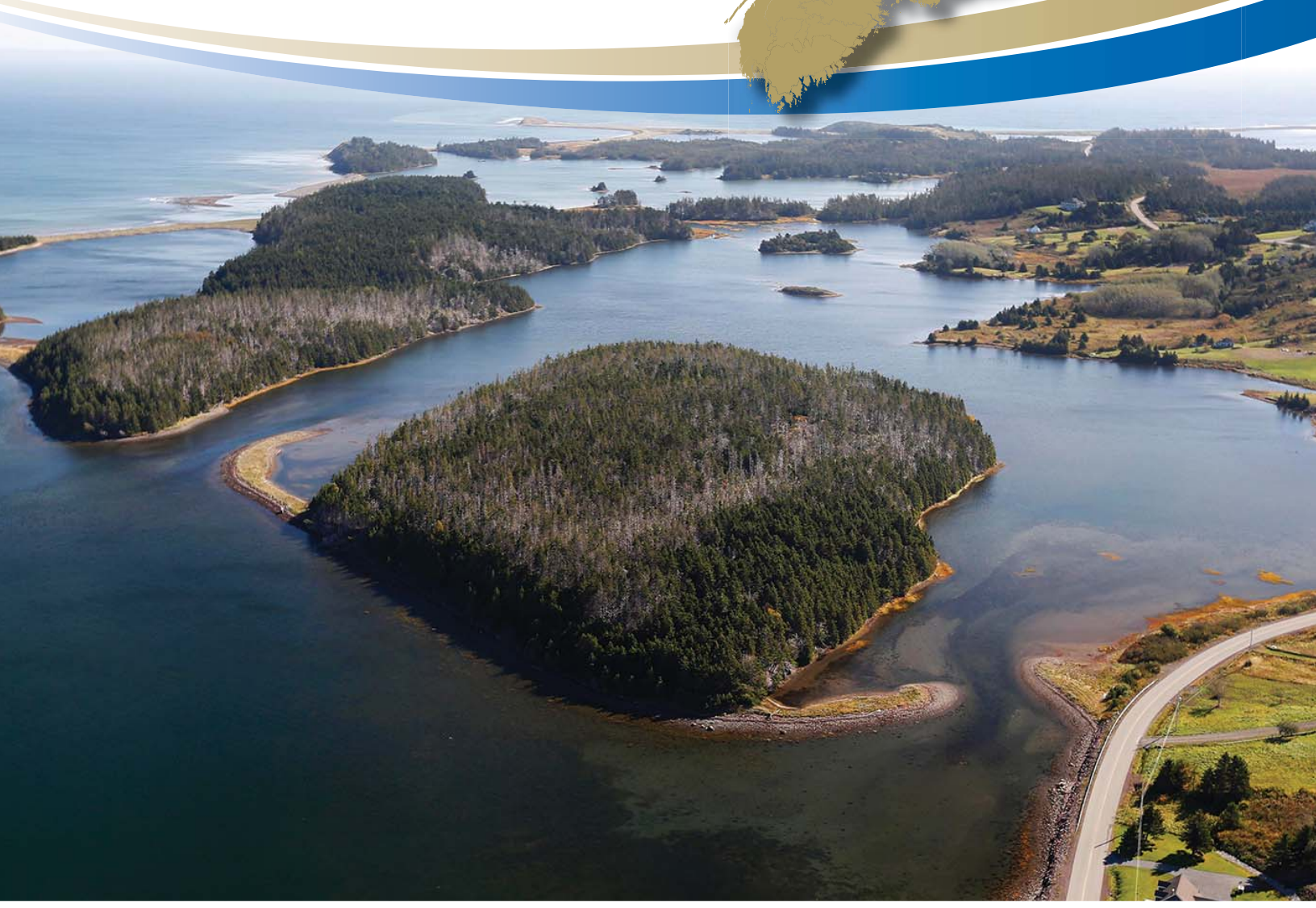
Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS CAPE BRETON COASTAL ECODISTRICT 810

PART 1: Overview of Ecodistrict
PART 2: Linking the Landscape to the Woodlot



ELA 2015-810

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 810: Cape Breton Coastal

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This report, one of 38 for the province, provides descriptions, maps, analysis, photos, and resources of the Cape Breton Coastal Ecodistrict.

The Ecological Landscape Analyses (ELAs) were analyzed and written from 2005 – 2009. They provide baseline information for this period in a standardized format designed to support future data updates, forecasts and trends. The original documents are presented in three parts: Part 1 – *Learning About What Makes this Ecodistrict Distinctive* – and Part 2 – *How Woodland Owners Can Apply Landscape Concepts to Their Woodland.* Part 3 – *Landscape Analysis for Forest Planners* – will be available as a separate document.

Information sources and statistics (benchmark dates) include:

- Forest Inventory (1995 to 1997) – stand volume, species composition
- Crown Lands Forest Model landbase classification (2006) – provides forest inventory update for harvesting and silviculture from satellite photography (2005), silviculture treatment records (2006) and forest age increment (2006)
- Roads and Utility network – Service Nova Scotia and Municipal Relations (2006)
- Significant Habitat and Species Database (2007)
- Atlantic Canada Data Conservation Centre (2013)

Conventions

Where major changes have occurred since the original ELA report was written, the new information will be provided in *italics,* so that the reader can see how some conditions have changed since the benchmark date of the ELA.

A glossary of definitions is provided for words that are underlined.

REPORT FOR ELA 2015-810

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An objective of ecosystem-based management is to manage landscapes in as close to a natural state as possible. The intent of this approach is to promote biodiversity, sustain ecological processes, and support the long-term production of goods and services. Each of the province's 38 ecodistricts is an ecological landscape with distinctive patterns of physical features. (Definitions of underlined terms are included in the print and electronic glossary.)

This Ecological Landscape Analysis (ELA) provides detailed information on the forest and timber resources of the various landscape components of Cape Breton Coastal Ecodistrict 810. The ELA also provides brief summaries of other land values, such as minerals, energy and geology, water resources, parks and protected areas, wildlife and wildlife habitat.

This coastal ecodistrict extends along the north shore of Chedabucto Bay and the east coast of Cape Breton Island and has a Maritime Boreal coastal forest. This forest includes stands of white spruce, balsam fir, and black spruce extending several kilometres inland. In sheltered areas and on drumlins occasional white pine and tolerant hardwoods will be found. However, red maple and white birch dominate the hardwood component of the coastal forests. Throughout the ecodistrict, small patches of jack pine and scattered red oak occur.

The coastal landscape is shaped by the waters and winds of the Atlantic Ocean, producing a stunning variety of islands, isthmuses, and inlets.

The coastal forests are subject to serious wind exposure and damage, abundant moisture, cool temperatures, a susceptibility to fungus attack, and windfall. As a result, balsam fir seldom exceeds 70 years of age. Windfall areas quickly regenerate to another crop of balsam fir.

Since the construction of the Canso Causeway in 1953, there has been no movement of spring ice from the Gulf of St. Lawrence through the Strait of Canso, where currents once flowed at about 20 knots per hour from St. Georges Bay.

The Atlantic Ocean and the lands it has helped shape create landscapes of striking beauty in the Cape Breton Coastal Ecodistrict.

The glacial history of the Cape Breton portion of this ecodistrict includes various depths of glacial deposits and drumlins.

Lakes and rivers are significant within this ecodistrict, accounting for 7% of the area.

Fortress Louisbourg is one of the main cultural and tourism attractions in the Cape Breton Coastal Ecodistrict.

The ecodistrict includes wilderness areas on Scatarie Island, at Gabarus, and Middle River Framboise, several provincial designated and non-designated parks and park reserves, and also a site of cultural and ecological significance at Baleine in Cape Breton County. The Fortress of Louisbourg National Historic Site is a major tourism attraction.

Private land ownership accounts for 56% of the total Cape Breton Coastal Ecodistrict area. Provincial Crown land makes up 33% of the ecodistrict. Only 4% is federal Crown land. The remaining lands are in transportation corridors, inland waters, and all other ownerships.

