Bog Rosemary (*Andromeda polifolia*) may be present and sometimes abundant. Blue Flag Iris (*Iris versicolor*) or Hooker's Iris (*Iris hookeri*) sometimes occur. The occasional presence of halophytes such as Seaside Plantain (*Plantago maritima*) indicate a brackish influence from wave run-up or salt spray.

When present, macrolichens typically include Reindeer Lichens (*Cladonia spp.*), usually on rock substrates. Peat mosses (*Sphagnum spp.*), are among the most common of mosses present, especially Magellan's Peat Moss (*Sphagnum magellanicum*) and Flat-topped Peat Moss (*Sphagnum fallax*). Liverworts are sometimes present in trace amounts. Bryophytes were undersampled for this unit and thus are likely to be underrepresented in the species composition table. However, bryophyte cover is less than levels found in DS4.

Empetrum nigrum – *Vaccinium oxycoccos* / *Trichophorum cespitosum* / *Sphagnum spp.* Shrubland, a similar association.

Thick upland humus, typical of coastal heathland

PHOTO: L&F (Sean Basquill)

Vegetation	Frequency (%)	Cover (%) (±SEM)
Shrubs		
<i>Empetrum nigrum</i>	100	44.0 (±8.9)
<i>Morella pensylvanica</i>	71.43	8.3 (±3.6)
<i>Juniperus communis</i>	57.14	5.9 (±4.6)
<i>Sibbaldia tridentata</i>	57.14	2.9 (±1.6)
<i>Aronia x prunifolia</i>	57.14	2.3 (±1.6)
<i>Vaccinium macrocarpon</i>	42.86	3.0 (±2.0)
<i>Vaccinium angustifolium</i>	42.86	1.6 (±1.5)
<i>Vaccinium vitis-idaea</i>	42.86	0.9 (±0.8)
Herbaceous Plants		
<i>Carex nigra</i>	100	38.9 (±6.0)
<i>Symphyotrichum novi-belgii</i>	71.43	1.1 (±0.8)
<i>Nabalus trifoliolatus</i>	42.86	0.7 (±0.8)
<i>Iris versicolor</i>	42.86	0.3 (±0.2)
<i>Maianthemum canadense</i>	42.86	0.3 (±0.2)
<i>Agrostis stolonifera</i>	28.57	0.9 (±0.8)

* The absence of lichens and bryophytes from this table reflects sampling bias and not a true absence; other vegetation data have shown bryophytes present in this community type.

Distribution

The DS5 association occurs along the Atlantic coast of mainland Nova Scotia, primarily in Halifax and Guysborough counties (see Figure 8).

Representative Sites – Halifax County: Chebucto Head, Pennant Point, Prospect High Head, Taylor Head Provincial Park; **Cape Breton County:** Gooseberry Cove

Related Associations – It is not known from Newfoundland, but wet grassy headlands on the south coast may support similar vegetation (Meades pers. comm. 2020).

Province	Present	Notes
NB	X	rare
PEI	?	likely absent
NL	?	may be present



DS6. Black Crowberry Mesic Coastal Barren

Empetrum nigrum – *Vaccinium vitis-idaea* / *Symphotrichum novi-belgii* / *Cladonia* spp.

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	20.6 (±1.3)
Vegetation Height (cm)	11 (±0.9)
Indicator Species	<i>Empetrum nigrum</i>
Sample size (n)	41
Conservation Status Rank	TBD

Concept

Black Crowberry mesic coastal barren is widespread along Nova Scotia's Atlantic Coast, including the Bay of Fundy, and is often the most abundant dwarf shrubland association found in provincial coastal barren complexes. It is dominated by Black Crowberry (*Empetrum nigrum*) and found on exposed, low elevation sites with thin soil. Soils typically consist of humus over bedrock, often with a thin veneer of glacial till. Moisture regime is typically mesic but ranges from xeric to subhygric. Composition of subordinate plant species can vary considerably among community occurrences, reflecting site history, exposure, moisture regime, local climate and latitude. This is the only coastal barren association in Nova Scotia dominated by Black Crowberry and found on well-drained soil.

Environment

This association is common along Nova Scotia's Atlantic coast on the most exposed peninsulas and windward islands. Its distribution roughly tracks coastal locations with the longest fetch distances. Sites are typically extremely wind-exposed, cool, foggy, very humid,



Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		11.6 (±2.6)	94	1
Slope Gradient (%)		23.5 (±4.6)	133	0
Distance to coast (m)		156 (±82.8)	3.4 km	0
Exposed Substrate				
Bedrock	19.5	4 (±1.7)	45	0
Rock (cobble, boulder, etc.)	43.9	2.4 (±0.9)	30	0
Woody material	2.4	0	0.5	0
Mineral soil	4.9	0.2 (±0.2)	5	0
Organic soil	19.5	0.6 (±0.2)	5	0
Surface water	2.4	0	0.1	0

	Frequency (%)
Exposure	extreme (82), moderately exposed (15), moderate (2)
Slope Position	midslope (34.1), level (24.4), upper slope (14.6), crest (12.2), lower slope (12.2), depression (2.4)
Microtopography	micro mounded (39), slightly mounded (19.5), severely mounded (19.5), moderately mounded (14.6), missing data (7.3)
Moisture Regime	submesic (36.6), xeric (14.6), subhygric (14.6), subxeric (12.2), mesic (7.3), missing data (14.6)
Aspect	E (35), NW (10), SW (10), W (10), N (7.5), NE (7.5), S (5), missing data (5), SE (2.5)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	30.9 (±3.3)	93	0

	Frequency (%)
Humus form	Humimor (32), Hemimor (20), Resimor (10), Mormoder (10), Fibrimor (2), Leptomoder (2)

and are often exposed to salt spray. Some near-shore microsites experience infrequent wave run-up.

Soils typically consist of humus over a thin horizon of sandy glacial till. Rooting is typically restricted by shallow bedrock, though at some sites rooting is limited by excessively stony mineral soil or a cemented horizon. Exposed bedrock is common.

Like all barrens plant communities in Nova Scotia, these soils are acidic and nutrient poor. Moisture regime is most frequently sub-mesic though it ranges through xeric to subhydric and is also often heterogeneous at small scales, e.g. microsites where water accumulates in small pools.

White Point, Victoria County

PHOTO: L&F (Sean Basquill)

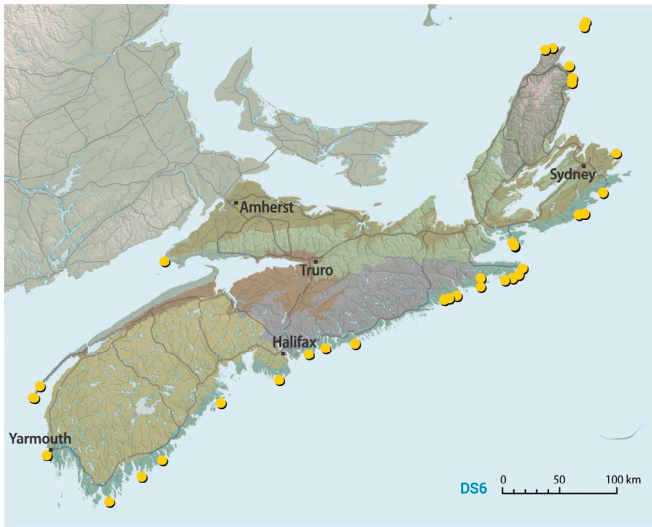


Figure 9. Survey sites for **DS6. Black Crowberry Mesic Coastal Barren Dwarf Shrubland Association** (n=41)

Vegetation

Black Crowberry (*Empetrum nigrum*) is the dominant species of this association, often forming thick mats interspersed with other species.

Patches of Northern Bayberry (*Morella pensylvanica*) are frequent. Four additional shrub species are at least moderately constant, and usually present with low cover: Foxberry (*Vaccinium vitis-idaea*), Three-toothed Cinquefoil (*Sibbaldia tridentata*), Common Juniper (*Juniperus communis*), and Lowbush Blueberry (*Vaccinium angustifolium*).

Patches of Soapberry (*Shepherdia canadensis*) occur at some sites in Cape Breton. Pink Crowberry (*Empetrum eamesii*) and Creeping Juniper (*Juniperus horizontalis*) typically occur on the more exposed microsites close to the ocean. Purple Crowberry (*Empetrum atropurpureum*) has been reported from several sites but was not observed by this survey. The provincially uncommon Alpine Bilberry (*Vaccinium uliginosum*) occurs at several low elevation sites in Cape Breton and on the Canso



Vegetation	Frequency (%)	Cover (%) (±SEM)
Shrubs		
<i>Empetrum nigrum</i>	100	55.4 (±3.7)
<i>Morella pensylvanica</i>	70.7	4.3 (±1.4)
<i>Vaccinium vitis-idaea</i>	70.7	1.9 (±0.6)
<i>Juniperus communis</i>	63.4	2.7 (±0.7)
<i>Sibbaldia tridentata</i>	56.1	1.3 (±0.5)
<i>Vaccinium angustifolium</i>	51.2	3.6 (±1.3)
<i>Cornus canadensis</i>	34.1	2.9 (±1.6)
<i>Kalmia angustifolia</i>	31.7	1 (±0.4)
<i>Juniperus horizontalis</i>	29.3	2.3 (±1.2)
<i>Aronia melanocarpa</i>	26.8	0.2 (±0.1)
Herbaceous Plants		
<i>Symphotrichum novi-belgii</i>	73.2	0.9 (±0.3)
<i>Festuca rubra</i>	51.2	2 (±0.7)
<i>Avenella flexuosa</i>	43.9	2.8 (±1.3)
<i>Danthonia spicata</i>	43.9	1 (±0.5)
<i>Agrostis scabra</i>	31.7	0.1
<i>Plantago maritima</i>	26.8	0.3 (±0.1)
<i>Lysimachia borealis</i>	24.4	0.2 (±0.1)
<i>Achillea borealis</i>	22	0.1 (±0.1)
<i>Maianthemum canadense</i>	22	0.1 (±0.1)
<i>Solidago bicolor</i>	20	0.2 (±0.1)
Lichens		
<i>Cladonia arbuscula ssp. mitis</i>	31.7	0.9 (±0.3)
<i>Cladonia arbuscula ssp. squarrosa</i>	26.8	1.1 (±0.7)
<i>Cladonia rangiferina</i>	26.8	0.9 (±0.5)
<i>Cladonia terrae-novae</i>	22	0.5 (±0.3)
<i>Cladonia uncialis ssp. uncialis</i>	22	0.2 (±0.1)

and Chebucto Peninsulas. The presence of the dwarf shrub Broom Crowberry (*Corema conradii*) typically coincide with pockets of drier, shallow mineral soil.

Herbaceous vascular plants are typically present, but the only faithfully occurring of these species is New York Aster (*Symphotrichum novi-belgii*), present at nearly three quarters of sites. Seaside Plantain (*Plantago maritima*), Northern Starflower (*Lysimachia borealis*), Wild Lily-of-the-Valley (*Maianthemum canadense*) and Silverrod, also called White Goldenrod (*Solidago bicolor*) are occasionally present.

Grasses are present in low abundance at most sites. Wavy Hair Grass (*Avenella flexuosa*) occurs at nearly half of sites. Poverty Oat Grass (*Danthonia spicata*) is common in microsites that are relatively dry, and it is sometimes associated with anthropogenic disturbance. Native species of Bent Grasses (*Agrostis spp.*) are also common in low abundance, especially Rough Bent Grass (*Agrostis scabra*). Three other grass species

Juniperus horizontalis (Creeping Juniper), a common coastal heathland species

PHOTO: L&F (Sean Basquill)

Empetrum nigrum
(Black Crowberry),
a boreal-arctic
species common
on Nova Scotia's
exposed coastline

PHOTO: L&F (Sean Basquill)



occur less frequently but may comprise substantial cover when present. Pickering's Reed Grass (*Calamagrostis pickeringii*) is a common constituent species of this association, most abundant in moister microhabitats. Red Fescue (*Festuca rubra*) is a frequent occurrence closer to the shoreline. In some northern coastal occurrences, American beach grass (*Ammophila breviligulata*) may be scattered throughout.

Macrolichens form a conspicuous component of this association and are often sufficiently abundant that they may be used to support delineation of the association from air photos. Twenty-seven species of *Cladonia* lichen species have been identified within this association, primarily on humus substrate but sometimes also on rock or exposed mineral soil. The most common of these are the Reindeer Lichens: *Cladonia arbuscula* (*ssp. squarrosa* and also *ssp. mitis*), Gray Reindeer Lichen (*Cladonia rangiferina*), Newfoundland Reindeer Lichen (*Cladonia terrae-novae*), and Thorn Cladonia (*Cladonia uncialis*). Fishnet Cladonia (*Cladonia boryi*) and the uncommon species Coast Reindeer Lichen (*Cladonia oricola*) are also known from this community. Occurring from Halifax county north through Cape Breton, Black-footed Reindeer Lichen (*Cladonia stygia*) is sometimes present and reflects northern climatic conditions.

Distribution

The association occurs along most of Nova Scotia's outer Atlantic coast on the most exposed peninsulas and windward islands (see Figure 9).

This is similar to the "*Empetrum typicum*" association defined from coastal headlands and near treeline sites in Newfoundland (Meades pers. comm. 2020).

Representative Sites

Halifax County: Duncan's Cove Nature Reserve, Taylor Head Provincial Park, West Dover Provincial Park; **Cumberland County:** Big Bald Rock in Cape Chignecto Provincial Park; **Cape Breton County:** Baleine Nature Reserve; **Victoria County:** White Point; **Inverness County:** Pollett's Cove Aspy Fault Wilderness Area

Similar Associations

- *Empetretum typicum* (Meades 1983)
- *Morella pensylvanica* – *Empetrum nigrum*
Dwarf-shrubland, CEGL006510

Province	Present	Notes
NB	X	rare
PEI	?	unconfirmed (<i>Empetrum nigrum</i> is absent from PEI)
NL	X	common

A consistent group of species characterizes this association, yet a notable proportion of constituent species vary between sites. Within our sample plots we detected 189 additional plant and lichen species that were present in less than 20% of sample plots. This variation can largely be explained by differences in moisture conditions, soil salinity and coastal exposure, anthropogenic history, and latitude.

DS7. Broom Crowberry Coastal Barren

Corema conradii – *Juniperus communis* / *Cladonia boryi*

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	22.5 (±3.5)
Vegetation Height (cm)	16.9 (±1.4)
Indicator Species	<i>Corema conradii</i> <i>Cladonia boryi</i> <i>Juniperus communis</i>
Sample size (n)	11
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		11.4 (±2.1)	25	3
Slope Gradient (%)		19.2 (±9.5)	100	0
Distance to coast (m)		514.5 (±169)	1867.6	7.7
Exposed Substrate				
Bedrock	27.3	1.5 (±0.9)	7	0
Rock (cobble, boulder, etc.)	18.2	3.4 (±3.3)	35	0
Woody material	0	0	0	0
Mineral soil	0	0	0	0
Organic soil	0	0	0	0
Surface water	0	0	0	0

Concept

This association occurs on moderately sheltered to exposed coastal sites and is dominated by Broom Crowberry (*Corema conradii*) and typically includes abundant Common Juniper (*Juniperus communis*) and patches of *Cladonia boryi*. It is the only Broom Crowberry barren community in Nova Scotia occurring on coastal glacial till and bedrock outcrops.

	Frequency (%)
Exposure	exposed (55), moderately exposed (46)
Slope Position	crest (40), upper slope (30), middle slope (20), level (20)
Microtopography	micro mounded (46), slightly mounded (18), moderately mounded (20), severely mounded (20)
Moisture Regime	very xeric (9), xeric (46), sub xeric (36), sub hydric (9)
Aspect	northwest (36), none (27), southeast (18), east (9)

Environment

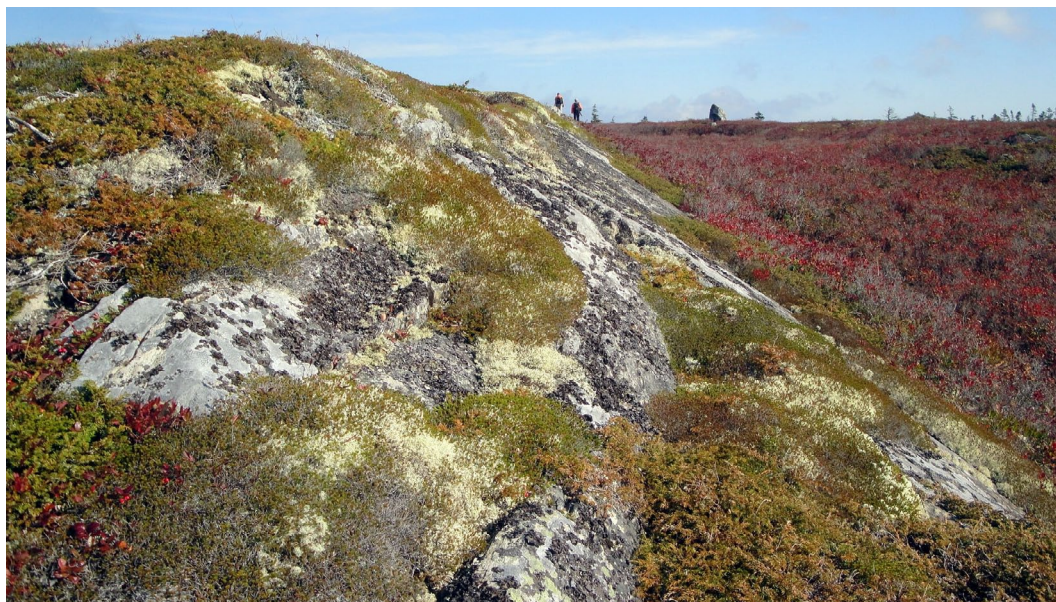
Sites occur along the coast and on moderately sheltered to exposed topography. This association is most common on sites with prominent ridges of exposed bedrock. It is situated outside the influence of salt spray, typically at distances greater than 100 m from the ocean. Soils consist of variably thin (usually 7–40 cm), poorly developed humus over bedrock. Moisture regime varies broadly. It occurs most often at xeric sites but can also occur at moist sites.

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	18.9 (±4.6)	39.5	5

	Frequency (%)
Humus form	Hemimor (36), Humimor (9), missing data (36)

Vegetation

This association is characterized by the co-dominance of Broom Crowberry (*Corema conradii*) and Common Juniper (*Juniperus communis*) in the shrub layer. Other shrubs present with lesser abundance may include: Lowbush Blueberry (*Vaccinium angustifolium*), Eastern Teaberry (*Gaultheria procumbens*), Three-toothed Cinquefoil



Owl's Head,
Halifax County

PHOTO: Nova Scotia Environment

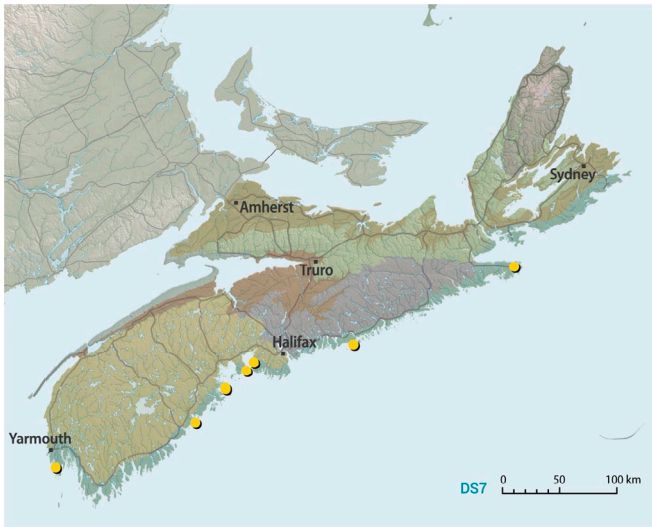


Figure 10. Survey sites for **DS7. Broom Crowberry Coastal Barren Dwarf Shrubland Association** (n=11)

(*Sibbaldia tridentata*), Foxberry (*Vaccinium vitis-idaea*), Black Crowberry (*Empetrum nigrum*), and Common Bearberry (*Arctostaphylos uva-ursi*).