Landscapes are large areas that function as ecological systems and respond to a variety of influences. Landscapes are composed of smaller ecosystems, known as elements. These elements are described by their physical features – such as soil and landform – and ecological features – such as climax forest type. These characteristics help determine vegetation development.

Element descriptions promote an understanding of historical vegetation patterns and the effects of current disturbances. This landscape analysis identified and mapped six key landscape elements – one dominant matrix element, four smaller patch elements, and a corridor element – in Cape Breton Coastal.

Coastal Spruce is the matrix element, representing 51% of the ecodistrict. The main species in this element are the softwoods black spruce, white spruce, and balsam fir.

Coastal Mixedwood Hills and Drumlins is the largest patch element, representing 41% of the eocdistrict. In addition to the species in the matrix, this element also contains hardwood forests of red maple, yellow birch, and white birch. The other patch elements, in order of size, are **Wetlands**, **Coastal Beach**, and **Salt Marsh**. The two corridors in **Valley Corridors**, a linear element that usually follows major waterways, are the Mira River and the Grand River.

Forest Ecosystem Management
For Cape Breton Coastal Ecodistrict

The primary ecological goals of ecosystem-based management are to maintain and conserve ecosystem biodiversity, productivity, and resilience. Integration of economic, ecological, and social values within a single planning process provides opportunities for creative solutions to meet the challenges of sustainable resource management. By maintaining their integrity, ecosystems can better adapt to environmental stressors such as extended cycles of climate change, atmospheric pollution, changes in land use and vegetation cover.

This ELA provides detailed information on the resources and descriptions of various components of the landscape for Cape Breton Coastal Ecodistrict 810. Resources and their components include the natural elements that make up the landscape and may affect functions like connectivity – how a landscape enables or impedes movement of resources, such as water and animals – as well as conditions of forest composition, road density, and land use intensity.

Only brief summaries are presented for other land values, including minerals, energy and geology, water resources, parks and protected areas, wildlife and wildlife habitat. These summaries are included in the document to present the range of land values that must be balanced during the design stage of the land management process and are not intended to be exhaustive treatments of the respective land values. Where possible, the reader will be referred to additional sources for detailed information.

Application

The data in this ELA does not represent current inventory, but instead provides baseline conditions for the time when the report was researched, which in the case of the Cape Breton Coastal Ecodistrict was up to 2006. These baseline measurements can be used to assess trends through comparison with present and future inventories.

The ELA supports an approach to maintaining healthy ecosystems by mimicking natural conditions. The report describes the inherent natural structure and condition of landscapes based on enduring physical features, such as elements. It goes on to show how this structure may influence ecosystem functions, such as wildlife movement and connectivity. The ELA summarizes conditions of ecosystems such as forest composition, land use intensity, and road density at the time the report was written.

Finally, the relationship between inherent structure and existing conditions is used to guide future direction. The ELA is part of an ecosystem approach that will expand to encompass other initiatives of the Department of Natural Resources (DNR), such as The Path We Share: A Natural Resources Strategy for Nova Scotia 2011 – 2020 (http://novascotia.ca/natr/strategy/pdf/Strategy_Strategy.pdf).

The intention is to describe important ecological characteristics to consider during resource planning – the ELA is not a plan in itself.

Part 1: An Overview of Cape Breton Coastal – *Learning About What Makes This Ecodistrict Distinctive*

This first part of the report provides an overview of the ecodistrict for a broad readership. By reviewing several key topics, the reader will have a better understanding of the features that help give the area its character and set it apart as a distinct and unique ecodistrict.

Ecodistrict Characteristics

The 117,317-hectare Cape Breton Coastal Ecodistrict makes up 36% of the Atlantic Coastal Ecoregion, which extends along the coast of Nova Scotia from Scatarie Island to Yarmouth.

Sedimentary rocks, such as siltstones, sandstones, shales, and conglomerates predominate on the Chedabucto north shore, Isle Madame and northeasterly to Loch Lomond. From Point Michaud to Scatarie Island, the Fourchu Group of rocks (volcanic granites, rhyolites, and andesite) as well as metamorphic sedimentary (slate and quartzite) underlie a deep deposit of glacial till, sand, and gravels with the underlying bedrock visible only along the coast.

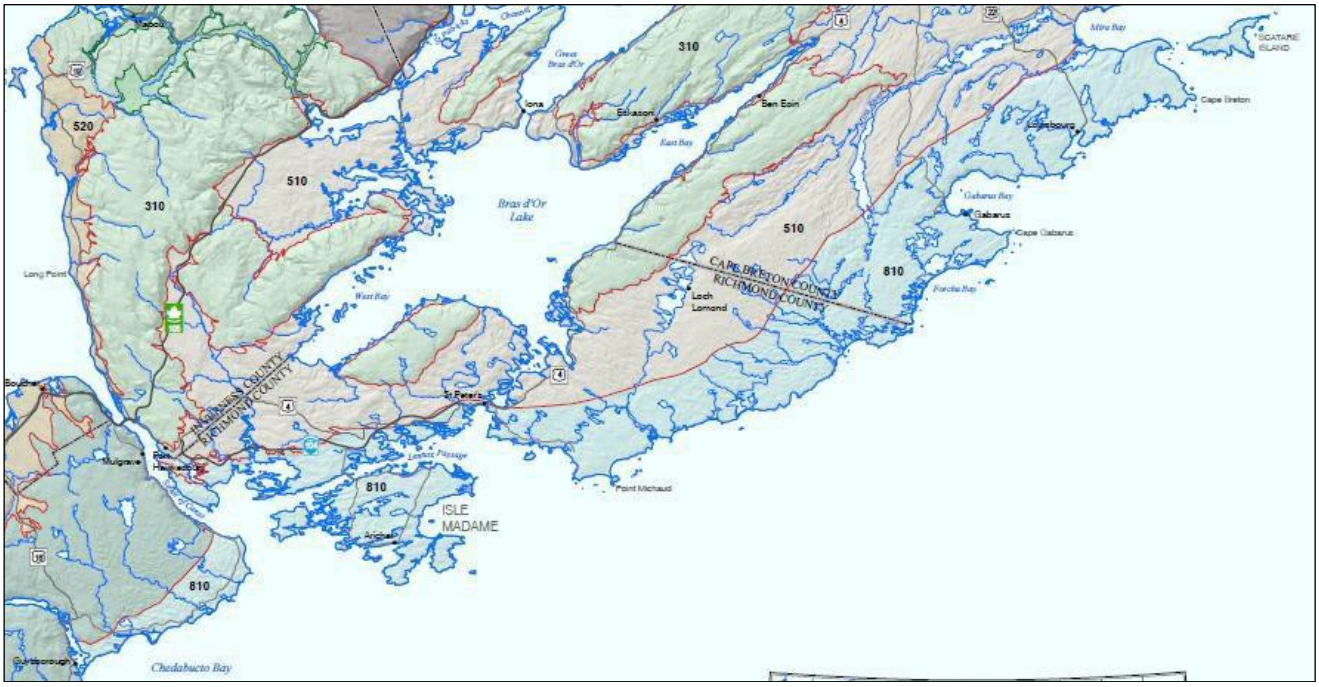
Two dominant soils define the ecodistrict. On the north shore of Chedabucto Bay fine-textured, well to imperfectly drained soils occur and extend to St. Peter's. From L'Ardoise to Mira Bay, coarse, better-drained soils are found, especially on the drumlins and elevated glacial deposits. However, several large areas of coarse-textured, imperfectly drained soils will be found around the bays of Fourchu and Gabarus and some poorly drained coarse soils occur at Little Lorraine.

The dominant forest of the Cape Breton Coastal Ecodistrict is the white spruce, balsam fir, and black spruce mix which is so prevalent in Nova Scotia's coastal forests and extends several kilometres inland, after which species of the Acadian Forest climax type start to appear.

For the most part, yellow birch and white birch with occasional red maple dominate the hardwood component of the coastal forests. In this ecodistrict, the red maple component is more prevalent in Guysborough and Cape Breton counties. The absence of white pine, sugar maple, and beech are usually strong indicators of a coastal influence.

The coastal forests are subjected to serious wind damage and exposure, abundant moisture and cool temperatures and are susceptible to fungus attack and consequent windfall, and so the balsam fir seldom exceed 70 years of age. These windfall areas quickly regenerate to another crop of balsam fir either from new seed fall or advanced regeneration. Other natural disturbance agents creating stand and individual tree mortality include spruce budworm, larch sawfly, and to a lesser extent fire.

See map on following page for overview of the Cape Breton Coastal Ecodistrict, including adjacent ecodistricts, locations of area towns and villages, county boundaries, and major waterways.



The Eastern Coastal Ecodistict 810 follows the eastern coastline of Cape Breton and the northern part of the mainland from Scatarie Island in the north to Guysborough in the south.
(From Ecodistricts of Nova Scotia map 2007)

Land Area

The Cape Breton Coastal Ecodistrict, one of five ecodistricts within the Atlantic Coastal Ecoregion, is predominantly rural. The main ownership is 56% private and 33% provincial Crown (Table 1).

Table 1 – Land Area by Ownership in the Cape Breton Coastal Ecodistrict*

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	38,627	32.9
Private	65,347	55.7
Federal	4,743	4
Aboriginal	0	0
Other (Includes inland water bodies and transportation corridors)	8,600	7.3
Total	**117,317**	**100**

*Note: Figures may vary slightly from table to table because of rounding, averaging, and overlapping of categories and other factors.

IRM Resource Classification for Provincial Crown Lands

The Integrated Resource Management (IRM) classification for Crown lands was developed through a public consultation process during the strategic phase of IRM completed in 2002.

Table 2 provides a summary of Crown lands designated as either C1, General Resource Use; C2, Multiple and Adaptive Use (allows most uses, but special management may be required); or C3, Protected and Limited Use (such as beaches and sites of cultural and historic significance).

Table 2 – IRM Land Use Categories for Provincial Crown Lands in Ecodistrict

IRM Land Use Category	Hectares	Percent of Crown Lands
C1 – General Resource Use	15,278	39.6
C2 – Multiple and Adaptive Use	17,902	46.3
C3 – Protected and Limited Use	4,255	11
Unclassified	1,192	3.1
Total	**38,627**	**100**

Land use by category size in Cape Breton Coastal is C2 (46%), C1 (40%), C3 (11%), and unclassified (3%).

Forests

Approximately 70% of the ecodistrict is forested, leaving 30% considered non-forested, such as wetland, barrens, agriculture, and urban sites (Table 3).

Current forests are dominated by softwood stands (75% or more softwood), which account for 67% of the forest cover. White spruce, balsam fir, and black spruce dominate the imperfectly drained soils, whereas the same softwood species mixed with yellow and white birch and occasional red maple are found on the better-drained medium to coarse-textured soils and drumlins.

Hardwood (75% or more hardwood) accounts for 9% and mixedwood for 17%. Yellow birch, white birch, and occasional red maple are the most common hardwood species, while the red maple component increases significantly in the western and eastern ends of the ecodistrict.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	81,448	69.4
Wetland	16,245	13.8
Agriculture	828	0.7
Barrens	2,768	2.3
Urban	4,105	3.5
Road, Trail, Utility	1,001	0.9
Other	10,922	9.4
Total	**117,317**	**100**

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 4.4 cubic metres per hectare per year (m^3/ha/yr), based on the ratings in Table 4. The average forest LC for the province is 4.9 m^3/ha/yr.

Some areas are not suitable for trees. These non-forested areas consist mainly of rock outcrops and barren lands.

Approximately 42% of forested land in the ecodistrict is LC 4 while 41% is LC 5. These ratings indicate that the land has good capability for forestry. Areas considered not suitable for growing fibre account for 20% of the area of the ecodistrict and consist mainly of poorly drained wetland and barren lands.

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	634	0.8
3	8,878	10.9
4	34,062	41.8
5	33,089	40.6
6	4,466	5.5
7 or more	319	0.4
Total	**81,448**	**100**

*Based on growth potential for softwood species.

NewPage Corporation, formerly StoraEnso Port Hawkesbury Ltd., is the major industrial manager in the ecodistrict. NewPage holds a license agreement on the Crown land and is the contractor for the province on the licensed Crown land, under the supervision of the DNR.
The former NewPage mill was purchased by a new buyer and re-opened in October 2012 as Port Hawkesbury Paper LP.


Softwood stands dominate in the Cape Breton Central Ecodistrict.

On the Crown land, forest harvesting and silviculture, such as planting and pre-commercial thinning, has been ongoing since the late 1950s.

Much the same forestry activity has been taking place on private holdings and the private land has been a major source of softwood pulp for the Port Hawkesbury mill since its opening. In the past there were many small sawmills operating in the ecodistrict, utilizing mostly private wood, but in recent years the number of these small mills has declined.

Water Resources

A significant feature of the Cape Breton Coastal Ecodistrict is the abundance of small rivers and streams that run to the Atlantic Ocean from the interior, as well as the numerous lakes. The lakes and rivers cover 7,748 hectares, or about 7% of the ecodistrict.

In Guysborough County, the St. Francis Harbour River runs across the ecodistrict and in Richmond County, the mouth of River Inhabitants passes through the ecodistrict as does River Tillard, Grand River, and the Framboise River.

The headwaters of the Mira River and Lorraine Brook are in the Cape Breton County part of the ecodistrict.

One designated water supply (Landrie Lake) and four non-designated water supply areas are found in this ecodistrict including the public water supply for the village of St. Peters (Beauvais Lake).

Water is an important provincial resource that must be considered in the context of IRM in general, and specifically within individual ecosystems.

The Marie Joseph Brook is one of several small waterways that provide an important water resource in the ecodistrict.

The Environmental Goals and Economic Prosperity Act, which was enacted in early 2007, has committed the province to prepare a comprehensive water strategy. This strategy will include a high-level evaluation of water resources. *Nova Scotia's water strategy can be found at http://www.novascotia.ca/nse/water.strategy/docs/WaterStrategy_Water.Resources.Management.Strategy.pdf*

Minerals, Energy and Geology

The Cape Breton Coastal Ecodistrict is underlain by rocks of the Mira (Avalon) Terrane. The ecodistrict can be separated into a northeastern area and a southwestern area based on bedrock geology.

The northeastern portion of the Ecodistrict is mainly underlain by Late Precambrian volcanic and sedimentary rocks (Stirling, Fourchu, and Main-à-Dieu groups). These Precambrian rocks are overlain in some areas by Cambrian and Carboniferous sedimentary rocks, and intruded by Late Precambrian and Devonian plutonic rocks.

The basement rocks in the southwestern portion of the ecodistrict are overlain by Carboniferous sedimentary rocks (Horton, Windsor, Cumberland, and Mabou groups). Devonian or Ordovician metamorphosed volcanic and sedimentary rocks outcrop on the southeastern side of Isle Madame.

The surficial geology of the Cape Breton Coastal Ecodistrict mainly consists of glacial till two to 30 metres thick. Drumlins are particularly abundant between Gabarus and Isle Madame. The

glacial deposits have affected the drainage pattern resulting in irregular lakes and wandering streams. Sections of shoreline contain recent marine or coastline sediments.

Minor glacial retreat and alluvial deposits contain limited sand and gravel resources. Surficial deposits make a major contribution to soil development and may be a source of aggregate. Unconsolidated granular aggregate has been extracted at a number of locations, especially in the Louisbourg and Gabarus areas.

Scattered across the ecodistrict are small organic deposits of sphagnum moss and peat, usually found in swamps and bogs. A number of peat moss deposits occur within the ecodistrict, primarily near Baleine and south of Gabarus. Several of the peat moss deposits are considered significant, such as Convict Point to Louisbourg Harbour, Deep Cove, and portions of the Gabarus Wilderness Area.