The herbs Northern Starflower (*Lysimachia borealis*) and Wild Lily-of-the-Valley (*Maianthemum canadense*) are moderately constant. Lichens frequently include the species Grey Reindeer Lichen (*Cladonia rangiferina*), Thorn Cladonia (*Cladonia uncialis*), Reindeer Lichen (*Cladonia arbuscula* ssp. *squarrosa*), and the indicator species Fishnet Lichen (*Cladonia boryi*). Frequently occurring bryophytes species include the mosses Bristly Haircap Moss (*Polytrichum piliferum*) and Spurred Broom Moss (*Dicranum spurium*).

Vegetation dynamics may be indicated by the presence of structural complexity typical of the association. Taller shrubs such as Dwarf Huckleberry (*Gaylussacia bigelovana*), herbaceous species such as Bracken Fern (*Pteridium aquilinum*), and trees including Balsam Fir (*Abies balsamea*), Red Maple (*Acer rubrum*), and or Jack Pine (*Pinus banksiana*) sometimes occur.

While Broom Crowberry (*Corema conradii*) is diagnostic for this association, this species occurs far less frequently in coastal areas than the other common crowberry species in Nova Scotia, the Black Crowberry (*Empetrum nigrum*). This association is much drier than the Black Crowberry mesic coastal barren (DS6), supporting lower levels of coastal associates like Foxberry (*Vaccinium vitis-idaea*), Red Fescue (*Festuca rubra*), and Newfoundland Reindeer Lichen (*Cladonia terrae-novae*).

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Picea glauca</i>	27.3	0.5 (±0.4)
Shrubs		
<i>Corema conradii</i>	100	40.3 (±6.6)
<i>Vaccinium angustifolium</i>	100	1.9 (±0.6)
<i>Juniperus communis</i>	90.9	15.5 (±5.6)
<i>Gaylussacia baccata</i>	72.7	12.7 (±5.6)
<i>Kalmia angustifolia</i>	54.5	2.1 (±1.2)
<i>Gaultheria procumbens</i>	54.5	1.6 (±1.0)
<i>Sibbaldia tridentata</i>	45.5	0.8 (±0.5)
<i>Arctostaphylos uva-ursi</i>	36.4	3.7 (±2.2)
<i>Empetrum nigrum</i>	36.4	0.8 (±0.5)
<i>Vaccinium vitis-idaea</i>	27.3	1.4 (±1.0)
<i>Aronia x prunifolia</i>	27.3	0.4 (±0.3)
<i>Morella pensylvanica</i>	27.3	0.3 (±0.3)
<i>Ilex mucronata</i>	27.3	0.2 (±0.2)
<i>Cornus canadensis</i>	27.3	0.1
<i>Aronia melanocarpa</i>	27.3	trace
Herbaceous Plants		
<i>Maianthemum canadense</i>	54.5	trace
<i>Lysimachia borealis</i>	54.5	0.1
<i>Avenella flexuosa</i>	27.3	trace
<i>Pteridium aquilinum</i>	27.3	0.6 (±0.5)
<i>Danthonia spicata</i>	27.3	0.1 (±0.1)
Lichens		
<i>Cladonia boryi</i>	81.8	5.5 (±2.0)
<i>Cladonia rangiferina</i>	45.5	4.9 (±3.8)
<i>Cladonia uncialis</i> ssp. <i>uncialis</i>	45.5	1.8 (±1.3)
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	36.4	4.5 (±3.5)
<i>Cladonia stellaris</i>	36.4	3 (±2.8)
Bryophytes		
<i>Polytrichum piliferum</i>	27.3	2.8 (±2.9)
<i>Dicranum spurium</i>	27.3	2.5 (±2.4)

Distribution

The DS7 association is found scattered along the outer Atlantic Coast of Nova Scotia (see Figure 10). It is not known from elsewhere in Canada.

Representative Sites

Lunenburg County: Blue Rocks; **Halifax County:** Owl's Head (Southwest Cove), West Dover Provincial Park (Peggy's Cove, Polly's Cove), Pennant Point (Crystal Crescent Beach Provincial Park); **Guysborough County:** Canso Coastal Barrens Wilderness Area

Province	Present	Notes
NB	—	absent
PEI	—	absent or extirpated
NL	—	absent

DS8. Common Juniper Coastal Barren

Juniperus communis – *Empetrum nigrum* / *Cladonia* spp.

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	26.6 (±2.3)
Vegetation Height (cm)	15.8 (±2.8)
Indicator Species	<i>Juniperus communis</i>
Sample size (n)	11
Conservation Status Rank	TBD

Concept

This association is dominated by Common Juniper (*Juniperus communis*). Ericaceous shrub species and Black Crowberry, graminoids and Reindeer Lichens (*Cladonia* spp.) frequently co-occur. Sites are dry and steep sloping, occurring on the coast and typically associated with exposed bedrock or extremely stony mineral soils.

Environment

The *Juniperus communis* – *Empetrum nigrum* / *Cladonia* spp. Dwarf Shrubland association occurs on exposed or moderately exposed coastal sites located beyond the direct influence of salt spray, typically more than 100 m from the ocean. Sites are frequently steep sloping upper and middle slopes. Soil establishment can be minimal, and humus is often poorly developed. Areas of exposed bedrock, loose rocks, and/or mineral soil are commonly. Moisture regime of this association is dry; most frequently sub-xeric but ranging from xeric to mesic. The association may be found in small patches associated with dry, rocky microsites, or it may occupy more expansive areas, especially at sites that have extensive bedrock exposures or cliff ledges.

(left) Shallow soil, showing humus over bedrock;
(right) Blue Rocks, Lunenburg County



Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		11.6 (±1.5)	20	4
Slope Gradient (%)		60.7 (±13.3)	98.2	15.3
Distance to coast (m)		170.8 (±79)	901.7	8.1
Exposed Substrate				
Bedrock	36.4	3.1 (±1.5)	13	0
Rock (cobble, boulder, etc.)	27.3	0.6 (±0.5)	5	0
Woody material	0	0 0	0	0
Mineral soil	9.1	0 0.5	0	0
Organic soil	0	0 0	0	0
Surface water	0	0 0	0	0
		<i>Frequency (%)</i>		
Exposure		exposed (81.8), moderately exposed (18.2)		
Slope Position		upper slope (45.5), middle slope (45.5), toe of slope (9.1)		
Microtopography		moderately mounded (45.5), slightly mounded (27.3), severely mounded (27.3)		
Moisture Regime		subxeric (45.5), xeric (27.3), mesic (27.3)		
Aspect		northwest (36.4), southeast (18.2), southwest (18.2), east (9.1), north (9.1), northeast (9.1)		
		<i>Soil Features</i>		
		Mean (±SEM)	max	min
Root Restriction Depth (cm)		25.1 (±4.7)	47	6
		<i>Humus form</i>		
Humus form		Humimor (36.4), Mormoder (18.2), Resimor (18.2), Hemimor (9.1), missing data (18.2)		

Vegetation

Common Juniper (*Juniperus communis*) dominates this association. Black Crowberry (*Empetrum nigrum*) and Lowbush Blueberry (*Vaccinium angustifolium*) are frequent and sometimes abundant. Though less frequent, Three-toothed Cinquefoil (*Sibbaldia tridentata*), Horizontal Juniper (*Juniperus horizontalis*) and occasionally



PHOTOS (l to r): L&F (Sean Basquill); Saint Mary's University (Caitlin Porter)

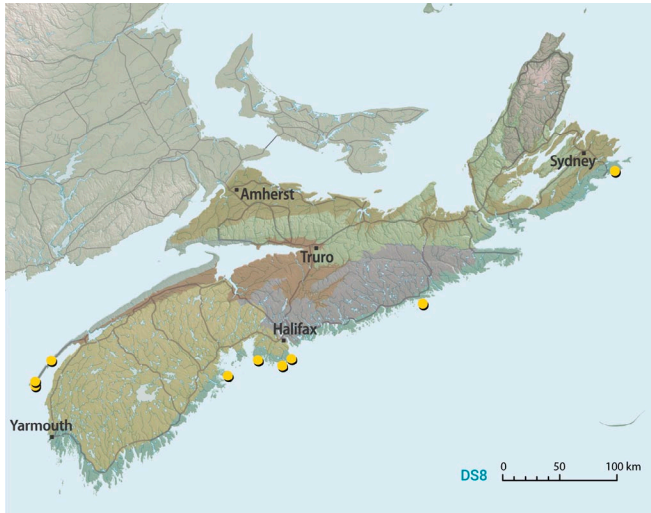


Figure 11. Survey sites for **DS8. Common Juniper Coastal Barren Dwarf Shrubland Association** (n=11)

Bunchberry (*Cornus canadensis*) can also be abundant. Small depressions may also support wetland species such as Small Cranberry (*Vaccinium oxycoccos*). The taller shrubs Black Huckleberry (*Gaylussacia baccata*), Sheep Laurel (*Kalmia angustifolia*), Northern Bayberry (*Morella pensylvanica*), Rhodora (*Rhododendron canadense*), and Purple Chokeberry (*Aronia x prunifolia*) are frequent. These taller shrubs sometimes form a low, sparse canopy, suggesting vegetation dynamics possibly representing a transition to forest.

The most frequently occurring herbaceous plants of this association include New York Aster (*Symphotrichum novi-belgii*), Downy Goldenrod (*Solidago puberula*), and Wild Lily-of-the-Valley (*Maianthemum canadense*). Silverrod (*Solidago bicolor*) sometimes occupies a substantial component. Poverty Oatgrass (*Danthonia spicata*) is both frequent and abundant. Rough Bent Grass (*Agrostis scabra*) and Red Fescue (*Festuca rubra*) are frequent.

Fishnet Lichen (*Cladonia boryi*) usually forms a substantial component of this association. The next most frequently occurring lichen species include Newfoundland Reindeer Lichen (*Cladonia terrae-novae*), the Reindeer Lichens (*Cladonia arbuscula ssp. mitis*, *Cladonia arbuscula ssp. squarrosa*), and Grey Reindeer Lichen (*Cladonia rangiferina*).

In some occurrences, moist soils may support wetland-associated species such as Labrador Tea (*Rhododendron groenlandicum*), Tufted Clubrush (*Trichophorum cespitosum*), Large Cranberry (*Vaccinium macrocarpon*), Small Cranberry (*Vaccinium oxycoccos*), and/or Rhodora (*Rhododendron canadense*).

Vegetation	Frequency (%)	Cover (%) (±SEM)
Shrubs		
<i>Juniperus communis</i>	100	30.8 (±3.7)
<i>Vaccinium angustifolium</i>	81.8	5.5 (±2.5)
<i>Empetrum nigrum</i>	81.8	15.9 (±5)
<i>Sibbaldia tridentata</i>	72.7	1.6 (±1.1)
<i>Morella pensylvanica</i>	63.6	5.5 (±2.8)
<i>Vaccinium vitis-idaea</i>	63.6	1.7 (±1.4)
<i>Kalmia angustifolia</i>	45.5	1.5 (±1)
<i>Alnus alnobetula</i>	45.5	0.5 (±0.4)
<i>Corema conradii</i>	36.4	4 (±2.4)
<i>Gaylussacia baccata</i>	36.4	4.2 (±4)
<i>Arctostaphylos uva-ursi</i>	27.3	6.4 (±3.6)
<i>Cornus canadensis</i>	27.3	2.8 (±2.9)
<i>Vaccinium oxycoccos</i>	27.3	trace
<i>Aronia x prunifolia</i>	27.3	0.8 (±0.7)
<i>Rhododendron groenlandicum</i>	27.3	0.6 (±0.5)
<i>Juniperus horizontalis</i>	27.3	0.6 (±0.5)
<i>Gaultheria procumbens</i>	27.3	0.5 (±0.5)
Herbaceous Plants		
<i>Danthonia spicata</i>	63.6	4.6 (±3.8)
<i>Symphotrichum novi-belgii</i>	54.5	0.7 (±0.3)
<i>Festuca rubra</i>	45.5	0.1
<i>Solidago puberula</i>	45.5	0.1 (±0.1)
<i>Agrostis scabra</i>	45.5	0.1 (±0.1)
<i>Maianthemum canadense</i>	36.4	0.1 (±0)
<i>Lysimachia borealis</i>	27.3	trace
<i>Trichophorum cespitosum</i>	27.3	0.5 (±0.5)
<i>Achillea borealis</i>	27.3	0.2 (±0.2)
Lichens		
<i>Cladonia boryi</i>	72.7	3.2 (±2.4)
<i>Cladonia arbuscula ssp. mitis</i>	63.6	1 (±0.7)
<i>Cladonia terrae-novae</i>	54.5	0.4 (±0.2)
<i>Cladonia rangiferina</i>	36.4	1 (±0.7)
<i>Cladonia arbuscula ssp. squarrosa</i>	36.4	0.2 (±0.2)
<i>Cladonia uncialis ssp. uncialis</i>	27.3	0.5 (±0.3)
<i>Cladonia stellaris</i>	27.3	0.4 (±0.2)
Bryophytes		
<i>Pleurozium schreberi</i>	27.3	trace
<i>Dicranum spurium</i>	27.3	trace
<i>Racomitrium lanuginosum</i>	27.3	0.1 (±0.1)

Distribution

Atlantic coast of Nova Scotia (see Figure 11).

Representative Sites

Halifax County: West Dover Provincial Park, Pennant Point, Chebucto Head; **Lunenburg County:** Blue Rocks; **Digby County:** Tommy's Beach (Digby Neck), Freeport (Long Island); **Guysborough County:** Goose Island; **Cape Breton County:** Gooseberry Cove

Related Associations — *Juniperus communis* is common in Newfoundland heaths but the species does not tend to

Province	Present	Notes
NB	X	rare
PEI	?	rare or absent
NL	?	rare or absent

form extensive communities as described here (Meades pers. comm. 2020).

DS9. Bearberry – Lowbush Blueberry Inland Barren

Arctostaphylos uva-ursi – *Vaccinium angustifolium*

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	18.9 (±2.1)
Indicator Species	<i>Arctostaphylos uva-ursi</i> <i>Pteridium aquilinum</i>
Sample size (n)	8
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		24.0 (±20.0)	149	9
Slope Gradient (%)		5 (±3.5)	17.6	0
Distance to coast (km)		13.4 (±48.3)	38.4	24.7
Exposed Substrate				
Bedrock	0.14	5 (±trace)	40	0
Rock (cobble, boulder, etc.)	28.6	3.6 (±3.8)	25	0
Woody material	14.3	1 (±1.1)	7	0
Mineral soil	28.6	0.5 (±0.5)	3	0
Organic soil	42.9	0.9 (±0.8)	5	0
Surface water	0	0	0	0

Concept

This association is characterized by Bearberry (*Arctostaphylos uva-ursi*) dominance on dry sites at low elevation with sandy, coarse loamy, and/or stony soils. It is conceptually similar to DS11, a unit with a comparable geographic range, but is generally associated with more recent disturbance.

Environment

This association typically occurs on inland sites at distances greater than 24 km from the coast. Sites are relatively sheltered, with moderate to negligible exposure. It occurs primarily in southwestern Nova Scotia. More than half of sites encountered in this survey have been burned at some time in the past. Soils are shallow, predominantly coarse textured and frequently gravelly glaciofluvial sand or glacial till. Moisture regime is frequently xeric but ranges through subxeric to submesic.

	Frequency (%)
Exposure	moderately exposed (28.6), moderate (71.4)
Slope Position	crest (37.5), upper slope (25.0), middle slope (12.5), level (25.0)
Microtopography	moderate mounded (71.4), missing data (28.6)
Moisture Regime	xeric (57.1), subxeric (28.6), submesic (14.3)
Aspect	none (42.9), missing data (28.6), north (14.3), west (14.3)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	27.8 (±9.5)	68	2
Frequency (%)			
Humus form	hemimor (42.9), humimor (28.6), Mormoder (14.3), missing data (14.3)		

Bowers Meadows Wilderness Area, Shelburne County

PHOTO: Saint Mary's University (Caitlin Porter)



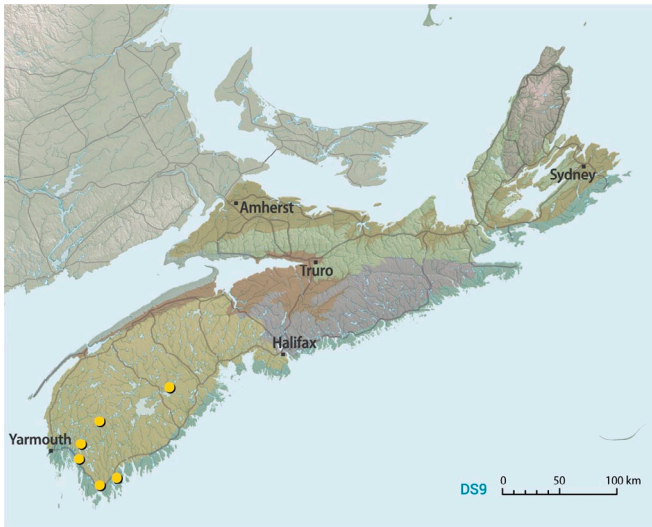


Figure 12. Survey sites for DS9. Bearberry – Lowbush Blueberry Inland Barren Dwarf Shrubland Association (n=9)

Vegetation

Bearberry (*Arctostaphylos uva-ursi*) and lesser amounts of Lowbush Blueberry (*Vaccinium angustifolium*) co-dominate this association. Sweetfern (*Comptonia peregrina*), Eastern teaberry (*Gaultheria procumbens*), Sheep Laurel (*Kalmia angustifolia*), and Broom Crowberry (*Corema conradii*) are also frequent.

Downy Goldenrod (*Solidago puberula*), Bracken Fern (*Pteridium aquilinum*), and Poverty Oatgrass (*Danthonia spicata*) are characteristic herbaceous species.

Red Pine (*Pinus resinosa*) or White Pine (*Pinus strobus*) are sometimes present. Reindeer lichens may be present with low cover but few species occur with notable constancy.