A number of base metal occurrences (e.g. zinc, copper, lead, and molybdenum) are found in the rocks of the Stirling, Fourchu, and Main-à-Dieu groups. Mineral exploration dates back to the late 1800s. Shafts and adits were driven on the more promising showings (13 documented abandoned mine openings have been found in the ecodistrict; undocumented abandoned mine openings may exist).

The Stirling mine was Nova Scotia's largest copper and zinc producer in the early to mid-1900s.

Potential geohazards, such as abandoned mine openings, potential karst areas, flood risk areas, sulphide-bearing slates, and underground coal workings, can be viewed at the following web sites:
http://gis4.natr.gov.ns.ca/website/nsgeomap/viewer.htm
http://gis4.natr.gov.ns.ca/website/mrlu83/viewer.htm
Please report any additional geohazards found on Crown lands to your nearest Natural Resources office.

The Stirling mine (1906 to 1956) was developed on the massive Mindamar sulphide deposit. The Stirling mine was Nova Scotia's largest copper and zinc producer and third largest lead producer. Favourable mineralization indicators can be traced north and south of the Mindamar deposit for several kilometres.

At Deep Cove, on the north side of Gabarus Bay, polymetallic sulphide mineralization (copper, lead, zinc, molybdenum) is associated with the Deep Cove Pluton. Significant mineralization (copper, lead, molybdenum) occurs immediately west of the Deep Cove area. Minor amounts of lead and zinc were mined near Arichat Harbour. Unexplored mineral occurrences and deposits may exist within the ecodistrict.

Currently, there are no active mines in the Cape Breton Coastal Ecodistrict.

Intrusive rocks, particularly those close to tidewater, are potential sources of aggregate materials for local and export markets (e.g. Capelin Cove granite).

The sedimentary rocks of the Carboniferous Period are targets for oil, gas, and coal exploration. These rocks provide source and reservoir rocks for hydrocarbons. Two petroleum boreholes drilled near Port Malcolm in the Cumberland Group had minor hydrocarbon shows (oil stained rock samples or minor gas response). The area from Lower L'Ardoise to Point Tupper is currently under a petroleum agreement. Approximately 5,000 tonnes of coal was historically mined near Inhabitants Bay.

The Windsor Group is known as a source of industrial minerals, including salt, potash, gypsum, anhydrite, limestone, and dolomite as well as a host for base metals, such as barite, celestite, and fluorite. Past production of these minerals and metals has made a major contribution to the mineral economy of the province for the last three decades and will remain a stable basis for the future. Within the Ecodistrict there are two documented salt deposits (one contains potash salts).

Several gypsum and limestone showings occur within the ecodistrict. Historically, small tonnages of gypsum (West Arichat), and limestone (Arichat and St. Peter's) were quarried. A dolomite quarry operated in the Catalone Lake area. The salt deposits have potential as underground gas storage sites. Underground gas storage cavern testing was conducted in the Port Richmond salt deposit in the 1970s.

Minerals in the Windsor Group can impact groundwater supplies, surface drainage, land development, and land use. Evaporate minerals of the Windsor Group, including gypsum, anhydrite, and salt are dissolved by circulating groundwater and contribute undesirable calcium,

sodium sulphate, and chloride to the water. Surface and near-surface karst terrains can adversely affect construction and development.

Parks and Recreation / Protected Areas

The Cape Breton Coastal Ecodistrict is characterized by an extensive coastline extending from the north shore of Chedabucto Bay, Guysborough County, all the way to Scatarie Island, Cape Breton County.

The DNR manages 27 properties within the ecodistrict as part of the provincial parks program.

Operational provincial parks encompass 200 hectares and include Battery, Point Michaud Beach, Port Shoreham Beach, Louisdale, Pondville Beach, and Lennox Passage.

Park reserves are located at Cove Road, Belfry, Arichat, Main-à-Dieu, Catalone Beach, Cap La Ronde, St. Esprit, False Bay, Cape Auguet and Poulamon and total 273 hectares.

A portion of the St. Peters rail corridor is also found in this ecodistrict.

Protected beaches are situated at Catalone Gut, Main-à-Dieu, Gabarus, Framboise, Point Michaud, Lower L'Ardoise, Pondville, Ragged Head Port Shoreham, Rocky Bay and Hadley Cove.

The Nova Scotia Department of Environment manages the Gabarus Wilderness area, which offers distinctive coastal scenery.

DNR has also identified two additional Crown properties as areas of interest to the provincial parks program based on an initial assessment of natural values and opportunities for outdoor recreation. These areas are located at Wild Cove, Gooseberry Cove, and Capelin Cove.

The Nova Scotia Department of Environment manages two wilderness areas within the Cape Breton Coastal Ecodistrict – Gabarus and Scatarie Island – which together encompass 5,245 hectares. In addition, the department is reviewing the potential designation of lands at Baleine under the Special Places Protection Act.

The federal government manages two national historic sites in the Cape Breton Coastal Ecodistrict – Fortress of Louisbourg and St. Peters Canal. These sites comprise 4,743 hectares.

Provincial parks and protected areas represent 4% of the ecodistrict. These properties, and in particular the two relatively large wilderness areas and the Fortress of Louisbourg National Historic Site, play an important role in protecting natural features and values.

From a parks and protected areas perspective, the importance of the Cape Breton Coastal Ecodistrict is due largely to the extensive coastline, much of which is relatively natural, and the opportunities provided for scenic viewing, saltwater recreation, and appreciation of the area's rich natural and cultural heritage. The Fortress of Louisbourg is a major tourism attraction.

Traditional recreational activities include boating, canoeing, hiking, hunting and fishing and, for about the last 25 years, ATV use has been very popular. There are many off-highway vehicle trails along the coastline and these sometimes extend into the interior. Many of these informal trails are located in sensitive habitats.

The most current and up-to-date information for parks and protected areas in this ecodistrict can be found at: http://novascotia.ca/parksandprotectedareas/plan/interactive-map/.

Wildlife and Wildlife Habitat

Wildlife in the Cape Breton Coastal Ecodistrict includes relatively common species of plants, animals and other organisms, along with some species that are rare and/or at risk in Nova Scotia.

Wildlife information for Cape Breton Coastal and other ecodistricts comes from a number of sources, including surveys, harvest statistics, hunter and trapper reports (abundance rankings), biological collections from harvested and road killed animals and observations and reports from the public and DNR staff. Information on important sites is documented by DNR in the Significant Habitats Database and by the Atlantic Canada Conservation Data Centre in Sackville, N.B.

Old forests are recognized as providing important wildlife habitat. The provincial goal is to have a minimum 8% for old forests on Provincial Crown land. Shade-tolerant hardwoods and softwoods may provide important wildlife structural components, such as cavity trees, and are encouraged across the landscape through appropriate silviculture systems.

Lakes and rivers are a significant portion of the ecodistrict, covering about 7,748 hectares or about 7% of the area. Wetlands, predominantly bogs and fens, also occupy a large part of this coastal area comprising a total of 15,660 hectares. In addition to those areas currently mapped as wetland, much of the forested land is imperfectly drained or worse, thus qualifying these sites as wetlands as well. Coastal barrens occur along the length of the ecodistrict and on many of the coastal islands, including Scatarie Island.

A large portion of this ecodistrict has been identified as significant wildlife habitat. These include sites with unusual concentrations of wildlife, habitats used by species at risk or habitats that are few in number in the province.

The low elevations and proximity to the coast make Cape Breton Coastal a good area for deer wintering, and 18 deer wintering areas (DWAs) have been identified, comprising a total area of about 10,000 hectares. The largest of these DWAs, Framboise/Lower St. Esprit, stretches along the coast for over 30 kilometres and varies from less than one kilometre to more than six kilometres in width inland from the coast, comprising 5,814 hectares.

Low elevations help make good deer wintering areas in the ecodistrict. Storm-tossed seaweeds provide a food source.