Arctostaphylos uva-ursi
(Bearberry), typical of dry sites

PHOTO: L&F (Sean Basquill)

Vegetation

	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Pinus resinosa</i>	25.0	trace
<i>Populus grandidentata</i>	25.0	trace
<i>Quercus rubra</i>	25.0	trace
Shrubs		
<i>Arctostaphylos uva-ursi</i>	100	41.3 (±3.7)
<i>Vaccinium angustifolium</i>	100	7.4 (±4.0)
<i>Gaultheria procumbens</i>	87.5	5.1 (±1.7)
<i>Kalmia angustifolia</i>	87.5	2.6 (±1.5)
<i>Comptonia peregrina</i>	62.5	0.6 (±0.2)
<i>Corema conradii</i>	62.5	25.4 (±4.3)
<i>Gaylussacia baccata</i>	62.5	2 (±1.8)
<i>Amelanchier laevis</i>	37.5	trace
<i>Aronia melanocarpa</i>	37.5	trace
Herbaceous Plants		
<i>Pteridium aquilinum</i>	75.0	1.6 (±1)
<i>Solidago puberula</i>	75.0	0.3 (±0.2)
<i>Danthonia spicata</i>	37.5	trace
<i>Nabalus trifoliolatus</i>	37.5	trace
<i>Lysimachia borealis</i>	37.5	trace
<i>Cornus canadensis</i>	25.0	trace
<i>Melampyrum lineare</i>	25.0	trace
<i>Rubus hispida</i>	25.0	trace
<i>Spiranthes lacera</i>	25.0	trace
Lichens		
<i>Cladonia rangiferina</i>	87.5	trace
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	37.5	trace
<i>Hypogymnia</i> sp.	37.5	trace
<i>Cladonia coccifera</i>	25.0	trace
<i>Cladonia terrae-novae</i>	25.0	7.5 (±7.4)
<i>Cladonia uncialis</i> ssp. <i>uncialis</i>	25.0	2.6 (±2.4)
Bryophytes		
<i>Dicranum polysetum</i>	25.0	trace
<i>Leucobryum glaucum</i>	25.0	trace

Distribution

The DS9 association occurs primarily on dry sites in the interior at low elevations of mainland Nova Scotia (see Figure 12).

Representative Sites – Yarmouth County: Tobetic Wilderness Area, Thompsons Bluff; **Shelburne County:** Bowers Meadows Wilderness Area

Related Associations – Nothing comparable occurs on insular Newfoundland; Bearberry (*Arctostaphylos uva-ursi*) may be present in some coastal heaths but is usually sparse, while Sweetfern (*Comptonia peregrina*) is very rare, and Broom Crowberry (*Corema conradii*) is absent from the island (Meades pers. comm. 2020).

Province	Present	Notes
NB	X	rare
PEI	–	absent
NL	–	absent

DS10. Broom Crowberry Rock Barren

Corema conradii – *Gaylussacia baccata* / *Cladonia boryi* – *Cladonia strepsilis*

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	22.7 (±1.5)
Vegetation Height (cm)	13.8 (±1.6)
Indicator Species	<i>Corema conradii</i> <i>Gaylussacia baccata</i> <i>Cladonia boryi</i> <i>Cladonia strepsilis</i>
Sample size (n)	16
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		125 (±NA)	206	13
Slope Gradient (%)		30.5 (±NA)	78.1	0
Distance to coast (km)		30.3 (±2.1)	46.3	0.5
Exposed Substrate				
Bedrock	100	14.2 (±3.1)	60	0
Rock (cobble, boulder, etc.)	100	3.5 (±1.8)	5	0
Woody material	0.6	0.5 (±0)	0.5	0
Mineral soil	0.6	5 (±0)	5	0
Organic soil	0	0	0	0
Surface water	0	0	0	0

Concept

This association is characterized by dominance of Broom Crowberry (*Corema conradii*) on low elevation bedrock exposures throughout the interior of Nova Scotia. Vegetation cover ranges along a gradient in soil depth, from extensive spreading mats to sparse patches rooted in rock crevices. It is the only inland Broom Crowberry barren found on exposed bedrock outcrops. A similar association occurs on coastal bedrock exposures where ambient humidity is higher from onshore oceanic influences (unit DS8).

	Frequency (%)
Exposure	moderate (90), moderately exposed (10)
Slope Position	crest (37.5), upper slope (37.5), lower slope (6), middle slope (12), level slope (6), missing data (0)
Microtopography	micro mounded (50), slightly mounded (16.7), smooth (33.3)
Moisture Regime	Very xeric (80), xeric (20)
Aspect	N (6.7), NW (10), SW (16.7), NE (3.3), NW (10), SE (3.3), None or missing data (40)

Environment

Sites are of moderate to negligible exposure and occur throughout the province's low elevation interior. The association occurs at a variety of slope positions

but most frequently occupies steep upper slopes, the crests of hills and prominent bedrock ridges. It is common both as a component of large open, near-treeless barrens and also on bedrock ridges embedded within forested landscapes, or on lakeshores.

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	5.0 (±NA)	26	0
Frequency (%)			
Humus form	hemimor (43.3), missing data or not present (56.7)		

Shingle Lake, Lunenburg County PHOTO: L&F (Sean Basquill)



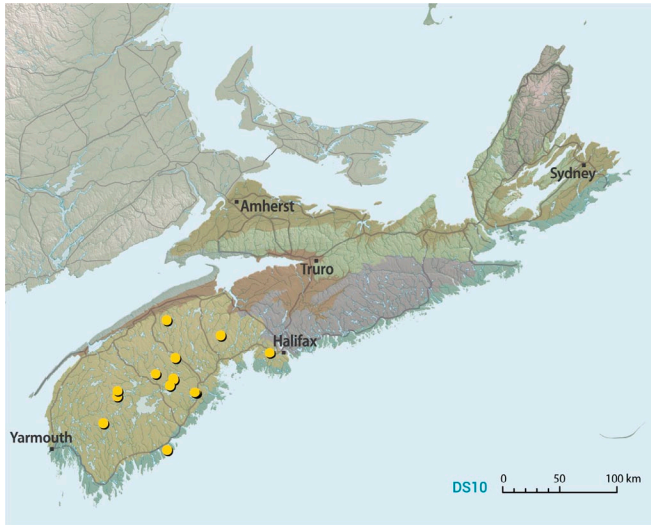


Figure 13. Survey sites for DS10. Broom Crowberry Rock Barren Dwarf Shrubland Association (n=16)

Shallow, nutrient poor soil limits the establishment of taller more extensive vegetation cover. Soils consist of a thin, poorly developed humus over bedrock. Sites are characterized by a very dry to dry moisture regime (very xeric – xeric).

Vegetation

Broom Crowberry (*Corema conradii*) is the dominant species, while Lowbush Blueberry (*Vaccinium angustifolium*) and Black Huckleberry (*Gaylussacia baccata*) are frequent co-occurring shrubs. Sheep Laurel (*Kalmia angustifolia*) and lesser amounts of Eastern Teaberry (*Gaultheria procumbens*) occasionally occur. Trees may be scattered sparsely.

Several species of Reindeer Lichen (*Cladonia spp.*) are both frequent and abundant at most sites. Among the most common Reindeer Lichens are: Thorn Cladonia (*Cladonia uncialis*), Fishnet Lichen (*Cladonia boryi*), Star-tipped Reindeer Lichen (*Cladonia stellaris*), Grey Reindeer Lichen (*Cladonia rangiferina*), and Reindeer Lichen (*Cladonia arbuscula ssp. squarrosa*). *Cladonia strepsilis* is more frequent in the association than any other inland dwarf shrubland represented in this guide. Lichen and bryophyte species characteristic of acidic rock substrate include: *Umbilicaria muhlenbergii*, *Polytrichum piliferum*, *Andreaea rupestris*, and *Bucklandiella venusta*, among other species.

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Acer rubrum</i>	25.0	0.06 (±0.05)
<i>Pinus resinosa</i>	25.0	1.5 (±0.8)
<i>Pinus strobus</i>	25.0	1.1 (±0.7)
Shrubs		
<i>Corema conradii</i>	100.0	36.6 (±4.2)
<i>Vaccinium angustifolium</i>	93.8	2.2 (±0.5)
<i>Gaylussacia baccata</i>	75.0	7.8 (±2.6)
<i>Gaultheria procumbens</i>	62.5	0.4 (±0.1)
<i>Kalmia angustifolia</i>	56.3	1.8 (±0.5)
<i>Sibbaldia tridentata</i>	31.3	0.7 (±0.6)
<i>Amelanchier sp.</i>	25.0	0.2 (±0.1)
<i>Aronia melanocarpa</i>	25.0	0.2 (±0.0)
Herbaceous Plants		
<i>Danthonia spicata</i>	37.5	0.2 (±0.1)
<i>Melampyrum lineare</i>	31.3	0.02 (±0.01)
<i>Solidago puberula</i>	25.0	0.08 (±0.05)
Lichens		
<i>Cladonia uncialis ssp. uncialis</i>	93.8	5.2 (±1.9)
<i>Cladonia boryi</i>	81.3	13.9 (±3.5)
<i>Cladonia rangiferina</i>	75.0	6.3 (±3.5)
<i>Cladonia stellaris</i>	75.0	6.9 (±3.0)
<i>Cladonia arbuscula ssp. squarrosa</i>	68.8	5.2 (±2.5)
<i>Cladonia strepsilis</i>	43.8	0.3 (±0.1)
<i>Cladonia squamosa</i>	37.5	1.5 (±0.7)
<i>Umbilicaria muhlenbergii</i>	37.5	0.8 (±0.3)
<i>Cladonia crispata</i>	31.3	0.4 (±0.2)
<i>Cladonia terrae-novae</i>	31.3	8.6 (±4.0)
<i>Pycnothelia papillaria</i>	31.3	0.3 (±0.2)
<i>Cladonia coccifera</i>	25.0	0.03 (±0.02)
Bryophytes		
<i>Leucobryum glaucum</i>	62.5	0.04 (±0.01)
<i>Polytrichum piliferum</i>	37.5	0.8 (±0.5)
<i>Andreaea rupestris</i>	31.3	0.13 (±0.05)
<i>Dicranum spurium</i>	31.3	0.06 (±0.02)
<i>Polytrichum juniperinum</i>	31.3	0.03 (±0.02)
<i>Bucklandiella venusta</i>	25.0	0.8 (±0.7)
<i>Dicranum montanum</i>	25.0	0.04 (±0.02)
<i>Dicranum polysetum</i>	25.0	0.01 (±0)

Distribution

The DS10 association occurs throughout the low elevation interior (> 500 m from the coast) of Nova Scotia (see Figure 13). It is not known from elsewhere in Canada.

Representative Sites – Shelburne County: Tobiatric Wilderness Area; **Yarmouth County:** Flintstone Rock; **Lunenburg County:** Labrador Castle, Shingle Lake; **Queens County:** Tupper Lake; **Halifax County:** Five Bridges Wilderness Area (Bluff Trails)

Province	Present	Notes
NB	–	absent
PEI	–	absent
NL	–	absent

DS11. Broom Crowberry Inland Barren

Corema conradii – *Arctostaphylos uva-ursi* / *Cladonia* spp.

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	18.1 (±1.7)
Indicator Species	<i>Corema conradii</i> <i>Arctostaphylos uva-ursi</i> <i>Cladonia</i> spp.
Sample size (n)	14
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		149 (±NA)	173	120
Slope Gradient (%)		8 (±NA)	32	0
Distance to coast (km)		30.3 (±NA)	NA	NA
Exposed Substrate				
Bedrock	42	4.3 (±NA)	20	0
Rock (cobble, boulder, etc.)	79	8.7 (±NA)	40	0
Woody material	0	0 (±0)	0	0
Mineral soil	86	12.5 (±NA)	40	5
Organic soil	0	0	0	0
Surface water	0	0	0	0

Concept

The *Corema conradii* – *Arctostaphylos uva-ursi* / *Cladonia* spp. Dwarf Shrubland Association occurs in the interior of Nova Scotia on shallow and excessively stony morainal (glacial) deposits. It is the only inland Broom Crowberry barren found on morainal deposits. The association is conceptually similar to unit DS9–Bearberry–Lowbush Blueberry Inland Barren, an earlier successional community, and to DS12–Broom Crowberry Sand Barren, which is strongly limited to deep and well-sorted glaciofluvial sand deposits, relatively free of stones and boulders.

	Frequency (%)
Exposure	moderate (100)
Slope Position	crest (29), lower slope (29), middle slope (21), level slope (7), missing data (14)
Microtopography	micro mounded (29), slightly mounded (21), smooth (50)
Moisture Regime	Very xeric (7), xeric (49), subxeric (14), missing data (30)
Aspect	N (6.7), NW (10), SW (16.7), NE (3.3), NW (10), SE (3.3), None or missing data (40)

Environment

Sites have moderate to negligible exposure and occur throughout the province's southwestern interior. They are common across large areas of glacial veneer typical of this region. The association occurs at a variety of topographic positions including upper slopes, hill crests, level flats, and lower slopes. Soils are dry, nutrient-poor, and often stony. Historic fire evidence was documented in some occurrences.

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	12.5 (±NA)	26	3

	Frequency (%)
Humus form	hemimor (14), resimor (7), None or missing data (79)

Vegetation

Broom Crowberry (*Corema conradii*) is the dominant species. Lowbush Blueberry (*Vaccinium angustifolium*) and Black Huckleberry (*Gaylussacia baccata*) are frequent co-occurring shrubs, while Sheep Laurel (*Kalmia angustifolia*) and lesser amounts of Eastern

Nessisse Lake, Yarmouth County PHOTO: L&F (Sean Basquill)



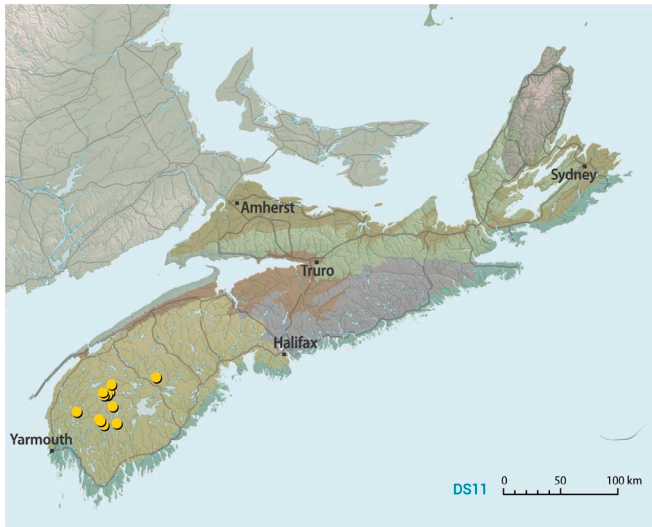


Figure 14. Survey sites for DS11. Broom Crowberry Inland Barren Dwarf Shrubland Association (n=14)

Teaberry (*Gaultheria procumbens*) occasionally occur. The herbaceous layer may be depauperate; few species occur with high constancy, other than Bracken Fern (*Pteridium aquilinum*), which is extensive in some stands.

The occasional presence of tall shrubs and trees within this association may suggest a successional transition to taller shrub or treed vegetation. Tall shrubs and trees are often observed on sites that were burned, especially in Southwestern Nova Scotia. Eastern White Pine (*Pinus strobus*) is the most frequent tree species present and large trees can comprise up to 30% cover. Red Oak (*Quercus rubra*), Black Spruce (*Picea mariana*), and or Red Maple (*Acer rubrum*) are also occasional constituents. At some sites, Bracken Fern (*Pteridium aquilinum*) and Black Huckleberry (*Gaylussacia baccata*) are abundant and can even be canopy forming.

Lichen cover can be extensive but is generally limited to common Reindeer Lichen species (*Cladonia*). Star-tipped Reindeer Lichen (*Cladonia stellaris*), Grey Reindeer Lichen (*Cladonia rangiferina*), and Reindeer Lichen (*Cladonia arbuscula ssp. squarrosa*) are typical.



Lechea intermedia
(Large-Pod Pinweed),
a temperate species
PHOTO: L&F (Sean Basquill)

Vegetation	Frequency (%)	Cover (%) (±SEM)
Shrubs		
<i>Corema conradii</i>	100.0	47.4 (±4.2)
<i>Kalmia angustifolia</i>	85.7	4.4 (±1.4)
<i>Arctostaphylos uva-ursi</i>	71.4	15.5 (±3.9)
<i>Vaccinium angustifolium</i>	71.4	3.7 (±2.9)
<i>Gaultheria procumbens</i>	71.4	1.5 (±0.5)
<i>Pinus strobus</i>	64.3	2.2 (±1.5)
<i>Gaylussacia baccata</i>	42.9	4.2 (±1.5)
<i>Aronia melanocarpa</i>	42.9	0.2 (±0.1)
<i>Ilex glabra</i>	28.6	1.0 (±0.4)
<i>Juniperus communis</i>	28.6	0.4 (±0.2)
<i>Morella pensylvanica</i>	28.6	1.8 (±0.6)
<i>Aronia arbutifolia</i>	28.6	1.5 (±0.3)
<i>Picea mariana</i>	28.6	0.8 (±0.5)
<i>Rhododendron canadense</i>	28.6	2.5 (±1.3)
<i>Viburnum nudum</i>	28.6	0.8 (±0.5)
<i>Alnus alnobetula</i>	21.4	0.3 (±0.3)
<i>Quercus rubra</i>	21.4	1.0 (±0.55)
Herbaceous Plants		
<i>Pteridium aquilinum</i>	71.4	8.5 (±4.9)
<i>Solidago puberula</i>	57.1	0.2 (±0.1)
<i>Oryzopsis asperifolia</i>	28.6	0.13 (±0.06)
<i>Danthonia spicata</i>	21.4	1.02 (±0.99)
<i>Melampyrum lineare</i>	21.4	0.01 (±0.01)
<i>Lysimachia borealis</i>	21.4	0.3 (±0.1)
Lichens		
<i>Cladonia rangiferina</i>	92.9	4.2 (±1.0)
<i>Cladonia stellaris</i>	64.3	7.4 (±1.6)
<i>Cladonia uncialis ssp. uncialis</i>	64.3	0.5 (±0.4)
<i>Cladonia arbuscula ssp. squarrosa</i>	57.1	20.7 (±8.2)
<i>Cladonia boryi</i>	50.0	1.9 (±1.4)
<i>Cladonia crispata</i>	21.4	0.2 (±0.1)
Bryophytes		
<i>Pleurozium schreberi</i>	21.4	1.0 (±0.6)

Distribution

The DS11 association occurs throughout the interior at low elevation (> 500 m from the coast) of Nova Scotia (see Figure 14). It is not known from elsewhere in Canada.

Representative Sites

Shelburne County: Tobeatic Wilderness Area

Province	Present	Notes
NB	—	absent
PEI	—	absent
NL	—	absent

DS12. Broom Crowberry Sand Barren

Corema conradii (*Hudsonia ericoides*) / *Cladonia arbuscula* ssp. *squarrosa*

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	10.8 (±0.88)
Indicator Species	<i>Corema conradii</i>
Sample size (n)	24
Conservation Status Rank	TBD

Concept

This association is dominated by Broom Crowberry (*Corema conradii*), overlying sandy outwash plains and other glaciofluvial deposits in the western interior of Nova Scotia. Reindeer lichens are typically abundant, especially *Cladonia arbuscula* ssp. *squarrosa*. Grey Reindeer Lichen (*Cladonia rangiferina*) and Lowbush Blueberry (*Vaccinium angustifolium*) are frequently present with lower relative cover. This is the only Broom Crowberry association in Nova Scotia occurring on deep, well sorted, and relatively stone free, loamy sand deposits of glaciofluvial origin; Broom Crowberry can also form extensive stands on coastal sand dunes formed through aeolian (wind-blown) deposition, on rock outcrops, and on coarse loamy glacial till.

Environment

Broom Crowberry (*Corema conradii*) sand barrens occur on well sorted glaciofluvial sand deposits and are most common on outwash plains. They occur less frequently on low kames, eskers, and low inactive dunes. These shrublands are found in the interior of the province usually, within 15 km from the coast, on relatively low elevation sites with negligible exposure. Sites are

Site Characteristics		Frequency (%)	Mean (±SEM)	max	min
Elevation (m)			34.8 (±7.5)	142	19
Slope Gradient (%)			0.7 (±0.7)	10.5	0
Distance to coast (km)			14.2 (±2.2)	44.6	9.3
Exposed Substrate					
Bedrock	0		0	0	0
Rock (cobble, boulder, etc.)	6.3		1.3 (±1.3)	20	0
Woody material	12.5		0.3 (±0.2)	3	0
Mineral soil	50		4.2 (±1.6)	15	0
Organic soil	31.3		0.4 (±0.2)	3	0
Surface water	0		0	0	0
Frequency (%)					
Exposure	moderate (100)				
Slope Position	level (62.5), crest (18.8), middle slope (6.3), toe (6.3), missing data (6.3)				
Microtopography	micro mounded (50), slightly mounded (18.8), middle slope (18.8), missing data (12.5)				
Moisture Regime	xeric (50), sub xeric (37.5), sub mesic (6.3), sub hygric (6.3)				
Aspect	no aspect (81.3), southeast (6.3), missing data (12.5)				
Soil Features		Frequency (%)	Mean (±SEM)	max	min
Root Restriction Depth (cm)			41.7 (±2.9)	64	22
Frequency (%)					
Humus form	Hemimor (37.5), Resimor (31.3), Hydromull (6.3), Missing data (25)				

typically on level ground or gently grading inclines; microtopography is flat to slightly mounded. Soils consist of nutrient poor, acidic, and poorly developed humus over deep rapidly drained loamy sand mineral horizons. Exposed patches of mineral soil are common on the surface.

Vegetation

Sand barren shrublands are dominated by Broom Crowberry (*Corema conradii*) and often Reindeer Lichen (*Cladonia arbuscula* ssp. *squarrosa*). Lowbush Blueberry (*Vaccinium angustifolium*) occurs in trace amounts within most occurrences. Grey Reindeer Lichen (*Cladonia rangiferina*), Star-tipped Reindeer Lichen (*Cladonia stellaris*), and Thorn Cladonia (*Cladonia uncialis*) are also common ground lichens. Sweetfern (*Comptonia peregrina*) is moderately frequent and notable because it is absent from similar Broom Crowberry dominated shrublands on the coast. The herbaceous layer of this association is considerably less developed than the lichen and shrub layers. Herbaceous species composition typically consists of species that are absent or relatively uncommon

Auburn, Kings County PHOTO: L&F (Sean Basquill)



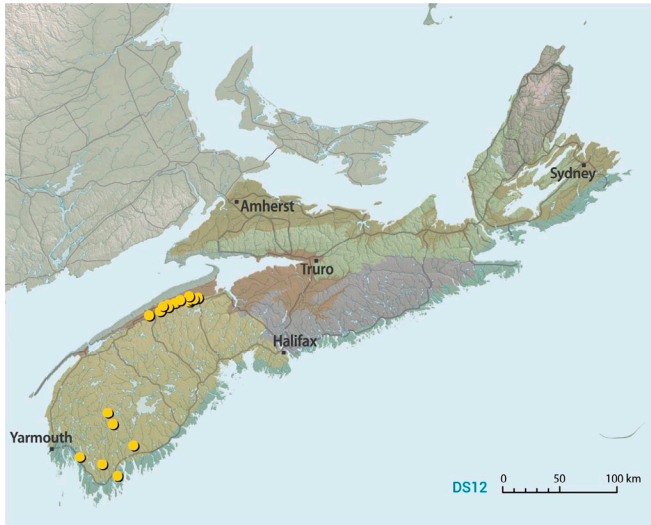


Figure 15. Survey sites for DS12. Broom Crowberry Sand Barren Dwarf Shrubland Association (n=24). Small pockets of sand barren in Colchester County also support this community.

on coastal barrens, such as Large Pod Pinweed (*Lechea intermedia*) and Gray-stemmed Goldenrod (*Solidago nemoralis*). This unit supports the majority of locations for the provincially endangered Rockrose, also called Canada Frostweed, (*Crocianthemum canadense*) and Pine Barren Golden Heather (*Hudsonia ericoides*) in Nova Scotia.

Trees are frequent and conspicuous, in contrast with most other dwarf shrublands found in Nova Scotia. Grey Birch (*Betula populifolia*), Red Pine (*Pinus resinosa*) and or Eastern White Pine (*Pinus strobus*) are often present, although widely dispersed. Black Spruce (*Picea mariana*), Jack Pine (*Pinus banksiana*), Red Oak (*Quercus rubra*), and Large Tooth Aspen (*Populus grandidentata*) sometimes occur. The invasive Scotch Pine (*Pinus sylvestris*) is also relatively common at some sites. Scotch Pine displaces native vegetation and quickly colonizes sand barrens, converting endemic shrubland to exotic forest (Catling and Carbyn 2004, Catling et al. 2004, Carbyn et al. 2006); similar trends are emerging with Black Locust (*Robinia pseudoacacia*). Other exotic plants such as Scotch Broom (*Cytisus scoparius*) have recently become more common, especially in southwestern Nova Scotia, while other non-native plant species such as Mouse-ear Hawkweed (*Pilosella officinarum*), Hair Fescue (*Festuca filiformis*), Canada Bluegrass (*Poa compressa*), and Sheep's Sorrel (*Rumex acetosella*), among others, have been previously documented in the sand barrens (e.g. Roland 1946, Catling et al. 2004).



Crocianthemum canadense
(Rockrose) PHOTO: L&F (Sean Basquill)

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Betula populifolia</i>	45.8	4.0 (±1.5)
<i>Pinus strobus</i>	37.5	2.4 (±1.8)
<i>Pinus resinosa</i>	29.2	3.1 (±1.8)
<i>Quercus rubra</i>	29.2	1.0 (±1.0)
<i>Picea mariana</i>	25.0	3.4 (±2.4)
Shrubs		
<i>Corema conradii</i>	100.0	43.6 (±7.3)
<i>Vaccinium angustifolium</i>	75.0	1.3 (±0.3)
<i>Comptonia peregrina</i>	50.0	5.3 (±4.8)
<i>Arctostaphylos uva-ursi</i>	41.7	37.0 (±10.1)
<i>Hudsonia ericoides</i>	41.7	9.6 (±6.9)
<i>Gaultheria procumbens</i>	41.7	1.2 (±0.8)
<i>Kalmia angustifolia</i>	37.5	4.8 (±3.2)
Herbaceous Plants		
<i>Solidago nemoralis</i>	37.5	0.7 (±0.3)
<i>Danthonia spicata</i>	29.2	0.05 (±0.03)
<i>Festuca filiformis</i>	25.0	2.0 (±0.6)
<i>Pteridium aquilinum</i>	25.0	1.9 (±1.6)
<i>Dichanthelium depauperatum</i>	25.0	0.2 (±0.3)
<i>Lechea intermedia</i>	20.8	0.2 (±0.2)
<i>Pilosella officinarum</i>	20.8	0.3 (±0.2)
Lichens		
<i>Cladonia rangiferina</i>	70.8	2.6 (±0.9)
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	66.7	13.4 (±4.6)
<i>Cladonia stellaris</i>	41.7	14.6 (±9.8)
<i>Cladonia uncialis</i> ssp. <i>uncialis</i>	41.7	2.3 (±1.8)
<i>Cladonia cristatella</i>	25.0	0.3 (±0.2)
<i>Cladonia boryi</i>	20.8	1.2 (±1.6)
Bryophytes		
<i>Pleurozium schreberi</i>	29.2	1.4 (±0.5)
<i>Dicranum polysetum</i>	25.0	0.4 (±0.2)
<i>Polytrichum piliferum</i>	20.8	7.3 (±8.1)

Distribution

The DS12 association can be found in the interior of Southwestern Nova Scotia, the Annapolis Valley, and central and western portions of Colchester County (see Figure 15). Within these regions it is restricted to a small number of sites on glaciofluvial sand deposits. It is not known from anywhere else in Canada.

Representative sites

Colchester County: Debert; **Shelburne County:** Tobeatic Wilderness Area, Bowers Meadows Wilderness Area; **Kings County:** Kingston Sand Barrens, Kentville Migratory Bird Sanctuary, Town of Kentville

Province	Present	Notes
NB	—	absent
PEI	—	absent or extirpated
NL	—	absent

DS13. Black Crowberry Coastal Dune

Ammophila breviligulata / *Empetrum nigrum*

Dwarf Shrubland Association

Species Richness (spp/25 m ²)	16.3 (±1.3)
Indicator Species	<i>Ammophila breviligulata</i> <i>Carex silicea</i>
Sample size (n)	24
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		5 (±NA)	22	1
Slope Gradient (%)		14 (±NA)	40	0
Distance to coast (m)		57.3 (±18.8)	106.4	0.4
Substrate Exposure				
Bedrock	0	0	0	0
Rock (cobble, boulder, etc.)	0	0	0	0
Woody material	0	0	0	0
Mineral soil	80	11.8 (±NA)	40	0
Organic soil	0	0	0	0
Surface water	0	0	0	0

Concept

This association is dominated by Black Crowberry (*Empetrum nigrum*) usually with lesser amounts of low growing Northern Bayberry (*Morella pensylvanica*). Marram Grass, also called American Beach Grass (*Ammophila breviligulata*) is a consistent associate but usually occurs with low cover. Reindeer Lichens (*Cladonia spp.*) are abundant in some occurrences. The association occurs in shallow, well drained depressions and level interdunal sites on stable coastal sand dunes. It is quite uncommon in mainland Nova Scotia and strongly expressed on Sable Island. DS14 is a similar association distinguished by Broom Crowberry (*Corema conradii*) dominance.

	Frequency (%)
Exposure	exposed (92), moderately exposed (8)
Slope Position	level (38), mid slope (21), upper slope (17), depression (8), crest (8), lower slope (8)
Microtopography	micro mounded (40), moderately mounded (20), missing data (20)
Moisture Regime	subxeric (60), submesic (30), mesic (10)
Aspect	none (43), west (4), east (8), north (26), south (17)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	>100 unknown	NA	

Environment

Only a small number of coastal sand dune complexes on mainland Nova Scotia support these dwarf shrubland plant communities. With the exception of Sable Island

National Park Reserve, large sand dune complexes are relatively uncommon in the province. Soils at these sites consist of deep, windblown sand deposits, typically with a thin layer of humus and or organic staining in upper

Sable Island National Park Reserve PHOTO: L&F (Sean Basquill)



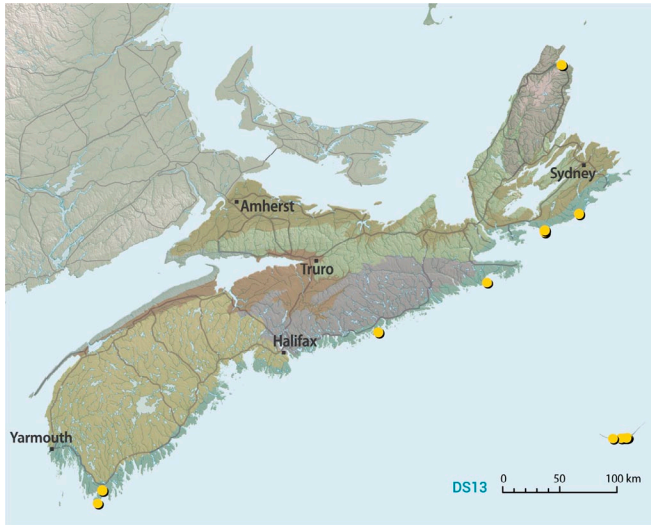


Figure 16. Survey sites for **DS13. Black Crowberry Coastal Dune Dwarf Shrubland Association** (n=24)

mineral soil horizons. In large, generally dynamic, sand dune complexes, these shrublands are found on sheltered back dunes and interdunal flats where the environment is more stable. Sites are not regularly inundated by tides, but they can be exposed to salt spray, particularly during storms. All coastal dunes may be subject to storm surge wash-over events.

Vegetation

This association is characterized by the abundance of Black Crowberry (*Empetrum nigrum*) and scattered coastal sand dune and beach plant species. Northern Bayberry (*Morella pensylvanica*) and Common Juniper (*Juniperus communis*) may be present but are far less abundant. Marram Grass, also called American Beach Grass (*Ammophila breviligulata*) is always present on these dunes but its abundance varies because it is outcompeted by shrub and lichen species on more stable sites. Foxberry (*Vaccinium vitis-idaea*) and Large Cranberry (*Vaccinium macrocarpon*) are occasionally present but the latter species is more typical of moist to wet dune hollows. Mosses and forbs are rarely present or abundant. On Sable Island, scattered Virginia Rose (*Rosa virginiana*), Magdalen Islands Juniper (*Juniperus communis* var. *megistocarpa*), and abundant, but strongly stunted, Northern Bayberry (*Morella pensylvanica*) are typical; exotic species such as Pasture Dewberry, (*Rubus x biformispinus*), Mouse-ear Chickweed (*Cerastium fontanum* ssp. *vulgare*), and European Centaury (*Centaureum erythraea*) are minor constituents at some sites on the island.

Vegetation

	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Picea glauca</i>	45.8	4.1 (±2.9)
Shrubs		
<i>Empetrum nigrum</i>	100.0	53.0 (±5.6)
<i>Morella pensylvanica</i>	75.0	11.0 (±2.4)
<i>Vaccinium angustifolium</i>	58.3	3.5 (±0.8)
<i>Juniperus communis</i>	29.2	12.0 (±3.4)
<i>Vaccinium macrocarpon</i>	29.2	8.4 (±1.6)
<i>Vaccinium vitis-idaea</i>	29.2	9.0 (±1.1)
<i>Rosa virginiana</i>	29.2	2.0 (±3.2)
<i>Juniperus horizontalis</i>	20.8	11.0 (±7.3)
Herbaceous Plants		
<i>Ammophila breviligulata</i>	70.8	0.1 (±2.2)
<i>Fragaria virginiana</i>	45.8	11.5 (±1.3)
<i>Carex silicea</i>	37.5	0.2 (±0.1)
<i>Festuca rubra</i>	29.2	0.2 (±0.1)
<i>Symphotrichum novi-belgii</i>	25.0	0.2 (±0.2)
<i>Agrostis scabra</i>	20.8	0.6 (±0.4)
<i>Pilosella officinarum</i>	20.8	trace
<i>Solidago puberula</i>	20.8	trace
<i>Spiranthes lacera</i>	20.8	0.2 (±0)
Lichens		
<i>Cladonia rangiferina</i>	58.3	7.2 (±2.2)
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	50.0	8.9 (±2.5)
Bryophytes		
<i>Dicranum polysetum</i>	20.8	trace

Distribution

Known from few locations in Nova Scotia, the DS13 association is limited to coastal areas with large and well-established coastal dune complexes (see Figure 16).

Representative Sites

Halifax County: Taylor Head Provincial Park; Sable Island National Park Reserve;
Cape Breton County: Point Michaud Provincial Park; **Shelburne County:** Sand Hills Provincial Park; **Queens County:** Carters Beach

Related Associations

It also occurs on large dune complexes in Prince Edward Island and the Magdalen Islands of Quebec. The association does not occur on insular Newfoundland (*Meades pers. comm.* 2020).

Province	Present	Notes
NB	X	uncommon
PEI	X	uncommon
NL	–	absent
QC	X	limited to Magdalen Islands

DS14. Broom Crowberry Coastal Dune

Corema conradii – *Morella pensylvanica* – *Arctostaphylos uva-ursi* / *Comandra umbellata* Dwarf Shrubland Association

Note on DS14

Sand dunes dominated by Broom Crowberry (*Corema conradii*) are very rare in Nova Scotia, and have only been documented at Pomquet Beach Provincial Park. While we collected plot data to classify and describe this unique community, we felt the unit's limited range in the province, and the close proximity of survey locations, only warranted a brief summary description of DS14 for this guide. All survey locations are from Pomquet Beach Provincial Park where the association occurs on rapidly drained wind-blown deposits on level ground.

Readers seeking additional information are referred to a report on similar vegetation on Prince Edward Island (Basquill 2010), where conditions are better developed and generally less disturbed by human activity.

Hog Island, Prince Edward Island

PHOTO: L&F (Sean Basquill)



Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		5 (±NA)	9	0
Slope Gradient (%)		0 (±NA)	0	0
Distance to coast (m)		247 (±18.8)	292	71
Substrate Exposure				
Bedrock	0	0	0	0
Rock (cobble, boulder, etc.)	0	0	0	0
Woody material	0	0	0	0
Mineral soil	20	13 (±NA)	15	0
Organic soil	0	0	0	0
Surface water	0	0	0	0

	Frequency (%)
Exposure	exposed (100)
Slope Position	level (67), crest (33)
Microtopography	micro mounded (40), nil (60)
Moisture Regime	xeric (60), subxeric (40)
Aspect	none (100)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	100 (±NA)		

	Frequency (%)
Humus form	Hemimor (40), Missing Data (60)



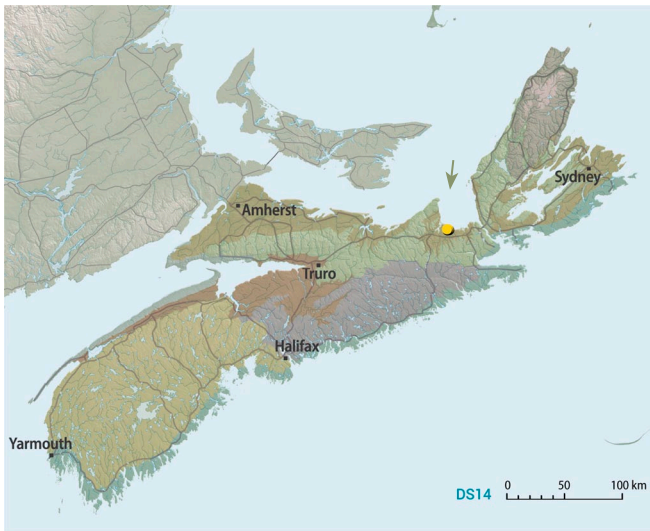


Figure 17. Survey sites for **DS14. Broom Crowberry Coastal Dune Dwarf Shrubland Association** (n=5)

Distribution

Only known in Nova Scotia from Pomquet Beach Provincial Park. Common on Barrier Island on the north shore of PEI and on the Magdalen Islands in Quebec.