Within this large DWA, deer congregate from some distance inland, gradually confining their activity to the areas near the coast as winter progresses. Mature balsam fir and black spruce forests provide good protection from snow accumulation and storm-tossed seaweeds provide a source of food.

Areas frequented most often for foraging on seaweed include several small coves open to the ocean where seaweeds accumulate on sand or cobble beaches and rocky shores, particularly during winter storms (e.g. Fox Cove, Capelin Cove, and Kelpy Cove).

The juxtaposition of good softwood cover stands in close proximity to beach areas with plentiful stranded seaweed determines the most heavily used sites. Deer access the coast using a series of defined trails established throughout the area which are used consistently from year to year.

DWAs further inland and not associated with the coast are typically situated on sheltered slopes with close juxtaposition of good cover stands of mature conifers and hardwood browse for winter feed. Special management practices for these sites will help to ensure winter forest cover is maintained (see http://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_White-tailed_Deer.pdf).

Coniferous forests of fir and spruce predominate over much of the coastal area of Cape Breton Coastal Ecodistrict 810. The cool moist climate along the Atlantic Ocean lends a boreal character to these forests. Several birds characteristic of the boreal forest are common, including gray jay, boreal chickadee, ruby-crowned kinglet, and spruce grouse.

There are about two dozen eagle nests in the ecodistrict. Most eagle nests are located in close proximity to coastal water and typically are situated in forest stands that contain a number of super-canopy trees (for nesting), often along steep valleys and often associated with a stream.

White pine is the most common tree species used by eagles for nesting although other species of either coniferous trees (e.g. spruce) or deciduous trees (e.g. red maple) are also used.

Although a nest may be abandoned over time as individual trees become decadent, eagles tend to return to the same forest stands to nest year after year. Nesting eagles are sensitive to forest harvesting and other disturbance during the nesting season. Their dependence on suitable stands of nest trees may also be locally limiting.

Special management practices for eagle nests is aimed at maintaining nesting areas for years to come (see http://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_Bald_Eagle_Nests.pdf).

Ospreys nest along the length of the ecodistrict, often on coastal islands, from Isle Madame east to Baleine. Unlike eagles, ospreys prefer spruce trees or often manmade structures such as power and light poles to nest. Shallow coastal waters or inland lakes provide habitat for a variety of fish which are their chief prey.

Among the forest raptors that occur in the ecodistrict, goshawk is one of the species most sensitive to forest harvesting, silviculture, and other developments. Goshawk occurs throughout the ecodistrict and nests in mature hardwood and mixedwood stands. Although populations appear to fluctuate depending on abundance of snowshoe hare, forest stands suitable for nesting may be a limiting factor for this species locally. Most nests in this ecodistrict occur in yellow birch trees.

The coastal areas and offshore islands of Cape Breton Coastal are important habitat for waterfowl, seabirds, shorebirds, terns, herons, and ospreys, including many species that are colonial nesters. Coastal waters, wetlands, beaches, and cliffs are used by a variety of birds for staging, breeding, and wintering.

In winter, several sea ducks, including scaup, scoters, eiders, and long-tailed ducks, frequent the coastal areas with notable concentrations in the waters off Scatarie Island and in the area of Lennox Passage. Local concentrations of dabbling ducks, such as black ducks, and divers, such as mergansers, also occur in sheltered estuarine waters.

The coastal barrens along this shore from Scatarie Island to Cape Auguet in Isle Madame support staging whimbrel and occasional nesting colonies of Leach's storm petrel. Cliffs associated with coastal headlands support nesting colonies of gulls, black-legged kittiwake, black guillemot, and double-crested and great cormorant.

Shorebirds, including sandpipers, plovers, yellowlegs, dowitchers, and other species, congregate in numbers on mudflats and salt marsh during summer and fall migration from breeding areas farther north. A variety of species have been recorded at sites across the ecodistrict, from Port Shoreham Beach (Ragged Head) in Guysborough County east to Scatarie. The mudflat and salt marsh complex at the confluence of Fullers River and MacKenzies River at Fullers Bridge in Fourchu is a significant staging area for shorebirds.

Mudflats and beaches at Point Michaud beach attract a large number of species. In addition to the many common species, unusual birds such as red knot, buff-breasted sandpiper, and dunlin may be encountered along the shores of Cape Breton Coastal.

Beaches are used only occasionally by piping plover and no confirmed breeding has been recorded for this ecodistrict.

Seals whelp in localized sites along the shore with concentrations identified at several sites including coastal islands such as Hay Island off Scatarie.

Loons, which typically nest on islands or emergent beds within lakes or rivers, have been recorded at 22 lakes across the ecodistrict.

Atlantic salmon occur in at least 13 streams in Cape Breton Coastal. These waterways and several other streams and lakes provide good brook trout habitat and support runs of smelt and gaspereau. Shad, striped bass, and Atlantic sturgeon are found in a few locations. Among the freshwater mussels that occur in the ecodistrict, the eastern pearlshell occurs most commonly in larger streams such as Catalone River and Grand River.

Spruce grouse, as its name suggests, is a common resident of black spruce forests of the Cape Breton Coastal Ecodistrict.

The rare coastal plain plant New Jersey rush has been recorded at about 50 sites, most of which are in Richmond County. Ecodistrict 810 accounts for over 80% of the known population in Cape Breton. This plant grows on the edge of bogs and fens and has a distribution unlike many other coastal plain species, most of which are found in southwestern Nova Scotia. These are the only known locations in Canada for this plant and together they represent more than half of the known world population.

Boreal felt lichen was discovered in Cape Breton in 2008 at Framboise in the Cape Breton Coastal Ecodistrict. This area of Richmond County remains the centre of the species range in Cape Breton with about half of the known sites located in Ecodistrict 810. Boreal felt lichen, along with several species which share similar habitat – wet balsam fir forest along the Atlantic coast – is known from about 40 sites in the ecodistrict. Species that share similar forest habitat include salted shell lichen, northern coral lichen, old growth rag lichen, and textured lungwort lichen. Special management practices for forest harvest and silviculture in boreal felt lichen habitat will help to conserve this and related species (see http://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_Boreal_Felt_Lichen.pdf).

Significant dunes systems, such as those found at Belfry Beach, Morrisons - Framboise Beach, and Point Michaud Beach, provide a diversity of habitats for low-growing plants tolerant of high winds and salt spray. Salt-loving (halophytic) plants, such as American beach grass and beach pea, predominate nearest the ocean, gradually being replaced inland by lichens, low shrubs, such as bayberry, and stunted white spruce.

Several other rare plants are found in wet areas or on coastal headlands. Some of these are more common further north. For example, a bunchberry found in the ecodistrict is also found in Greenland.

The coastal area at Baleine in Cape Breton County has been identified as a significant wildlife habitat due to the presence of rare plants, especially the arctic-alpine floral species. Species found on the coastal barrens and bogs include spurred gentian, loose-flowered alpine sedge, multi-rayed goldenrod, northern blueberry, lesser wintergreen, marsh lousewort, and Michaux's dwarf birch.

The lands at Baleine are an outstanding example of undisturbed coastal ecosystems ranging from beaches and rocky shores to barrens, bogs, and coastal forest. Similar habitats also occur further west along the coast from Lorraine to Fortress Louisbourg.

The Baleine area provides an example of a relatively undisturbed coastal ecosystem.

Two coastal areas were listed by the International Biological Program (IBP) in the early 1970s: Gabarus-Belfry Gut for black-legged kittiwakes and fragile coastal vegetation, including grape-fern; and Point Michaud for its sand dune systems.

Since the time of the identification of these sites by the IBP, the Gabarus Wilderness Area has been established, incorporating much of the former IBP site. In a similar vein, the IBP site at Point Michaud is largely contained within the Point Michaud Protected Beach, which has since been established.

One Ducks Unlimited impoundment at Shoal Lake in Richmond County is currently maintained in Cape Breton Coastal. This unique site provides breeding habitat for a few unusual birds such as pied-billed grebe.