Province	Present	Notes
NB	–	absent
PEI	X	rare
NL	–	absent
QC	X	limited to Magdalen Islands



Vegetation

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Picea glauca</i>	80.0	1.8
<i>Abies balsamea</i>	40.0	1.5
<i>Picea mariana</i>	40.0	1.0
<i>Pinus strobus</i>	40.0	0.8
<i>Betula populifolia</i>	40.0	2.0
<i>Acer rubrum</i>	20.0	0.0
<i>Quercus rubra</i>	20.0	2.0
Shrubs		
<i>Corema conradii</i>	100.0	37.4
<i>Arctostaphylos uva-ursi</i>	100.0	14.6
<i>Morella pensylvanica</i>	100.0	3.2
<i>Juniperus communis</i>	80.0	2.8
<i>Vaccinium angustifolium</i>	80.0	7.5
<i>Amelanchier interior</i>	60.0	0.4
<i>Rosa virginiana</i>	40.0	0.1
<i>Viburnum nudum</i>	40.0	trace
<i>Vaccinium vitis-idaea</i>	20.0	37.0
<i>Amelanchier sp.</i>	20.0	trace
<i>Gaylussacia baccata</i>	20.0	2.0
Herbaceous Plants		
<i>Agrostis scabra</i>	80.0	0.6
<i>Danthonia spicata</i>	80.0	0.1
<i>Comandra umbellata</i>	80.0	2.2
<i>Solidago bicolor</i>	80.0	0.5
<i>Melampyrum lineare</i>	60.0	0.5
<i>Luzula multiflora</i>	40.0	0.0
<i>Pilosella officinarum</i>	40.0	1.5
<i>Spiranthes lacera</i>	40.0	0.0
<i>Lysimachia borealis</i>	40.0	0.0
<i>Agrostis stolonifera</i>	20.0	0.0
<i>Ammophila breviligulata</i>	20.0	0.0
<i>Deschampsia flexuosa</i>	20.0	1.0
<i>Festuca rubra</i>	20.0	0.1
<i>Cornus canadensis</i>	20.0	0.1
<i>Doellingeria umbellata</i> var. <i>umbellata</i>	20.0	0.0
<i>Pilosella piloselloides</i>	20.0	0.2
<i>Lechea intermedia</i>	20.0	0.0
<i>Maianthemum canadense</i>	20.0	0.1
<i>Nabalus trifoliolatus</i>	20.0	0.1
<i>Rumex acetosa</i>	20.0	1.0
<i>Solidago puberula</i>	20.0	0.0
Lichens		
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	80.0	2.6
<i>Cladonia rangiferina</i>	80.0	1.4
<i>Cladonia stellaris</i>	60.0	0.1
<i>Cladonia albonigra</i>	20.0	0.0
<i>Cladonia boryi</i>	20.0	0.0
<i>Cladonia rei</i>	20.0	0.0
Bryophytes		
<i>Dicranum polysetum</i>	40.0	0.1
<i>Polytrichum juniperinum</i>	40.0	1.5
<i>Ceratodon purpureus</i>	20.0	0.1
<i>Dicranum condensatum</i>	20.0	0.0

Corema conradii
(Broom Crowberry)

PHOTO: L&F (Sean Basquill)

S

S1. Black Huckleberry Heath

Gaylussacia baccata – *Kalmia angustifolia* / *Pteridium aquilinum*

Shrubland Association

Species Richness (spp/25 m ²)	21.1 (±1.2)
Vegetation Height (cm)	63.2 (±5.8)
Indicator Species	<i>Gaylussacia baccata</i>
Sample size (n)	52
Conservation Status Rank	TBD

Concept

The association is dominated by Black Huckleberry (*Gaylussacia baccata*). It typically occurs on sites with shallow and stony soils, frequently with a cemented or partially cemented horizon. It is among the most widespread shrubland associations of Nova Scotia's barrens. It is the only association in this guide strongly dominated by Black Huckleberry.



Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		91.2 (±15.7)	426	4
Slope Gradient (%)		12.6 (±2.7)	93.3	0
Distance to coast		9.6 km (±2 km)	44.6 km	38 m
Exposed Substrate				
Bedrock	3.8	0.3 (±0.2)	10	0
Rock (cobble, boulder, etc.)	30.8	7 (±3.4)	158	0
Woody material	5.8	0.8 (±0.5)	20	0
Mineral soil	1.9	0	0.1	0
Organic soil	5.8	0.1 (±0.1)	5	0
Surface water	0	0	0	0

	Frequency (%)
Exposure	exposed (46.2), moderate (32.7), moderately exposed (21.2)
Slope Position	midslope (25.5), level (17.6), upper slope (17.6), depression (13.7), lower slope (9.8), crest (5.9), toe of slope (5.9), missing data (2), GU (2)
Microtopography	micro mounded (42.3), slightly mounded (28.8), moderately mounded (11.5), extremely mounded (7.7), missing data (9.6)
Moisture Regime	subxeric (30.8), subhydryc (19.2), subhygric (15.4), xeric (11.5), submesic (7.7), hygric (7.7), hydric (3.8), mesic (1.9), missing data (1.9)
Aspect	none (17.3), NW (17.3), S (9.6), SW (7.7), W (7.7), SE (5.8), E (3.8), N (3.8), NE (1.9), missing data (25)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	28.8 (±3)	>100	2

	Frequency (%)
Humus form	Hemimor (40.3), Humimor (6.5), Lignomor (1.6), Mesimor (1.6), Saprimoder (1.6), Missing Data (32.3)

Environment

Black Huckleberry heath is widespread on Nova Scotia's barrens. The association occurs on sites that range from extremely windy summits to those that are negligibly or only moderately exposed. The moisture regime varies across all classes though moister conditions are somewhat more common at coastal sites. On coastal barrens, this association occurs outside of the influence of salt spray; typically, it is greater than 400 m from the ocean and only rarely as near as 50 m.

Near Branch Pond, Cape Breton Highlands National Park

PHOTO: Saint Mary's University (Caitlin Porter)

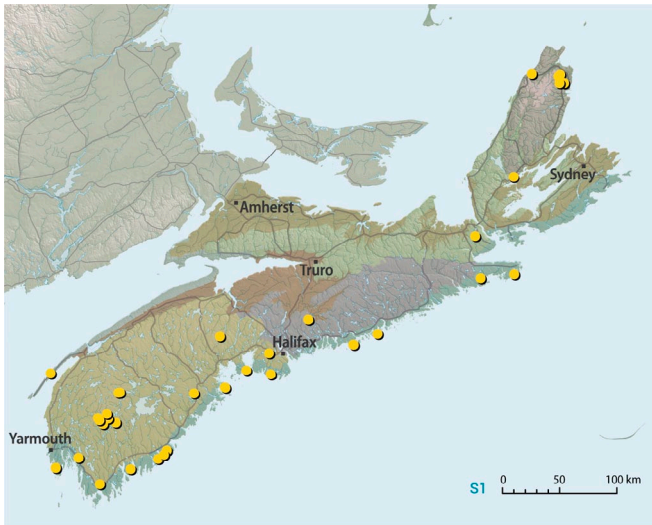


Figure 18. Location of survey sites for S1. Black Huckleberry Heath Shrubland Association (n=52)

Soils of this association typically consist of nutrient poor and acidic humus over coarse-grained mineral soils. Soils are typically shallow but depth ranges from as shallow as 4 cm to soils over 1 m in thickness that support trees. Rooting potential is typically limited by either excessively stony or cemented mineral soil horizons, or by shallow bedrock. Cemented horizons are most common at sites in the interior of southwestern Nova Scotia.

Fire appears to be an important factor in the origin and possibly maintenance of this association; charcoal was frequently present in soil surveys conducted for this study. Coarse woody material or wood fragments in soils also provide evidence of historic tree cover. This association may be one of the most dynamic barren communities found in Nova Scotia. Forest expansion has been documented at several sites in Halifax County and throughout Southwestern Nova Scotia (Burley et al. 2010).

Vegetation

Black Huckleberry (*Gaylussacia baccata*) forms extensive shrublands, strongly dominating this association with an average of 50 % cover. Lambkill (*Kalmia angustifolia*) is the second most frequent species, but its abundance varies broadly between sites from those where it co-dominates the association to others where it is absent or only present in trace amounts.

The abundance of constituent species can vary between inland, coastal and highland sites. Lowbush Blueberry (*Vaccinium angustifolium*) is frequently present within this association, especially at coastal and highland sites. Eastern Teaberry (*Gaultheria procumbens*) occurs

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Acer rubrum</i>	30.8	0.2 (±0.1)
<i>Picea mariana</i>	25	1.7 (±0.6)
Shrubs		
<i>Gaylussacia baccata</i>	100	50.2 (±2.7)
<i>Kalmia angustifolia</i>	84.6	12 (±2.3)
<i>Vaccinium angustifolium</i>	73.1	3 (±0.8)
<i>Rhododendron canadense</i>	63.5	3.1 (±1)
<i>Gaultheria procumbens</i>	61.5	3.1 (±1.1)
<i>Viburnum nudum</i>	61.5	2.4 (±0.8)
<i>Ilex mucronata</i>	51.9	3.7 (±1)
<i>Cornus canadensis</i>	51.9	1.1 (±0.4)
<i>Juniperus communis</i>	48.1	10.9 (±3)
<i>Morella pensylvanica</i>	38.5	2.5 (±0.8)
<i>Aronia melanocarpa</i>	34.6	1 (±0.5)
<i>Amelanchier</i> sp.	30.8	0.6 (±0.2)
<i>Aralia nudicaulis</i>	26.9	0.4 (±0.2)
<i>Empetrum nigrum</i>	25	0.7 (±0.3)
<i>Rhododendron groenlandicum</i>	21.2	0.5 (±0.2)
<i>Alnus incana</i>	19.2	0.7 (±0.3)
Herbaceous Plants		
<i>Pteridium aquilinum</i>	73.1	6.2 (±1.4)
<i>Lysimachia borealis</i>	42.3	0.1
<i>Maianthemum canadense</i>	36.5	0.1
<i>Osmundastrum cinnamomeum</i>	21.2	0.4 (±0.2)
Lichens		
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	38.5	4.8 (±1.6)
<i>Cladonia stellaris</i>	28.8	6.4 (±2.2)
<i>Cladonia rangiferina</i>	28.8	1.1 (±0.4)
Bryophytes		
<i>Pleurozium schreberi</i>	42.3	1 (±0.4)

frequently and is present at most inland sites. Inkberry (*Ilex glabra*) is frequent on inland sites in southwestern Nova Scotia but it is seldom encountered on the coast and absent from the Cape Breton Highlands. False Holly (*Ilex mucronata*) is common in the Cape Breton Highlands.

Common Juniper (*Juniperus communis*) is a frequent occurrence on the coast in rocky microsites or as an understory species where it can be as abundant as 90% cover. Coastal sites also sometimes support an abundance of Northern Bayberry (*Morella pensylvanica*).

Several herbaceous species consistently appear within this association. Bunchberry (*Cornus canadensis*) and Wild Lily-of-the-Valley (*Maianthemum canadense*) are frequently occurring, especially on the coast. Starflower (*Lysimachia borealis*) is frequent on low elevation coastal and inland barrens but infrequently occurs in the highlands. Bracken Fern (*Pteridium aquilinum*) is frequently present in sheltered microsites.

Agalinis neoscotica
(Nova Scotia False
Foxglove), a highly
range limited
northeastern
temperate species

PHOTO: L&F (Sean Basquill)



Schreber's Moss (*Pleurozium schreberi*) is the most common bryophyte encountered within this association, frequently present in trace amounts. *Leucobryum glaucum* and *Dicranum polysetum* also occur occasionally on low elevation sites.

Lichen abundance and species composition varies depending on regional environmental context. Highland sites typically support an abundance of Black-footed Reindeer Lichen (*Cladonia stygia*) and Star-tipped Reindeer Lichen (*Cladonia stellaris*). These two northern species co-occur in the highlands as a blanket forming ground cover. Lesser amounts of other Reindeer Lichens (*Cladonia spp.*) are also common. On low elevation sites, the lichen layer is much reduced and instead Grey Reindeer Lichen (*Cladonia rangiferina*) and Reindeer Lichen (*Cladonia arbuscula ssp. squarrosa*) are the most common species. The nationally and provincially rare Dixie Reindeer Lichen (*Cladonia subtenuis*) has been documented within this unit in the interior of Southwestern Nova Scotia.

Small trees sometimes become established in this association, particularly Balsam Fir (*Abies balsamea*), Black Spruce (*Picea mariana*), White Spruce (*Picea glauca*) and Tamarack (*Larix laricina*). On low elevation sites, Red Maple (*Acer rubrum*) is the most frequent tree species, especially in areas of the interior of southwest Nova Scotia that appear to be reforesting. Eastern White Pine (*Pinus strobus*) is also relatively common in barrens of Nova Scotia's southwestern interior. A potential successional trajectory is suggested by the sparsely scattered trees and transition to open woodland present at the periphery of these interior barrens.

Vegetation height and species richness vary considerably between coastal, interior and highland sites, although these differences were not significant enough to substantiate recognition of different Black Huckleberry (*Gaylussaccia baccata*) associations in the province.

Distribution

The association is found throughout Nova Scotia and is most common at lower inland elevations (see Figure 18).

Black Huckleberry heaths are relatively common and widespread. However, there are some notable geographic patterns within its provincial range in Nova Scotia.

It is most common in the interior of southwestern Nova Scotia. On the coast, it is most common on large sites that extend farther than 500 m inland, and that were also historically burned. It occurs in the Cape Breton Highlands but is largely absent from northwestern Cape Breton.

Representative Sites

Queens County: Kejimikujik National Park, Thomas Raddall Provincial Park, Tobeatic Wilderness Area; **Lunenburg County:** Hebb Lake; **Halifax County:** Terence Bay Wilderness Area

Related Associations

Nothing comparable occurs on insular Newfoundland, where Black Huckleberry (*Gaylussaccia baccata*) is only known from peatlands in southern parts of the island (Meades pers. comm. 2020).

Province	Present	Notes
NB	X	common
PEI	X	fairly common
NL	–	absent

Vegetation height overall ranges from 9 cm to 1.5 m with a mean of 61 cm. Within this range, heights tend to be shorter on the coast: 52 cm vs. 71 cm on low elevation sites in the interior of Nova Scotia, and 61 cm in the Cape Breton Highlands. Geographical context also affects species richness of the association. In the Cape Breton Highlands, our 25 m² area sample plots contained seven more plant and lichen species on average (i.e. mean of 28 spp./plot in the highlands vs. 21 spp./plot across all).

S2. Dwarf Huckleberry Heath

Gaylussacia bigeloviana – *Juniperus communis* – *Rhododendron groenlandicum*

Shrubland Association

Species Richness (spp/25 m ²)	29.2 (±3.4)
Indicator Species	<i>Gaylussacia bigeloviana</i> <i>Cladonia terrae-novae</i>
Sample size (n)	9
Conservation Status Rank	TBD

Concept

This association typically occurs within 10 km of the coast. Sites are frequently wet but can be mesic. Dwarf Huckleberry (*Gaylussacia bigeloviana*) is the dominant species. The shrubs Common Juniper (*Juniperus communis*) and Rhodora (*Rhododendron canadense*) are frequently present with lesser abundance. Newfoundland Reindeer Lichen (*Cladonia terrae-novae*) can occupy substantial cover when present.

Environment

Dwarf Huckleberry heath occurs across mainland Nova Scotia on both coastal and inland sites, typically within 10 km of the ocean. Coastal sites are usually situated outside of the influence of salt spray; more than 100 m from the coastline.

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		25.3 (±8.9)	80	1
Slope Gradient (%)		0	0.8	0
Distance to coast (m)		1.7 km (±972 m)	7.1 km	66.5 m
Exposed Substrate				
Bedrock	0	0	0	0
Rock (cobble, boulder, etc.)	22.2	1.8 (±1.3)	10	0
Woody material	11.1	0.1 (±0.1)	0.8	0
Mineral soil	0	0	0	0
Organic soil	1	0	0	0
Surface water	22.2	1.8 (±1.3)	10	0
	<i>Frequency (%)</i>			
Exposure	exposed (44.4), moderately exposed (33.3), moderate (22.2)			
Slope Position	level (33), depression (22), lower slope (11), middle slope (11), upper slope (11), missing data (11)			
Microtopography	micro mounded (33.3), moderately mounded (22.2), severely mounded (22.2), extremely mounded (22.2)			
Moisture Regime	hydic (88.9), subhydic (77.8), submesic (22.2), hygric (22.2), mesic (11.1), subhygric (11.1)			
Aspect	none (67), NW (11), N (11), SE (11)			
Soil Features		Mean (±SEM)	max	min
Restriction Depth (cm)		44.4 (±4)	60	33
	<i>Frequency (%)</i>			
Humus form	hemimor (33.3), humimor (11.1), saprimoder (11.1), missing data (44.4)			

Bonnet Lake Wilderness Area, Guysborough County PHOTO: Saint Mary's University (Caitlin Porter)



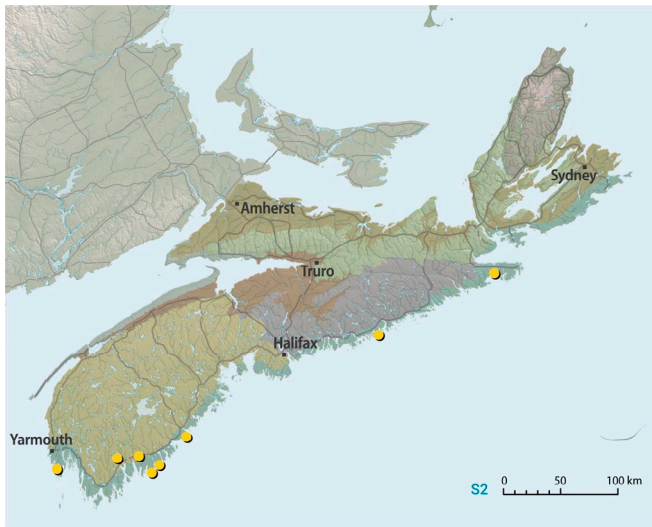


Figure 19. Survey sites for **S2. Dwarf Huckleberry Heath** Shrubland Association (n=9)

Dwarf Huckleberry heath is most frequently found in depressions or on level and shallow grading topography associated with moist to wet conditions. Although Dwarf Huckleberry is generally considered to be an obligate wetland species it can occur on mesic sites along the coast, where atmospheric humidity from persistent fog is an important factor contributing to ambient moisture regimes.

Soils typically consist of thin humus over coarse-textured and frequently gravelly mineral horizons; a clay-textured soil component has been observed at some sites. Rooting is most often restricted by shallow bedrock. Soil depth is variable, but in comparison with coastal dwarf shrublands, soils are somewhat deeper; mean thickness is 44 cm. There is typically evidence of saturated soil conditions, including shallow peat deposits in small depressions and hydric soil indicators, such as soil mottles.

This association sometimes occurs on sites that were historically burned and/or otherwise disturbed by early European settlers (especially for sheep pasture and coastal fishing outposts). The presence of charcoal and an Ap horizon reveal evidence of past land use in some occurrences.

Vegetation	Frequency (%)	Cover (%) (\pm SEM)
Trees < 2 m		
<i>Picea mariana</i>	22.2	0.7 (\pm 0.7)
<i>Larix laricina</i>	22.2	0.3 (\pm 0.2)
Shrubs		
<i>Gaylussacia bigeloviana</i>	100	32.6 (\pm 6.3)
<i>Juniperus communis</i>	88.9	8.9 (\pm 3.6)
<i>Rhododendron groenlandicum</i>	88.9	0.6 (\pm 0.2)
<i>Kalmia angustifolia</i>	77.8	1.4 (\pm 0.8)
<i>Morella pensylvanica</i>	66.7	5.1 (\pm 2.5)
<i>Rhododendron canadense</i>	66.7	0.9 (\pm 0.6)
<i>Aronia melanocarpa</i>	66.7	0.5 (\pm 0.2)
<i>Vaccinium oxycoccos</i>	66.7	0.2 (\pm 0.1)
<i>Empetrum nigrum</i>	55.6	1.4 (\pm 1.2)
<i>Vaccinium angustifolium</i>	55.6	0.1
<i>Chamaedaphne calyculata</i>	44.4	2.9 (\pm 2)
<i>Gaylussacia baccata</i>	44.4	2.1 (\pm 1.1)
<i>Gaultheria procumbens</i>	44.4	1.2 (\pm 1.2)
<i>Ilex mucronata</i>	44.4	0.8 (\pm 0.6)
<i>Kalmia polifolia</i>	44.4	0.1 (\pm 0.1)
<i>Cornus canadensis</i>	33.3	3.5 (\pm 3.5)
<i>Alnus alnobetula</i>	33.3	1.3 (\pm 0.9)
<i>Viburnum nudum</i>	33.3	0.5 (\pm 0.4)
<i>Rubus hispidus</i>	33.3	0.2 (\pm 0.1)
<i>Corema conradii</i>	22.2	4.2 (\pm 3.5)
<i>Vaccinium macrocarpon</i>	22.2	0.6 (\pm 0.6)
<i>Rubus chamaemorus</i>	22.2	0.3 (\pm 0.3)
<i>Myrica gale</i>	22.2	0.2 (\pm 0.1)
Herbaceous plants		
<i>Osmundastrum cinnamomeum</i>	55.6	5.8 (\pm 2.6)
<i>Trichophorum cespitosum</i>	44.4	6.3 (\pm 5.8)
<i>Calamagrostis pickeringii</i>	44.4	1 (\pm 0.6)
<i>Maianthemum canadense</i>	44.4	0.1
<i>Lysimachia borealis</i>	33.3	trace
<i>Coptis trifolia</i>	33.3	trace
<i>Sarracenia purpurea</i>	33.3	0.3 (\pm 0.2)
<i>Solidago uliginosa</i>	33.3	0.1 (\pm 0.1)
<i>Oclemena nemoralis</i>	22.2	trace
<i>Drosera rotundifolia</i>	22.2	0.1 (\pm 0.1)
Lichens		
<i>Cladonia terrae-novae</i>	44.4	9.2 (\pm 4.4)
<i>Cladonia rangiferina</i>	44.4	3.4 (\pm 3.5)
<i>Cladonia stellaris</i>	44.4	1.3 (\pm 0.6)
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	33.3	2.4 (\pm 1.3)
<i>Hypogymnia</i> sp.	22.2	trace
<i>Cladonia crispata</i>	22.2	trace
<i>Cladonia pyxidata</i>	22.2	trace
<i>Cladonia oricola</i>	22.2	0.3 (\pm 0.4)
<i>Cladonia arbuscula</i> ssp. <i>mitis</i>	22.2	0.3 (\pm 0.2)
<i>Cladonia verticillata</i>	22.2	0.1 (\pm 0.1)
Bryophytes		
<i>Leucobryum glaucum</i>	44.4	0.1
<i>Dicranum undulatum</i>	33.3	0.4 (\pm 0.4)
<i>Sphagnum capillaceum</i>	22.2	15 (\pm 9.8)
<i>Ptilidium pulcherrimum</i>	22.2	trace

Vegetation

This association is characterized by the dominance of Dwarf Huckleberry (*Gaylussacia bigeloviana*) and a relatively high richness of shrub species, most associated with coastal and wetland environments. The dwarf shrub Common Juniper (*Juniperus communis*) is frequent and abundant at most sites. Commonly occurring taller shrubs include: Common Labrador Tea (*Rhododendron groenlandicum*), Sheep Laurel (*Kalmia angustifolia*), Northern Bayberry (*Morella pensylvanica*), Rhodora (*Rhododendron canadense*), Black Huckleberry (*Gaylussacia baccata*) and Black Chokeberry (*Aronia melanocarpa*). The dwarf shrubs Lowbush Blueberry (*Vaccinium angustifolium*) and Black Crowberry (*Empetrum nigrum*) occur with moderate frequency. Bunchberry (*Cornus canadensis*), and Northern Starflower (*Lysimachia borealis*) also occur frequently. Green Alder (*Alnus alnobetula*) and Bristly Dewberry (*Rubus hispidus*), while present at only one third of sites, are notable since they occur less frequently in other coastal barrens associations.

Several frequently encountered species demonstrate the wet conditions indicative of this association. The trees Black Spruce (*Picea mariana*) and Tamarack (*Larix laricina*) can occur within this association, typically on wet sites that are located farther from coastal exposure. The small, wetland associated shrubs, Small Cranberry (*Vaccinium oxycoccos*) and Pale Bog Laurel (*Kalmia polifolia*) are relatively frequent but present usually only in trace amounts. Several wetland-associated herbs including Northern



Gaylussacia bigeloviana (Dwarf Huckleberry), an Atlantic Coastal Plain Species

PHOTO: L&F (Sean Basquill)

Bog Goldenrod (*Solidago uliginosa*) and Northern Pitcher Plant (*Sarracenia purpurea*) are relatively common. Round-leaved Sundew (*Drosera rotundifolia*) sometimes occurs. Cinnamon Fern (*Osmundastrum cinnamomeum*), is a frequently occurring fern species, especially in dwarfed growth form. Tufted Clubrush (*Trichophorum cespitosum*) is the most frequent and abundant sedge species, but others are occasionally encountered. The grass Pickering's Reed Grass (*Calamagrostis pickeringii*) occurs frequently with as much as 5% cover.

Lichens are typically abundant. Newfoundland Reindeer Lichen (*Cladonia terrae-novae*) occurs at less than half of sites (44% presence) but can occupy nearly a quarter of the area of this association, when present. *Cladonia rangiferina* is also common and sometimes abundant. *Cladonia stellaris* occurs in smaller amounts.

Distribution

The association is widely distributed from southwest Nova Scotia through Halifax county; there are few occurrences on Cape Breton Island (see Figure 19).

Related Associations

The species Dwarf Huckleberry is fairly common on bogs and fen hummocks in southern and eastern Newfoundland but does not occur on the barrens (Meades et al. 2020).

The Dwarf Huckleberry association is relatively less common compared with the Black Huckleberry (*Gaylussacia baccata*) association. It occupies a relatively smaller proportion of sites where it occurs, and it is more frequently associated with wet conditions.

Representative Sites

Halifax County: Duncan's Cove Nature Reserve

Province	Present	Notes
NB	X	fairly common
PEI	X	rare
NL	–	absent

S3. Mixed Tall Shrubland

Ilex mucronata – *Aronia melanocarpa*

Shrubland Association

Species Richness (spp/25 m ²)	20.4 (±3.7)
Vegetation Height (cm)	128.2 (±36.7)
Indicator Species	<i>Amelanchier laevis</i> <i>Aralia nudicaulis</i> <i>Ilex mucronata</i> <i>Aronia melanocarpa</i> <i>Pleurozium schreberi</i> <i>Rhododendron canadense</i> <i>Viburnum nudum</i>
Sample size (n)	5
Conservation Status Rank	TBD

Concept

This association is characterized by a mixture of False Holly (*Ilex mucronata*), Black Chokeberry (*Aronia melanocarpa*), Sheep Laurel (*Kalmia angustifolia*), Wild Raisin (*Viburnum nudum*), Rhodora (*Rhododendron canadense*), and/or Black Huckleberry (*Gaylussaccia baccata*). Relative abundances vary depending on environmental conditions and site history. This association is successional dynamic.

Environment

This mixed shrub association is usually found on relatively sheltered topography, less frequently on extremely exposed sites. It often occurs near forest edges and is sometimes present on small floodplains of slow-moving streams. Many sites have a known fire history and this association is likely quite dynamic and may represent a transitional stage between open barrens and forest.

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		50.3 (±27.4)	144	8
Slope Gradient (%)		9.5 (±4.3)	21.3	0
Distance to coast		9.1 km (±7 km)	38 km	52.6 m
Exposed Substrate				
Bedrock	0	0 0	0	
Rock (cobble, boulder, etc.)	20	0.1 (±0.2)	0.3	0
Woody material	0	0 0	0	
Mineral soil	0	0 0	0	
Organic soil	0	0 0	0	
Surface water	0	0 0	0	

	Frequency (%)
Exposure	exposed (40), moderate (40), moderately exposed (20)
Slope Position	Middle slope (40), lower slope (40), depression (10), level (10)
Microtopography	micro mounded (40), moderately mounded (20), severely mounded (20), extremely mounded (20)
Moisture Regime	subxeric (40), mesic (20), subhygric (20), hygric (20)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	18 (±4.9)	18	18

Soils typically consist of thick litter accumulation and thin, poorly developed humus over stony till. Alluvial soils can be present near riparian areas.

Vegetation

This association sometimes supports trees, especially Red Maple (*Acer rubrum*) and sometimes Balsam Fir (*Abies balsamea*). Vegetation height for this association is on average taller than elsewhere on barrens and can approach 2 m.

The proportion of each shrub species comprising the mixed shrub association varies considerably, ranging with regional climate, moisture regime, anthropogenic and/or fire history and random factors. The most frequently co-occurring shrub species belong to the Heath, Rose, and Holly Families, and include: False holly (*Ilex mucronata*), Rhodora (*Rhododendron canadense*), Sheep Laurel (*Kalmia angustifolia*), Smooth Serviceberry (*Amelanchier laevis*), Black Huckleberry (*Gaylussaccia baccata*) and Black Chokeberry (*Aronia melanocarpa*).

Northern Bayberry (*Morella pensylvanica*) commonly occurs on coastal sites. Sites that are imperfectly to poorly drained typically host a greater proportion of Rhodora

Herring Cove Provincial Park, Halifax County
PHOTO: Saint Mary's University (Caitlin Porter)



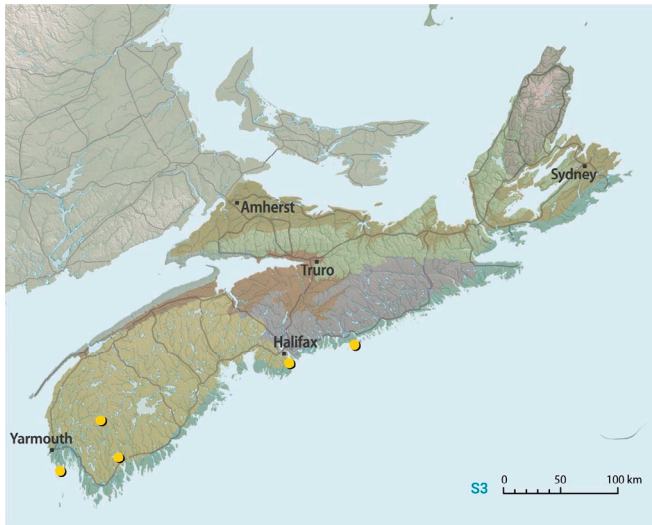


Figure 20. Survey sites for **S3. Mixed Tall Shrubland** Shrubland Association (n=5)

(*Rhododendron canadense*) and sometimes also support Common Winterberry (*Ilex verticillata*) or Alders (*Alnus spp.*); usually Green Alder (*Alnus alnobetula*) on the coast and Speckled Alder (*Alnus incana ssp. rugosa*) inland. Lowbush Blueberry (*Vaccinium angustifolium*) occurs frequently, sometimes reaching heights comparable to the other tall shrubs. In southwest Nova Scotia, this plant community can also support a substantial component of High-bush Blueberry (*Vaccinium corymbosum*). Inkberry (*Ilex glabra*) is sometimes abundant at sites in southwestern Nova Scotia.

Herbaceous vegetation is variable but Northern Starflower (*Lysimachia borealis*) is most often present. Wild Sarsaparilla (*Aralia nudicaulis*) and Bunchberry (*Cornus canadensis*) are frequent in the herbaceous layer.

The association provides habitat for a greater proportion of common forest-floor dwelling moss species than most elsewhere in barren complexes. For example, this association supports a greater diversity of Broom mosses (five *Dicranum spp.*) than other barrens communities. Pincushion Moss (*Leucobryum glaucum*) is the most frequently occurring bryophyte within this association. Thick leaf litter often impedes establishment of mosses or liverworts; thus, diversity of mosses is substantially higher in areas with a greater proportion of exposed substrate (e.g. rock). In general, the low canopy created by the mixed shrub association creates a microclimate more suitable for bryophytes typical of forests (i.e. sheltered, humid, and somewhat shaded conditions).

Reindeer Lichens (*Cladonia spp.*) are often absent but a few species occur and are sometimes abundant on sites with dry, shallow, stony soils, especially with rock exposure and where shrubs are sparser, allowing light to reach lower vegetation strata.

Vegetation

	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Abies balsamea</i>	40	4 (±2.7)
<i>Picea glauca</i>	20	0.6 (±0.6)
<i>Acer rubrum</i>	20	0.5 (±0.4)
Shrubs		
<i>Ilex mucronata</i>	100	32.6 (±9.9)
<i>Aronia melanocarpa</i>	80	8.4 (±3.1)
<i>Kalmia angustifolia</i>	60	7.2 (±4.1)
<i>Gaylussacia baccata</i>	60	6.4 (±4.4)
<i>Rhododendron canadense</i>	60	20 (±9.6)
<i>Amelanchier laevis</i>	60	2 (±1.2)
<i>Cornus canadensis</i>	60	1.1 (±0.9)
<i>Viburnum nudum</i>	40	8 (±3.9)
<i>Morella pensylvanica</i>	40	6.5 (±6)
<i>Amelanchier sp.</i>	40	4 (±1.7)
<i>Vaccinium corymbosum</i>	40	3 (±1.7)
<i>Gaultheria procumbens</i>	40	trace
<i>Rubus hispida</i>	40	trace
<i>Vaccinium angustifolium</i>	40	0.4 (±0.3)
<i>Alnus alnobetula</i>	40	0.3 (±0.4)
<i>Ilex verticillata</i>	20	3 (±2.8)
<i>Ilex glabra</i>	20	1.4 (±1.3)
<i>Prunus pensylvanica</i>	20	1 (±0.9)
<i>Alnus incana</i>	20	1.3 (±1)

Herbaceous plants

<i>Lysimachia borealis</i>	80	0.1 (±0.5)
<i>Aralia nudicaulis</i>	60	2 (±1.1)
<i>Oclemena acuminata</i>	40	trace
<i>Osmundastrum cinnamomeum</i>	40	0.4 (±0.4)
<i>Pteridium aquilinum</i>	40	0.3 (±0.4)
<i>Maianthemum canadense</i>	40	0.1 (±0.2)
<i>Clintonia borealis</i>	20	1.2 (±1.1)

Lichens

<i>Cladonia maxima</i>	40	trace
<i>Cladonia uncialis ssp. uncialis</i>	20	0.5 (±0.3)

Bryophytes

<i>Leucobryum glaucum</i>	60	0.1 (±0.4)
<i>Hypnum imponens</i>	40	0.4 (±0.4)
<i>Racomitrium lanuginosum</i>	20	4 (±3.8)
<i>Sphagnum tenellum</i>	20	1.2 (±1.1)
<i>Dicranum spp.</i>	20	0.6 (±0.5)

Distribution

Widespread across much of Nova Scotia (see Figure 16).

Representative Sites — **Shelburne County:** Jordan Falls; **Cumberland County:** Joggins; **Halifax County:** Chebucto Head, Peggy's Cove; **Victoria County:** on the plateau around Cheticamp Lake

Similar Associations — This association may occur on insular Newfoundland. *Ilex verticillata* does not occur in the barrens, however, *Ilex mucronata* is common

Province	Present	Notes
NB	X	common
PEI	X	common
NL	?	probable

particularly on moist barrens usually in association with *Viburnum cassinoides* (Meades pers. comm. 2020).

S4. Sheep Laurel Highland Heath

Kalmia angustifolia – *Vaccinium angustifolium* / *Cladonia stellaris*

Shrubland Association

Species Richness (spp/25 m ²)	31.2 (±6.9)
Vegetation Height (cm)	18.3 (±1.1)
Indicator Species	<i>Kalmia angustifolia</i>
Sample size (n)	6
Conservation Status Rank	TBD

Concept

The vegetation of this association is dominated by Sheep Laurel (*Kalmia angustifolia*) and a diversity of lichens, especially Star-tipped Reindeer Lichen (*Cladonia stellaris*). In lesser abundance, the shrubs Lowbush Blueberry (*Vaccinium angustifolium*), False holly (*Ilex mucronata*), and Wild Raisin, also known as Witherod (*Viburnum nudum*), are typically present. This association occurs in the Cape Breton Highlands, at sites which are characterized by harsh climatic conditions; Felsenmeer rock formations (stonefields created by freeze-thaw cycles) may be present.

Environment

These heaths typically occur on upper slopes and crests of prominent summits or the flat plateau of the Cape Breton Highlands. Elevation at these sites may be as low as 126 m on Tittle Point at the northernmost tip of Cape Breton Island to as high as 527 m on the highland plateau near Cheticamp Lake. The climate of this region is humid, with persistent fog and frequent precipitation. The growing season is relatively short and winters are

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		354.7 (±63.3)	527	126
Slope Gradient (%)		12.2 (±5.7)	32.5	0
Distance to coast (m)		5.4 km (±2.8 km)	1.8 km	770.5 m
Exposed Substrate				
Bedrock	0	0	0	0
Rock (cobble, boulder, etc.)	50	18 (±14.9)	83	0
Woody material	16.7	0	0.2	0
Mineral soil	0	0	0	0
Organic soil	0	0	0	0
Surface water	0	0	0	0

	Frequency (%)
Exposure	exposed (100)
Slope Position	upper slope (50), crest (16.7), level (16.7), middle slope (16.7)
Microtopography	micro mounded (50), moderately mounded (16.7), extremely mounded (16.7), missing data (16.7)
Moisture Regime	xeric (33.3), subxeric (16.7), submesic (16.7), subhygric (16.7), missing data (16.7)
Aspect	none (33.4), east (16.7), southeast (16.7), south (16.7), southwest (16.7)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	23.3 (±7.8)	44	0
	Frequency (%)		
Humus form	resimor (50), hemimor (16.7), mullmoder (16.7), none or missing data (16.7)		

long with snow persisting late in spring. The region is exposed to high winds (including les Suêtes). These shrublands form on extremely exposed windy sites that are subject to frequent disturbance, including soil freezing and thawing.

Soils are nutrient poor, acidic, stony and usually thin; sites are frequently rocky on the surface. At a small number of remote, exposed summits in the highlands, this association occurs on stonefields called “felsenmeer” created by freezing and thawing cycles where soil only accumulates in thin rock crevices. Humus at some half of sites originates from woody materials (Resimor).

Vegetation

Sheep Laurel (*Kalmia angustifolia*) predominates in this association, often with lesser amounts of Lowbush Blueberry (*Vaccinium angustifolium*), Wild Raisin (*Viburnum nudum*), and False holly (*Ilex mucronata*).

Spotted Mountain, North River Wilderness Area, Victoria County
 PHOTO: Saint Mary's University (Caitlin Porter)



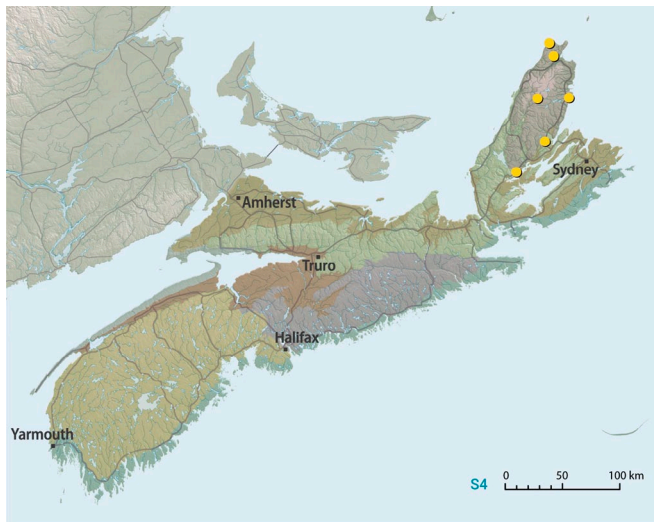


Figure 21. Survey sites for **S4. Sheep Laurel Highland Heath** Shrubland Association (n=6)

Rhodora (*Rhododendron canadense*) is also relatively constant. Black Crowberry (*Empetrum nigrum*), Common Juniper (*Juniperus communis*) and Foxberry (*Vaccinium vitis-idaea*) are relatively frequent dwarf shrub species. Eastern Teaberry (*Gaultheria procumbens*) and Black Huckleberry (*Gaylussacia baccata*) are notably absent from this association.