For more detailed and current information on species at risk and species of conservation concern in this ecodistrict, refer to Appendix 3 and Map 6 in a separate Part 3 of this document. These species are important components of the landscape and are given priority attention in planning, management, and stewardship activities.

With much of the ecodistrict privately owned, effective wildlife management will to a great extent rely on active, informed stewardship by the many landowners. The DNR can assist private land stewardship by providing knowledge and information on various management strategies. Legislation such as the Wildlife Habitat and Watercourse Protection Regulations, the Endangered Species Act, and the Environment Act's Activities Designation Regulations address species and habitat concerns within the forest and wetland ecosystems.

Wetlands, swamps, and bogs provide important wildlife habitat in the Cape Breton Coastal Ecodistrict.

Part 2: Linking the Landscape to the Woodlot – *How Woodland Owners Can Apply Landscape Concepts to Their Woodland*

This second part of the report provides information on how landscape concepts can be applied at the woodlot level. The starting point is an introduction to natural disturbances and succession to provide a foundation for better understanding forest ecosystems. The focus then shifts to elements that make up each ecodistrict and the forest groups and vegetation types at the stand level. This allows woodland owners to move between elements and stands to see how their woodland fits in with the larger landscape.

Forest Disturbances and Succession

Forest Disturbances

A disturbance can be described as an event, either natural or human-induced, that causes a change in the existing condition of an ecological system.

Disturbance pattern controls forest development classes (establishment, young, mature, multi-aged / old forest) and their distribution over area and time.

Due to the coastal location of Nova Scotia and its Maritime climate, the extent, intensity, and frequency of natural disturbances is difficult, for the most part, to predict. Prior to European settlement, natural disturbances were only curtailed by natural barriers such as water, climate, topography, and vegetation change. After about 400 years of activity by European settlers, the frequency, intensity, and magnitude of these natural processes has been affected.

New disturbances have been introduced as a result of human activity and include:

- clearing of forests for agriculture
- timber harvesting
- urbanization and development
- introduction of exotic animals, plants, and insects
- disease-causing agents, such as viruses or bacteria
- fire suppression in the forest
- changes in the chemical and physical characteristics of the atmosphere

Understanding how ecosystems respond to disturbances is critical to understanding how they function and how they can be managed. This will assist woodland owners and forest managers in:

i. assessing the potential for old forest stands and development class distributions
ii. determining appropriate patch sizes and species composition to emulate natural structures and processes

iii. prescribing the appropriate rotation age and development class structure across a forested landscape
iv. projecting future changes to the forest due to climate change and human disturbances
v. maintaining and conserving biodiversity

Natural disturbances are agents that abruptly change existing conditions and initiate secondary succession to create new ecological communities.

By adapting forest management practices to create the structures and processes that emulate natural disturbances, woodland owners and forest managers can help shape forest landscapes.

One approach that closely mimics nature is to allow ecosystems to naturally develop without active management. This approach is particularly effective on lands with long-lived tree species, such as red spruce, white pine, hemlock, sugar maple, yellow birch, and beech. One of the roles of protected areas is to allow this to occur and also to provide a model to compare with managed forests.

Natural Succession

Succession refers to the changes in vegetation types (communities) following disturbance which, over time, often leads to a climax stage. Most changes follow a course of vegetation community development (seral stages) for a particular disturbance regime.

Climax vegetation refers to vegetation communities that are relatively long-lasting and self-replacing. Three types of climax vegetation can be described as follows:

Climatic climax – Vegetation types that are mainly a function of regional climate conditions; these occur on sites with average (mesic) moisture and nutrient conditions.

Disturbance climax – Vegetation types which, due to frequency of disturbance, do not progress to the climatic climax.

Edaphic climax – Vegetation types that are mainly a function of soil and site conditions (i.e. low or excess moisture, low or high fertility) which do not progress to the climatic climax.

Another Definition of Succession

Succession, as defined by Odum (1971), is an orderly process of community development that involves changes in species structure and community processes with time; it is reasonably directional and, therefore, predictable.

Successional development generally proceeds through a number of distinct seral stages (e.g. early, middle, late) that replace one another in a predictable sequence and which culminates in a relatively stable and self-perpetuating community condition called a climax.

– From *Part 1: Vegetation Types (2010) of Forest Ecosystem Classification for Nova Scotia* *http://www.gov.ns.ca/natr/forestry/veg-types*

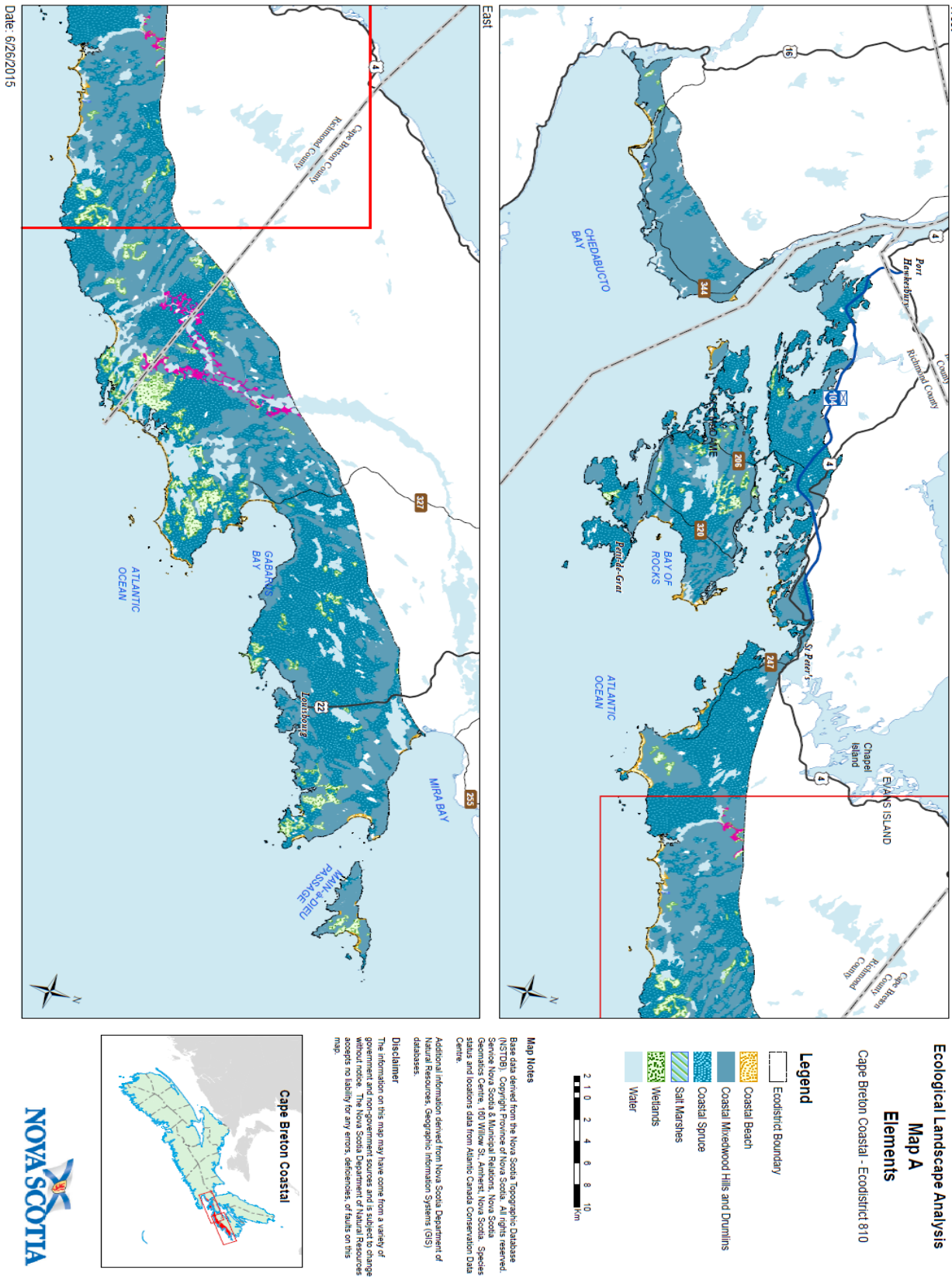
Cape Breton Coastal – Elements Defined

Landscapes are large areas that function as ecological systems and respond to a variety of influences. Landscapes are composed of smaller ecosystems, known as elements. These elements are described by their physical (e.g. soil, landform) and ecological features (e.g. climax forest type). These characteristics help determine vegetation development. Elements promote an understanding of historical vegetation patterns and present disturbances.