Reindeer Lichens within this association are typically abundant and species rich, especially in rocky situations where suitable microhabitats are available. The lichens Star-tipped Reindeer Lichen (*Cladonia stellaris*) and Black-footed Reindeer Lichen (*Cladonia stygia*) are the most frequently occurring and abundant. The diversity of Reindeer Lichens (*Cladonia* spp.) present with felsensmeer rock formations can be attributed to amplexness of this suitable substrate and the numerous microhabitat conditions offered within a relatively small area. Arctic and alpine associated species such as Alpine Foam Lichen (*Stereocaulon alpinum*), Arctic Saucer Lichen (*Ochrolechia frigida*), False Reindeer Lichen (*Cladonia wainioi*) occur at some sites.

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Picea mariana</i>	66.7	5.5 (±5.8)
<i>Abies balsamea</i>	50.0	0.2 (±0.2)
Shrubs		
<i>Kalmia angustifolia</i>	100.0	40.8 (±9.1)
<i>Vaccinium angustifolium</i>	100.0	2.1 (±0.8)
<i>Ilex mucronata</i>	100.0	1.0 (±0.5)
<i>Viburnum nudum</i>	100.0	0.8 (±0.3)
<i>Cornus canadensis</i>	66.7	2.3 (±0.9)
<i>Rhododendron canadense</i>	66.7	1.9 (±1.2)
<i>Vaccinium vitis-idaea</i>	33.3	1.7 (±1.8)
<i>Juniperus communis</i>	33.3	0.8 (±0.9)
<i>Amelanchier</i> sp.	33.3	0.4 (±0.3)
<i>Empetrum nigrum</i>	33.3	0.3 (±0.2)
<i>Kalmia polifolia</i>	33.3	0.2 (±0.2)
Herbaceous Plants		
<i>Coptis trifolia</i>	50.0	trace
<i>Melampyrum lineare</i>	50.0	0.3 (±0.3)
<i>Maianthemum canadense</i>	50.0	0.2 (±0.2)
<i>Pteridium aquilinum</i>	33.3	3.3 (±3.7)
Lichens		
<i>Cladonia stellaris</i>	83.3	14.6 (±10.3)
<i>Cladonia rangiferina</i>	66.7	4.7 (±3.5)
<i>Cladonia squamosa</i>	66.7	trace
<i>Cladonia stygia</i>	50.0	4.0 (±4.2)
<i>Cladonia arbuscula</i> ssp. <i>mitis</i>	50.0	3.0 (±2.7)
<i>Hypogymnia</i> sp.	33.3	trace
<i>Cladonia crispata</i>	33.3	trace
<i>Cladonia gracilis</i> ssp. <i>gracilis</i>	33.3	trace
<i>Cladonia coccifera</i>	33.3	trace
<i>Cladonia merochlorophaea</i>	33.3	trace
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	33.3	0.3 (±0.2)
<i>Cladonia uncialis</i> ssp. <i>uncialis</i>	33.3	0.1 (±0.1)
Bryophytes		
<i>Pleurozium schreberi</i>	83.3	0.5 (±0.3)
<i>Ptilidium ciliare</i>	33.3	0.1

The herbaceous layer is poorly developed, with few species present but for trace quantities of Wild Lily-of-the-Valley (*Maianthemum canadense*), American Cow-Wheat (*Melampyrum lineare*) and Goldthread (*Coptis trifolia*). Schreber's Moss (*Pleurozium schreberi*) is a frequent occurrence but bryophytes are otherwise also relatively uncommon.

Distribution

In Nova Scotia, the association is restricted to the Cape Breton Highlands (see Figure 21).

Representative Sites

Victoria County: Spotted Mountain (North River Wilderness Area), McEvoy's Barren, Tittle Point. **Inverness County:** Plateau barrens near Cheticamp Lake in Northern Plateau Ecoregion

Related Associations

This association is also almost identical to what is described as "Kalmia Typicum" heath in Newfoundland; here the average vegetation height is a bit higher but this varies locally with wind exposure and snow depth.

Province	Present	Notes
NB	X	uncommon
PEI	–	absent
NL	X	common

S5. Sheep Laurel Inland Heath

Kalmia angustifolia – *Rhododendron canadense* / *Pteridium aquilinum* – *Gaultheria procumbens*

Shrubland Association

Species Richness (spp/25 m ²)	20.5 (±2.2)
Indicator Species	<i>Kalmia angustifolia</i> <i>Pteridium aquilinum</i> <i>Gaultheria procumbens</i> <i>Ilex glabra</i> <i>Cladonia ochrochlora</i> <i>Cladonia floerkeana</i>
Sample size (n)	13
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		93.2 (±21.3)	221	10
Slope Gradient (%)		9.9 (±3.6)	32.5	0
Distance to coast (m)		17.5 (±3.2)	39	1.5
Exposed Substrate				
Bedrock	0	0	0	0
Rock (cobble, boulder, etc.)	69.2	10.9 (±3.4)	35	0
Woody material	15.4	0.1 (±0.1)	0.7	0
Mineral soil	7.7	0.2 (±0.2)	2	0
Organic soil	7.7	0.5 (±0.6)	7	0
Surface water	0	0	0	0

Concept

This association is represented by Sheep Laurel (*Kalmia angustifolia*) dominated heaths on inland barrens occurring over surficial deposits of glacial till or sand. At least one third of sites were burned.

Environment

This association occurs on relatively sheltered sites in the interior of Nova Scotia with moderate to negligible wind exposure.

Evidence of fire disturbance is relatively frequent; at least one third of sites have physical evidence of historical fire such as the presence of charcoal near the surface. Exposed woody substrates (coarse woody material), rock, mineral soil and humus are frequently present, and surface rocks may be abundant (up to 35% or more surface cover).

	Frequency (%)
Exposure	moderately exposed (23.1), moderate (76.9)
Slope Position	lower slope (30.8), depression (15.4), level (15.4), crest (15.4), midslope (7.7), upper slope (7.7), missing data (7.7)
Microtopography	slightly mounded (38.5), moderately mounded (30.8), micro mounded (7.7), severely mounded (7.7), extremely mounded (7.7), missing data (7.7)
Moisture Regime	xeric (7.7), subxeric (30.8), submesic (7.7), mesic (15.4), subhygric (23.1), hygric (15.4)
Aspect	no aspect (46.1), northwest (15.4), south (15.4), north (7.7), southwest (7.7), missing data (7.7)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	35 (±5.7)	88	4

	Frequency (%)
Humus form	hemimor (61.5), humimor (15.4), Resimor (15.4), saprimoder (7.7)

Vegetation

This association is characterized by the dominance of the shrub Sheep Laurel (*Kalmia angustifolia*), frequently with lesser components of Rhodora (*Rhododendron canadense*) and Wild Raisin (*Viburnum nudum*).



(left) Shelburne County;
(right) *Kalmia angustifolia* (Sheep Laurel),
a boreal species

PHOTOS: L&F (Sean Basquill)

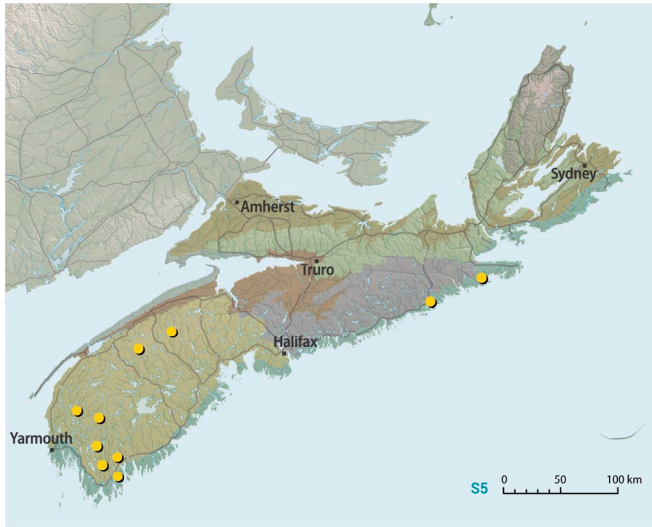


Figure 22. Survey sites for **S5. Sheep Laurel Inland Heath** Shrubland Association (n=13)

The dwarf shrubs Eastern Teaberry (*Gaultheria procumbens*) and Lowbush Blueberry (*Vaccinium angustifolium*) are the second and third most frequently encountered species respectively, but *Gaultheria procumbens* is typically the more abundant. Bristly Dewberry (*Rubus hispidus*) and Black Chokeberry (*Aronia melanocarpa*) are also frequently present in the association.

Trees are present at one quarter to one third of sites and are likely suggestive of increasing forest cover. Black Spruce (*Picea mariana*) and Eastern White Pine (*Pinus strobus*) are the most common species encountered within the association.

Bracken Fern (*Pteridium aquilinum*) is frequent and abundant in the association. This species is found on coastal and highland sites substantially less often. Other notable herbs and dwarf shrubs include Bunchberry (*Cornus canadensis*), Northern Starflower (*Lysimachia borealis*), and Wild Lily-of-the-Valley (*Maianthemum canadense*).

A distinct component of the lichen and bryophyte layer, Wavy-leaved Broom Moss (*Dicranum polysetum*) is frequently encountered, contrasting with coastal and highland Sheep Laurel (*Kalmia angustifolia*) sites where it is not observed. The most frequent and abundant lichens are Grey Reindeer Lichen (*Cladonia rangiferina*) and Reindeer Lichen (*Cladonia arbuscula* ssp. *squarrosa*), both are typically present with less than 5% cover. *Cladonia ochrochlora* and *Cladonia floerkeana*, are two other Reindeer Lichen species that are infrequently encountered on woody substrates, but characteristic of this association because they are scarce in other heaths.

Vegetation	Frequency (%)	Cover (%) (±SEM)
Trees < 2 m		
<i>Picea mariana</i>	30.8	1.1 (±0.6)
<i>Pinus strobus</i>	23.1	0.2 (±0.2)
Shrubs		
<i>Kalmia angustifolia</i>	100.0	49.2 (±4.8)
<i>Gaultheria procumbens</i>	92.3	8.9 (±4)
<i>Vaccinium angustifolium</i>	92.3	5.7 (±2.6)
<i>Rhododendron canadense</i>	61.5	9.9 (±3.2)
<i>Viburnum nudum</i>	61.5	2.0 (±1)
<i>Rubus hispidus</i>	53.8	1.2 (±0.6)
<i>Aronia melanocarpa</i>	46.2	0.2 (±0.2)
<i>Ilex glabra</i>	30.8	5.7 (±3.3)
<i>Cornus canadensis</i>	30.8	1.0 (±1.0)
<i>Corema conradii</i>	30.8	0.8 (±0.8)
<i>Morella pensylvanica</i>	30.8	0.7 (±0.5)
<i>Juniperus communis</i>	23.1	3.9 (±4)
<i>Ilex mucronata</i>	23.1	2.8 (±2.8)
<i>Alnus incana</i>	23.1	0.6 (±0.5)
<i>Rhododendron groenlandicum</i>	23.1	0.5 (±0.5)
Herbaceous plants		
<i>Pteridium aquilinum</i>	92.3	15.9 (±6.5)
<i>Lysimachia borealis</i>	53.8	0.1
<i>Oryzopsis asperifolia</i>	23.1	trace
Lichens		
<i>Cladonia rangiferina</i>	61.5	4.6 (±2.5)
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	61.5	4.4 (±2.5)
<i>Cladonia stellaris</i>	23.1	4.5 (±3.5)
<i>Cladonia crispata</i>	23.1	0.1 (±0.1)
Bryophytes		
<i>Dicranum polysetum</i>	61.5	0.2 (±0.2)
<i>Pleurozium schreberi</i>	46.2	0.7 (±0.5)
<i>Sphagnum capillaceum</i>	23.1	1.5 (±1)
<i>Polytrichum commune</i>	23.1	trace

Distribution

This community occurs in the interior of Nova Scotia, especially in southwestern parts of the province (see Figure 22).

Related Associations

The association is somewhat similar to Newfoundland *Kalmia* heaths except for the high frequency of southern species, particularly Eastern Teaberry (*Gaultheria procumbens*) that is only known from one site in central Newfoundland. (Meades pers. comm. 2020).

Province	Present	Notes
NB	X	common
PEI	–	fairly common
NL	X	common

S6. Black Spruce Highland Heath

Picea mariana – *Rhododendron canadense* / *Cladonia stellaris* (*Cladonia stygia*)

Shrubland Association

Species Richness (spp/25 m ²)	27.9 (±2.1)
Vegetation Height (cm)	34.4 (±4.3)
Indicator Species	<i>Bazzania trilobata</i> <i>Cladonia stellaris</i> <i>Cladonia stygia</i> <i>Hylocomium splendens</i> <i>Ilex mucronata</i> <i>Picea mariana</i> <i>Pleurozium schreberi</i> <i>Racomitrium lanuginosum</i> <i>Rhododendron canadense</i> <i>Viburnum nudum</i>
Sample size (n)	16
Conservation Status Rank	TBD

Site Characteristics	Frequency (%)	Mean (±SEM)	max	min
Elevation (m)		470.9 (±11.7)	532	401
Slope Gradient (%)		4.2 (±1.8)	21.3	0
Distance to coast		13.4 km (±855.4 m)	18.4 km	7.9 km
Exposed Substrate				
Bedrock	6.3	0.7 (±0.7)	10	0
Rock (cobble, boulder, etc.)	6.3	0.3 (±0.3)	5	0
Woody material	0	0 0	0	
Mineral soil	0	0 0	0	
Organic soil	12.5	0.3 (±0.3)	5	0
Surface water	0	0 0	0	

	Frequency (%)
Exposure	exposed (100)
Slope Position	crest (25), depression (18.8), middle slope (18.8), upper slope (18.8), level (6.3), lower slope (6.3), missing data (6.3)
Microtopography	severely mounded (43.8), slightly mounded (18.8), moderately mounded (6.3), missing data (31.3)
Moisture Regime	hygric (18.8), subxeric (18.8), mesic (18.8), submesic (12.5), xeric (6.3), subhygric (6.3),
Aspect	none (50.1), E (12.5), N (12.5), NE (12.5), S (6.3), SE (6.3), missing data (13)

Soil Features	Mean (±SEM)	max	min
Root Restriction Depth (cm)	35.3 (±4.3)	65	9
Humus form	Frequency (%) Hemimor (25), Humimor (25), Resimor (12.5), SH (6.3), missing data (31.3)		

Concept

This association occurs on exposed sites in the Cape Breton Highlands. Vegetation is comprised of dense and strongly stunted Black Spruce (*Picea mariana*) and other heath species of comparable height (< 50 cm).

Environment

Black Spruce heath is found on the Cape Breton Highlands, which experiences the most severe weather in Nova Scotia, including the localized occurrences of very strong winds called Les Suêtes. This unique type of wind has been recorded at speeds exceeding 200 km/hr.

The climate on the highlands is very humid with persistent fog and frequent precipitation events. The growing season is relatively short with long winters and snow persisting late into spring.



Spotted Mountain, North River Wilderness Area, Victoria County

PHOTO: Saint Mary's University (Jeremy Lundholm)

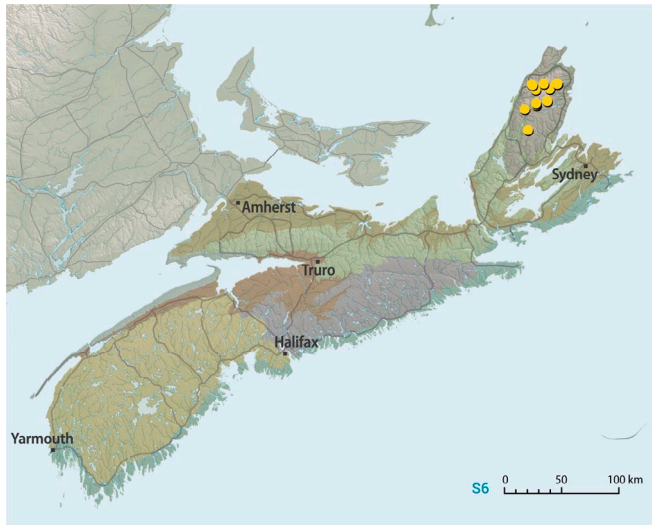


Figure 23. Survey sites for **S6. Black Spruce Highland Heath** Shrubland Association (n=16).

The Black Spruce heath association mostly occurs at elevations exceeding 400 m. Sites are typically situated on the crests of hills, in moist depressions, and on slopes with exposed coastal, northern or eastern aspects. Microtopography is hummocky; frequently strongly mounded. Mounds can also be formed by the vegetation itself.

Soils consist of relatively well-developed upland humus over rock or excessively stony mineral soil. Rooting depth is restricted to an average of 56 cm. Moisture regime is variable, but sites are most frequently in the mesic to hygric range. Soils are sometimes moist due to imperfect drainage and/or substantial atmospheric humidity. Nutrient availability is consistently low. Humus, rock and bedrock are frequently exposed and at some sites, vegetation is discontinuous.

Vegetation

This association is co-dominated by Black Spruce (*Picea mariana*) and several shrub species. Vegetation is typically under 50 cm even though individual trees may exceed 150 years in age. Tamarack (*Larix laricina*) and Balsam Fir (*Abies balsamea*) are locally abundant at some sites. Often considered a peatland or mineral swamp species, Tamarack can occur on upland soils especially in the highlands.

The most frequently occurring co-dominant shrubs include: Sheep Laurel (*Kalmia angustifolia*), False holly (*Ilex mucronata*) and Rhodora (*Rhododendron canadense*). Black Huckleberry (*Gaylussacia baccata*) is uncommon

Vaccinium angustifolium (Lowbush Blueberry)

PHOTOS: L&F (Sean Basquill)

Vegetation

Vegetation	Frequency (%)	Cover (%) (±SEM)
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Trees < 2 m

<i>Picea mariana</i>	93.8	38.5 (±5.2)
<i>Larix laricina</i>	31.3	0.5 (±0.4)
<i>Abies balsamea</i>	25.0	0.3 (±0.2)

Shrubs

<i>Rhododendron canadense</i>	87.5	12.7 (±3.2)
<i>Vaccinium angustifolium</i>	75.0	8.2 (±2.3)
<i>Kalmia angustifolia</i>	75.0	6.4 (±2)
<i>Viburnum nudum</i>	75.0	2.3 (±1.1)
<i>Kalmia polifolia</i>	75.0	0.9 (±0.3)
<i>Ilex mucronata</i>	56.3	1.2 (±0.8)
<i>Empetrum nigrum</i>	50.0	3.3 (±1.9)
<i>Juniperus communis</i>	43.8	6 (±3.8)
<i>Chamaedaphne calyculata</i>	43.8	2.3 (±1.1)
<i>Vaccinium vitis-idaea</i>	43.8	0.6 (±0.3)
<i>Amelanchier</i> sp.	37.5	1.3 (±0.3)
<i>Rhododendron groenlandicum</i>	37.5	0.6 (±0.3)
<i>Amelanchier bartramiana</i>	25.0	0.2 (±0.1)
<i>Gaultheria hispida</i>	25.0	0.2 (±0.1)
<i>Gaylussacia baccata</i>	18.8	4.5 (±4)
<i>Aronia melanocarpa</i>	18.8	trace
<i>Myrica gale</i>	18.8	0.1

Herbaceous Plants

<i>Cornus canadensis</i>	81.3	2.4 (±1)
<i>Coptis trifolia</i>	68.8	0.2 (±0.1)
<i>Melampyrum lineare</i>	31.3	0.1 (±0.1)
<i>Maianthemum canadense</i>	25.0	trace
<i>Clintonia borealis</i>	25.0	0.1
<i>Calamagrostis pickeringii</i>	25.0	0.1 (±0.1)

Lichens

<i>Cladonia stellaris</i>	87.5	9.8 (±4.8)
<i>Cladonia rangiferina</i>	50.0	8.1 (±4.1)
<i>Cladonia stygia</i>	43.8	2.6 (±2)
<i>Cladonia arbuscula</i> ssp. <i>mitis</i>	43.8	1 (±0.5)
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	31.3	0.7 (±0.4)
<i>Cladonia uncialis</i> ssp. <i>uncialis</i>	31.3	0.2 (±0.1)
<i>Cladonia maxima</i>	18.8	trace
<i>Cladonia crispata</i>	18.8	trace

Bryophytes

<i>Pleurozium schreberi</i>	81.3	11.3 (±3.7)
<i>Hylocomium splendens</i>	50.0	9.6 (±5.5)
<i>Racomitrium lanuginosum</i>	50.0	0.6 (±0.2)
<i>Ptilidium ciliare</i>	43.8	0.1
<i>Bazzania trilobata</i>	18.8	trace
<i>Ptilidium pulcherrimum</i>	18.8	trace
<i>Dicranum polysetum</i>	18.8	trace
<i>Sphagnum capillaceum</i>	18.8	0.3 (±0.2)



in the north and western highlands and at the few sites where it is abundant in the eastern highlands its occurrence apparently coincides with the historical incidence of fire.