A landscape profile identified and mapped six distinctive elements in the Cape Breton Coastal Ecodistrict – one matrix, four patches and a corridor (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types. Corridors are natural linear communities, such as river valleys, that link parts of the ecodistrict.

Coastal Spruce is the matrix element, representing 51% of the ecodistrict. The main species in this element are the softwoods black spruce, white spruce, and balsam fir. **Coastal Mixedwood Hills and Drumlins** is the largest patch element, representing 41% of the eocdistrict. In addition to the species in the matrix, this element also contains hardwood forests of red maple, yellow birch, and white birch. The other patch elements, in order of size, are **Wetlands**, **Coastal Beach**, and **Salt Marsh**. The two corridors in **Valley Corridors**, a linear element that usually follows major waterways, are the Mira River and the Grand River.

Map of Elements in Ecodistrict



Forest Stands Within Elements

Each element contains a number of forest stands that can be classified by vegetation, soil, and ecosites. The DNR publication ***Forest Ecosystem Classification for Nova Scotia, Part I: Vegetation Types (2010)*** (http://novascotia.ca/natr/forestry/veg-types/veg-navigation.asp) is helpful in identifying forest plant communities.

Viewed online or available in print through DNR, woodland owners can learn about the characteristics of a particular forest community. Refer to Table 5a for descriptions of elements and Table 5b for forest vegetation types that are likely to be found within elements.

Forests that grow near the coastline are one of the distinctive features of the Cape Breton Coastal Ecodistrict.

Table 5a – Elements Within Cape Breton Coastal		
Element	**Size (Hectares)**	**Element Description**
Coastal Spruce (Matrix)	56,344 51.4%	This matrix element occurs on a variety of topography features, such as hummocks, drumlins, flats, ridges, and-low level hills. Soils are well to imperfectly drained, fine to medium-textured glacial tills. Typically forests of black spruce, white spruce, and balsam fir occur either as mixedwood or single species-dominated stands. White pine will form a minor component of stands in sheltered locations. The exceptions to the dominant matrix forest are the few small patches of hardwood covertypes comprising yellow birch, white birch, and red maple that occur on the crests and upper slopes of the well-drained drumlins and on the well-drained medium to coarse-textured soils associated with hummocky or ridged terrain. As soil drainage gets progressively poorer, wet forests of red maple, black spruce, tamarack, alders, false holly, winterberry, and ericaceous woody shrubs occur, usually on the lower slopes and flats. Often embedded within this element are wet open woodlands, bogs, swamps, fens, and seasonally flooded flats.
Coastal Mixedwood Hills and Drumlins (Patch)	45,369 41.4%	Well-drained drumlins and low hills make up the majority of this patch element with the primary area between St. Esprit and Framboise. Black and white spruce and balsam fir are the dominant forest species on the lower slopes and flats but hardwood forests of red maple, yellow birch, and white birch dominate the crests and upper slopes. A mixedwood forest of fir and birch with red maple often occupies the middle slope and can transition between the mixedwood and hardwood covertypes depending on disturbance and successional stage. White pine is found occasionally in sheltered locations. Frequent, stand-level disturbances due to windthrow or insects or natural old age create opportunities for abundant advanced regeneration of fir. On mixedwood sites, red maple and white birch will initiate an earlier successional forest following stand-level disturbances. Where forests have been cleared for settlement and later abandoned, forests of white spruce and tamarack are common.
Wetlands (Patch)	5,659 5.2%	The wetlands element comprises bogs, fens, swamps, and poorly drained areas (salt marshes are excluded). In this ecodistrict, Wetlands is a patch element that occurs primarily as a complex of bogs and fens and imperfectly to poorly drained hummocks. Other occurrences of wetlands include complexes associated with rivers and lakes, narrow linear communities associated with flow accumulations and small streams, communities of hydrophytic vegetation associated with level terrain where drainage is impeded, or depressions in the terrain where water remains in excess year round. Smaller disjoint wetlands are often embedded within other elements, especially where imperfectly drained soils are dominant. Wetlands are located throughout the ecodistrict with larger areas near Fourchu and Gabarus. Wetlands are generally treeless or sparsely forested woodlands which, due to the limitations for tree growth, remain in an open seral type of vegetation. For the most part, sites are underlain by poorly drained mineral soils or organic soils derived from peat (sphagnum mosses) or sedges.

Table 5a – Elements Within Cape Breton Coastal		
Element	**Size (Hectares)**	Element Description
Coastal Beach (Patch)	1,122 1%	Coastal beaches are wave-dominated deposits composed of a mixture of sand, gravel, cobbles, and other sizes of sediments and occur under a variety of circumstances leading to several types of beach landforms. These can be barrier beaches, spits, tombolos, or pocket beaches. Barrier beaches are the most common type along the Cape Breton Coastal Ecodistrict. The longest stretch of barrier beaches occurs from Cape Gabarus to Fourchu, where cobble and gravel beaches connect the islands and headlands along a distance of over 15 kilometres. These barrier beaches enclose numerous lagoons and lakes, with Belfry Lake and Winging Point Lake as good examples. In most cases, the lagoons and lakes are brackish. Small inlets occur along the beaches and the larger lakes receive considerable drainage from the upland. Tombolos are beaches formed in the lee of islands where wave action is reduced and they extend from the mainland shore to the island forming a permanent connection. A good example of a tombolo is at Port Shoreham and at Point Michaud, where a double tombolo connects the smaller island to the larger. Where stable conditions have developed on these coastal beaches, a variety of vegetation can become established. Pioneer species such as beach grass and associates occur near the high-water mark.
Salt Marsh (Patch)	15 <0.1%	Along the coast there are a few small areas that are periodically flooded by the tide and are mapped as salt marshes. The best examples are near Port Shoreham and St. Esprit where salt marshes have formed from coastal sediments deposited in low-lying, sheltered, intertidal areas or behind spits, bars or islands, and protected bays. Deposits of silty clay loam sediments with semi-decomposed grasses and sedges trapped in the accumulating layers form along the tidal shores. The dominant natural vegetation is grasses, such as saltwater cordgrass and salt meadow cordgrass. Certain grasses are found on the drier and higher marsh microsite, which is flooded less frequently. The lands have not been used for agriculture other than for pasture or the harvesting of salt marsh grass for hay or bedding for livestock.
Valley Corridors (Corridor)	1,063 1%	There are two corridors that have been identified in the Cape Breton Coastal Ecodistrict. They are the Mira River and Grand River corridors. The Mira River corridor runs from just north of Victoria Bridge and follows the drainage to the uppermost headwaters of the river and then over a short divide and follows the Framboise River system to the coast. This corridor is traveled by people and aquatic animals, as well as anadromous fish species. Softwood stands predominant, with white spruce, black spruce, and balsam fir being the main species. In the portions of the corridor that pass through the Coastal Mixedwood Hills and Drumlins patch element, the softwood species again predominate but the content of mid to late seral stage hardwood species, such as yellow birch and white birch, are found in some abundance.
Total	**109,572***	*Area is not the same as in Table 1 because water has not been included.