Several other shrub species occur frequently but are not abundant. Bartram’s Serviceberry (*Amelanchier bartramiana*) may be present in small quantities. Low-bush Blueberry (*Vaccinium angustifolium*) occurs at most sites and can be abundant. Common Labrador Tea (*Rhododendron groenlandicum*) and Leatherleaf (*Chamaedaphne calyculata*), Foxberry (*Vaccinium vitis-idaea*), and or Black Chokeberry (*Aronia melanocarpa*) are sometimes present but are rarely abundant; they are typically not present with greater than 1% cover.

The dwarf shrubs Black Crowberry (*Empetrum nigrum*) and Common Juniper (*Juniperus communis*) are each present at approximately half of sites and vary in their abundance. Bunchberry (*Cornus canadensis*) is the third most frequently occurring species in this association, but it rarely occupies substantial area. Pale Bog Laurel (*Kalmia polifolia*) occurs at most sites but can be sparse in distribution, occupying 1% cover on average.

Herbaceous vegetation consists primarily of species that are typically forest dwelling. This is the only heathland association in Nova Scotia where One-sided Wintergreen (*Orthilia secunda*) occurs. Goldthread (*Coptis trifolia*) and Creeping Snowberry (*Gaultheria hispidula*) are often present within this association but are otherwise uncommon on Nova Scotia’s barrens. American Cow Wheat (*Melampyrum lineare*), Blue Bead Lily (*Clintonia borealis*) and Wild Lily-of-the-Valley (*Maianthemum canadense*) are occasionally present. Grasses include Pickering’s Reed Grass (*Calamagrostis pickeringii*)



Soil profile of upland heath, showing eluviation in surface horizons and shallow rooting depth
PHOTOS: L&F (Sean Basquill)

and Ricegrass (*Oryzopsis asperifolia*). Except for the relatively common Tufted Clubrush (*Trichophorum cespitosum*), sedges are not usually present.

Star-tipped Reindeer Lichen (*Cladonia stellaris*) is typically the dominant lichen species of this association. Black-footed Reindeer Lichen (*Cladonia stygia*), Grey Reindeer Lichen (*Cladonia rangiferina*), Stair-step Moss (*Hylocomium splendens*), and Schreber’s Moss (*Pleurozium schreberi*) are at least moderately frequent and may be abundant when present. Woolly Fringe Moss (*Racomitrium lanuginosum*) comprises minimal area but occurs at nearly one quarter of sites. Other bryophytes are often present in smaller quantities, including Northern Peat Moss (*Sphagnum capillifolium*) and the liverworts Ciliate Fringewort (*Ptilidium ciliare*) and Three-lobed Bazzania (*Bazzania trilobata*). Epiphytic species have not been extensively surveyed but are both diverse and abundant at most sites.

Distribution

The association is limited to the Cape Breton Highlands, mostly at elevations exceeding 400 m (see Figure 23).

It blankets much of the Northern Plateau, including Nova Scotia’s highest summit at White Hill (535 m). The association is frequently on sites above 400 m elevation, especially those with coastal exposure, and is otherwise common in transition zones between highland boreal forest and barrens.

Representative Sites

Victoria County: White Hill, Jim Campbell Barren, Cheticamp Lake;
Inverness County: Pollett’s Cove–Aspy Fault Wilderness Area

Related Associations

- *Kalmia angustifolia* – *Ilex mucronata* – *Picea mariana* community described from insular Newfoundland; it is extensive across southern areas of the island usually in the transition from blanket bogs to upland forests and on wind exposed landscapes (Meades pers. comm. 2020).

Province	Present	Notes
NB	X	rare
PEI	–	absent
NL	X	common

- *Picea mariana* – *Abies balsamea*/ *Sibbaldia tridentata* Shrubland, CEG006038, primarily documented in alpine regions of the Northeastern United States (Gawler 2003)

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Species List: Scientific and common names

Trees < 2 m

<i>Abies balsamea</i>	Balsam Fir
<i>Acer rubrum</i>	Red Maple
<i>Betula cordifolia</i>	Heart-Leaved Birch
<i>Betula papyrifera</i>	White or Paper Birch
<i>Betula populifolia</i>	Grey Birch
<i>Larix laricina</i>	Tamarack
<i>Picea glauca</i>	White Spruce
<i>Picea mariana</i>	Black Spruce
<i>Pinus banksiana</i>	Jack Pine
<i>Pinus resinosa</i>	Red Pine
<i>Pinus sylvestris</i>	Scotch Pine
<i>Pinus strobus</i>	Eastern White Pine
<i>Populus grandidentata</i>	Large Tooth Aspen
<i>Robinia pseudoacacia</i>	Black Locust
<i>Quercus rubra</i>	Red Oak
<i>Sorbus americana</i>	Mountain-ash

Shrubs

<i>Alnus alnobetula</i>	Green Alder
<i>Alnus incana</i> ssp. <i>rugosa</i>	Speckled Alder
<i>Amelanchier</i> sp.	Serviceberry
<i>Amelanchier bartramiana</i>	Bartram's Serviceberry
<i>Amelanchier interior</i>	Inland Serviceberry
<i>Amelanchier laevis</i>	Smooth Serviceberry
<i>Aralia nudicaulis</i>	Wild Sarsaparilla
<i>Arctostaphylos uva-ursi</i>	Bearberry
<i>Aronia arbutifolia</i>	Red Chokecherry
<i>Aronia melanocarpa</i>	Black Chokeberry
<i>Aronia x prunifolia</i>	Purple Chokecherry
<i>Chamaedaphne calyculata</i>	Leatherleaf
<i>Corema conradii</i>	Broom Crowberry
<i>Cornus canadensis</i>	Bunchberry
<i>Empetrum eamesii</i>	Pink Crowberry
<i>Empetrum nigrum</i>	Black Crowberry
<i>Gaultheria hispida</i>	Creeping Snowberry
<i>Gaultheria procumbens</i>	Eastern Teaberry
<i>Gaylussaccia baccata</i>	Black Huckleberry
<i>Gaylussaccia bigeloviana</i>	Dwarf Huckleberry
<i>Ilex glabra</i>	Inkberry
<i>Ilex mucronata</i>	False Holly
<i>Ilex verticillata</i>	Common Winterberry
<i>Juniperus communis</i>	Common Juniper
<i>Juniperus communis</i> var. <i>megistocarpa</i>	Magdalen Islands Juniper
<i>Juniperus horizontalis</i>	Creeping Juniper
<i>Kalmia angustifolia</i>	Lambkill or Sheep Laurel
<i>Kalmia polifolia</i>	Pale Bog Laurel
<i>Morella pensylvanica</i>	Northern Bayberry
<i>Myrica gale</i>	Sweet Gale
<i>Prunus pensylvanica</i>	Pin Cherry
<i>Rhododendron canadense</i>	Rhodora
<i>Rhododendron groenlandicum</i>	Common Labrador Tea
<i>Ribes</i> spp.	Currants
<i>Rosa carolina</i>	Carolina Rose
<i>Rosa virginiana</i>	Virginia Rose

<i>Rubus</i> spp.	Brambles
<i>Rubus chamaemorus</i>	Bakeapple or Cloudberry
<i>Rubus hispidus</i>	Bristly Dewberry
<i>Rubus idaeus</i>	Red Raspberry
<i>Rubus x biformispinus</i>	Pasture Dewberry
<i>Sibbaldia tridentata</i>	Three-leaved Cinquefoil
<i>Vaccinium</i> spp.	Blueberries and Cranberries
<i>Vaccinium angustifolium</i>	Lowbush Blueberry
<i>Vaccinium boreale</i>	Northern Blueberry
<i>Vaccinium corymbosum</i>	High-bush Blueberry
<i>Vaccinium macrocarpon</i>	Large Cranberry
<i>Vaccinium oxycoccos</i>	Small Cranberry
<i>Vaccinium uliginosum</i>	Alpine Bilberry
<i>Vaccinium vitis-idaea</i>	Foxberry or Mountain Cranberry
<i>Viburnum nudum</i>	Wild Raisin

Herbaceous plants

<i>Achillea borealis</i>	Yarrow
<i>Agrostis scabra</i>	Rough Bent Grass
<i>Agrostis stolonifera</i>	Creeping Bent-Grass
<i>Ammophila breviligulata</i>	Marram Grass or American Beach Grass
<i>Aralia nudicaulis</i>	Wild Sarsaparilla
<i>Avenella flexuosa</i>	Wavy Hair Grass
<i>Calamagrostis canadensis</i>	Bluejoint
<i>Calamagrostis pickeringii</i>	Pickering's Reed Grass
<i>Campanula intercedens</i>	Common Harebell
<i>Carex nigra</i>	Black Sedge
<i>Carex silicea</i>	Seabeach Sedge
<i>Carex stricta</i>	Tussock Sedge
<i>Centaureum erythraea</i>	European Centaury
<i>Cerastium fontanum</i>	Common Mouse-ear Chickweed
<i>Cerastium fontanum</i> ssp. <i>vulgare</i>	Common Mouse-ear Chickweed
<i>Clintonia borealis</i>	Blue Bead Lily
<i>Cochlearia tridactylites</i>	Scurvy-grass
<i>Comandra umbellata</i>	Bastard Toadflax
<i>Comptonia peregrina</i>	Sweetfern
<i>Coptis trifolia</i>	Goldthread
<i>Cornus canadensis</i>	Bunchberry
<i>Crocantemum canadense</i>	Rockrose or Canada Frostweed
<i>Cytisus scoparius</i>	Scotch Broom
<i>Danthonia spicata</i>	Poverty Oat Grass
<i>Deschampsia flexuosa</i>	Common Hair Grass
<i>Dichanthelium depauperatum</i>	Starved Panicgrass
<i>Doellingeria umbellata</i>	Flat-Topped White Aster
<i>Doellingeria umbellata</i> var. <i>umbellata</i>	Flat-Topped White Aster
<i>Drosera intermedia</i>	Spatulate-leaved Sundew
<i>Drosera rotundifolia</i>	Round-leaved Sundew
<i>Eriophorum virginicum</i>	Tawny Cottongrass
<i>Festuca filiformis</i>	Hair Fescue
<i>Festuca rubra</i>	Red Fescue
<i>Fragaria virginiana</i>	Strawberry
<i>Hudsonia ericoides</i>	Pine Barren Golden Heather
<i>Iris versicolor</i>	Blue Flag Iris
<i>Iris hookeri</i>	Hooker's Iris
<i>Juncus brevicaudatus</i>	Narrow-panicled Rush

<i>Lathyrus japonicus</i>	Beach Pea
<i>Lechea intermedia</i>	Large Pod Pinweed
<i>Ligusticum scoticum</i>	Scotch Lovage
<i>Limonium carolinianum</i>	Sea Lavender
<i>Luzula multiflora</i>	Common Woodrush
<i>Lysimachia borealis</i>	Northern Starflower
<i>Maianthemum canadense</i>	Wild Lily-of-the-Valley
<i>Melampyrum lineare</i>	American Cow Wheat
<i>Nabalus trifoliolatus</i>	Three-leaved Rattlesnake Root
<i>Oclemena acuminata</i>	Whorled Wood Aster
<i>Oclemena nemoralis</i>	Bog Aster
<i>Oryzopsis asperifolia</i>	Rough Leaved Mountain Ricegrass
<i>Osmundastrum cinnamomeum</i>	Cinnamon Fern
<i>Orthilia secunda</i>	One-sided Wintergreen
<i>Oxytropis campestris</i>	Field Locoweed
<i>Pilosella officinarum</i>	Mouse-ear Hawkweed
<i>Pilosella piloselloides</i>	Tall Hawkweed
<i>Plantago maritima</i>	Seaside Plantain
<i>Poa compressa</i>	Canada Bluegrass
<i>Potentilla anserina</i> subsp. <i>anserina</i>	Common Silverweed
<i>Pteridium aquilinum</i>	Bracken Fern
<i>Rumex acetosa</i>	Garden Sorrel
<i>Rumex acetosella</i>	Sheep Sorrel
<i>Sagina nodosa</i> spp. <i>borealis</i>	Knotted Pearlwort
<i>Sarracenia purpurea</i>	Northern Pitcher Plant
<i>Solidago</i> spp.	Goldenrods
<i>Solidago bicolor</i>	Silverrod
<i>Solidago nemoralis</i>	Gray-stemmed Goldenrod
<i>Solidago puberula</i>	Downy Goldenrod
<i>Solidago rugosa</i>	Rough Goldenrod
<i>Solidago sempervirens</i>	Seaside Goldenrod
<i>Solidago uliginosa</i>	Northern Bog Goldenrod
<i>Sonchus arvensis</i>	Field Sow Thistle
<i>Spiranthes lacera</i>	Northern Slender Ladies'-tresses
<i>Symphotrichum novi-belgii</i>	New York Aster
<i>Trichophorum cespitosum</i>	Tufted Clubrush

Lichens

<i>Bryoria nadvornikiana</i>	Shiny Gray Horsehair Lichen
<i>Cetraria aculeata</i>	Spiny Heath Lichen
<i>Cetraria islandica</i> ssp. <i>crispiformis</i>	True Iceland Lichen
<i>Cetraria laevigata</i>	Smooth Iceland Lichen
<i>Cladonia</i> spp.	Reindeer and Cladonia Lichens
<i>Cladonia albonigra</i>	Black-footed Pixie-cup Lichen
<i>Cladonia arbuscula</i> ssp. <i>mitis</i>	Green Reindeer Lichen
<i>Cladonia arbuscula</i> ssp. <i>squarrosa</i>	Reindeer Lichen
<i>Cladonia boryi</i>	Fishnet Lichen
<i>Cladonia coccifera</i>	Eastern Boreal Pixie-cup Lichen
<i>Cladonia crispata</i>	Organ Pipe Lichen
<i>Cladonia cristatella</i>	British Soldiers Lichen
<i>Cladonia gracilis</i>	Smooth Cladonia Lichen
<i>Cladonia gracilis</i> ssp. <i>gracilis</i>	Smooth Cladonia Lichen
<i>Cladonia maxima</i>	Giant Cladonia Lichen
<i>Cladonia merochlorophaea</i>	Gritty Pixie-cup Lichen
<i>Cladonia oricola</i>	Coast Reindeer Lichen
<i>Cladonia pyxidata</i>	Pebbled Pixie-cup Lichen
<i>Cladonia rangiferina</i>	Grey Reindeer Lichen

<i>Cladonia rei</i>	Wand Lichen
<i>Cladonia squamosa</i>	Dragon Lichen
<i>Cladonia stellaris</i>	Star-tipped Reindeer Lichen
<i>Cladonia strepsilis</i>	Olive Cladonia Lichen
<i>Cladonia stygia</i>	Black-footed Reindeer Lichen
<i>Cladonia subtenuis</i>	Dixie Reindeer Lichen
<i>Cladonia terrae-novae</i>	Newfoundland Reindeer Lichen
<i>Cladonia uncialis</i>	Thorn Cladonia
<i>Cladonia verticillata</i>	Ladder Lichen
<i>Cladonia wainioi</i>	False Reindeer Lichen

<i>Hypogymnia</i> sp.	Tube Lichen
<i>Hypogymnium kroggiae</i>	Freckled Tube Lichen
<i>Ochrolechia androgyna</i>	Powdery Saucer Lichen
<i>Ochrolechia frigida</i>	Arctic Saucer Lichen
<i>Platismatia glauca</i>	Varied Rag Lichen
<i>Pycnothelia papillaria</i>	Gnome Fingers
<i>Sphaerophorus fragilis</i>	Fragile Coral Lichen
<i>Sphaerophorus globosus</i>	Coral Lichen
<i>Stereocaulon alpinum</i>	Alpine Foam Lichen
<i>Umbilicaria muhlenbergii</i>	Plated Rock Tripe

Bryophytes

<i>Anastrophyllum minutum</i>	Comb Notchwort
<i>Andreaea rupestris</i>	Black Rock-Moss
<i>Bazzania trilobata</i>	Three-lobed Bazzania
<i>Bucklandiella venusta</i>	a Bucklandiella moss
<i>Ceratodon purpureus</i>	Fire Moss
<i>Dicranum</i> spp.	Broom mosses
<i>Dicranum condensatum</i>	Condensed Broom Moss
<i>Dicranum montanum</i>	Mountain Broom Moss
<i>Dicranum polysetum</i>	Wavy-leaved Broom Moss
<i>Dicranum scoparium</i>	Common Broom Moss
<i>Dicranum spurium</i>	Spurred Broom Moss
<i>Dicranum undulatum</i>	Waved or Undulate Broom Moss
<i>Gymnocolea inflata</i>	Inflated Notchwort
<i>Hylocomium splendens</i>	Stair-step Moss
<i>Hypnum imponens</i>	Hypnum Moss
<i>Leucobryum glaucum</i>	Pincushion Moss
<i>Pleurozium schreberi</i>	Schreber's Moss
<i>Polytrichum commune</i>	Haircap moss
<i>Polytrichum juniperinum</i>	Juniper Haircap Moss
<i>Polytrichum piliferum</i>	Bristly Haircap Moss
<i>Ptilidium ciliare</i>	Ciliate Fringewort
<i>Ptilidium pulcherrimum</i>	Naugehyde liverwort
<i>Racomitrium lanuginosum</i>	Woolly Fringe Moss
<i>Schistidium maritimum</i>	Seaside Grimmia
<i>Sphagnum</i> spp.	Peat Mosses
<i>Sphagnum bartlettianum</i>	Bartlett's Sphagnum
<i>Sphagnum capillaceum</i>	Northern Peat Moss
<i>Sphagnum fallax</i>	Flat topped Peat Moss
<i>Sphagnum flavicomans</i>	Northeastern Peat Moss
<i>Sphagnum fuscum</i>	Rusty Peat Moss
<i>Sphagnum magellanicum</i>	Magellan's Peat Moss
<i>Sphagnum papillosum</i>	Brown fat-leaved Sphagnum
<i>Sphagnum tenellum</i>	Sphagnum tenellum
<i>Ulota phyllantha</i>	Frizzled Pincushion Moss



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