Table 5b – Forest Vegetation Types[1] Within Elements in Cape Breton Coastal

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Coastal Mixedwood Hills and Drumlins	OF1, OF2, OF4	7	CO5	18	**CO4, CO6**	64
Coastal Spruce	OW1, OW2, CO5, SP1, SP6			30	**CO1, CO2, CO4,** SP4, SP5	57
Salt Marsh	Grasslands of *Spartina spp.*					
Coastal Beach	CO7, Beach grass, Bayberry, Rose spp., White spruce					
Wetlands	WC1, WC2, WC3, WC6, WC7, WD2, WD3, WD4, WD6, SP7					

View forest groups and vegetation types at
http://novascotia.ca/natr/forestry/veg-types/veg-navigation.asp
To help with identification of vegetation types, the 14 forest groups in Nova Scotia designated by DNR are: Cedar (CE), Coastal (CO), Flood Plain (FP), Highland (HL), Intolerant Hardwood (IH), Karst (KA), Mixedwood (MW), Old Field (OF), Open Woodland (OW), Spruce Hemlock (SH), Spruce Pine (SP), Tolerant Hardwood (TH), Wet Coniferous (WC), Wet Deciduous (WD)
Bolded vegetation types indicate typical late successional community
[1] Forest Ecosystem Classification for Nova Scotia (2010)
*Percentage of element in each successional stage. Percentages may not total 100 due to unclassified lands (such as clearcuts and regenerating stands) not being included.

Photos Illustrating Vegetation Types in Elements

The following photos show some of the vegetation types expected to be found within their respective elements.

Balsam fir / Foxberry – Twinflower (CO4) is a late successional vegetation type found in the Coastal Spruce matrix element.

White spruce / Aster – Goldenrod / Shaggy moss (OF1) is an early successional vegetation type found on abandoned farmland in the Coastal Mixedwood Hills and Drumlins element.

White spruce / Bayberry (CO7) is a vegetation type found in the Coastal Beach element.

A foxberry plant grows in the trunk of a tree in a Black spruce / Cinnamon fern / Sphagnum (WC1) vegetation type found in the Wetlands element.

Landscape Composition and Objectives

Landscapes contribute to the maintenance and conservation of native biodiversity. Managing landscapes for biodiversity requires a variety of planning approaches and tools. Sustaining forest composition diversity by reflecting natural patterns of disturbance and succession is one approach that DNR is employing to try and realize this objective. DNR is developing a number of additional approaches and planning tools which will be integrated with objectives defined in the ELA protocol.

Human activities, such as forest harvesting, can have a significant impact on the structure and composition of the forested landscape. Well-planned harvesting can provide a tool to achieve landscape composition goals.

Natural Disturbance Regimes

Three natural disturbance regimes dominate natural forests:

Frequent Stand Initiating – Disturbances usually occur more frequently than the average life span of the dominant species and are of sufficient intensity to kill most of the existing mature trees, thereby promoting the establishment of a new forest within a relatively short period. Some unharmed trees often survive the disturbance in pockets and/or as scattered individuals.

Infrequent Stand Initiating– The time between stand-initiating disturbances is usually longer than the average longevity of dominant species, thereby supporting processes of canopy gap formation and understory development in mature forests.

Gap Replacement – An absence of stand-initiating disturbances supports the development of a dominant overstory that is sustained through dynamic processes of canopy gap formation, understory development, and overstory recruitment. Gap formation ranges from individual tree mortality to the replacement of a small group of trees.

In the Cape Breton Coastal Ecodistrict, frequent stand-initiating disturbances are the predominant natural disturbance shaping the diversity of forest ecosystems. These disturbances occur frequently enough that there is a rapid mortality of an existing stand and quick establishment of a new stand of relatively even age.

The disturbance agents in the ecodistrict associated with frequent disturbances include insects and wind and, in some locations, fire has played an important role as well, especially in the past.

The forest ecosystems that arise from this disturbance type include softwood forests of white and black spruce and balsam fir. In parts of Isle Madame, jack pine grows, possibly as a result of fire disturbance in the past.

In areas of the ecodistrict where the interval between disturbance events is normally longer than the average longevity of the dominant species (e.g. infrequent and gap stand-initiating disturbances) gap dynamics and understory recruitment evolve and become evident.

Compared to other ecodistricts, such as Cape Breton Hills, the occurrence of forest ecosystems characterized by gap and small patch mortality followed by understory recruitment – resulting in stands with multiple age classes – are unusual. These gap disturbances usually only occur where the well-drained drumlin soils allow for the existence of hardwood stands of yellow and white birch and some red maple. Gap mosaic disturbance regimes generally lead to establishment and/or perpetuation of late successional vegetation types.

Fire in Cape Breton Coastal

The incidence of fire in the Cape Breton Coastal Ecodistrict in modern times is rare, but fires were quite common in the days of early European settlement when fires were intentionally set to clear the forest for pasture. The presence of jack pine in several places on the Canso Peninsula and on Isle Madame suggests that the constant winds may create a drought condition that is conducive to wildfire.

Forest Composition

Forest disturbances lead to forest renewal and the development of young forest habitats with characteristic successional patterns. Management of landscapes to conserve biodiversity requires sustaining ecologically adequate representation of natural habitat diversity, among a number of other measures and planning approaches.

At a landscape planning scale, the variety of habitats can be broadly described in terms of the composition of development classes, seral stages, and covertypes.

Development Classes describe changes in structure and process as forests age and trees grow larger. For landscape management purposes, four development classes are recognized:

- forest establishment (0 to 6 m height)
- young competing forest (7 to 11 m height)
- mature forest (> 11 m height; including multi-aged and old forest)
- multi-aged / old forest (multiple layered)

Within this simplified description there is considerable variation in the processes and structures that evolve in particular stands. When the current forest inventory is used to classify development classes, the height criterion is used. When forecasting future conditions using the Forest Model, the age criterion is preferred.

Harvesting and silviculture activities, such as planting and thinning, have been ongoing on Crown land since the 1940s.

Seral Stages describe changes in species composition of forest communities as succession progresses from domination of early seral “pioneer” species following disturbance, toward late seral communities dominated by long-lived, shade-tolerant “climax” species. Seral stage is dependent on the composition of tree species of a forest, irrespective of age. For landscape management purposes, three seral stages are recognized:

- early
- mid
- late

Early successional species are those that do well in direct sunlight and include white and grey birch, aspen, poplar, white spruce, tamarack, pin cherry, jack pine, and red pine. These species grow quickly, but are usually short-lived.

They are replaced by mid-successional species that can tolerate moderate amounts of shade, such as white ash and red oak.

Late successional species generally have a high shade tolerance and include hemlock, red spruce, sugar maple, and beech, as well as yellow birch and white pine. The species often develop slowly in shaded understories and can be long-lived and form old growth.

Covertypes descriptions further refine landscape composition by distinguishing forests of different community conditions. Management generally recognizes three forest covertypes:

- softwood (overstory cover of softwood species is 75% or more)
- hardwood (overstory cover of hardwood species is 75% or more)
- mixedwood (overstory cover of either softwood or hardwood is between 25% and 75%)

Forest Composition Objectives

Within ecodistricts, the forest composition should contain a range of conditions that sustain the inherent forest communities and dominant natural disturbance regimes. Table 6 provides target ranges for development class and seral stage composition appropriate for different disturbance regimes. These ranges have been derived from the professional judgment of DNR forest ecologists to guide composition objectives for large landscape areas.

Woodland owners can use this guidance to assess how their holdings contribute to the overall ecodistrict structure by referring to the landscape element bar charts that illustrate where deficiencies exist. For example, landowners who have a large amount of mature forest in an element where this is in short supply can recognize the contribution of their holdings to the overall health of the landscape.

Four hundred years of European settlement in the Acadian region has left insufficient natural landscape structure to confirm these ranges. Facing similar challenges, a comprehensive modeling approach was used by the Ontario Ministry of Natural Resources to support “range of variation” targets for natural disturbance regimes in the Great Lakes St. Lawrence region (http://www.ontario.ca/document/forest-management-great-lakes-and-st-lawrence-landscapes).

A full description of definitions and mapping of Nova Scotia’s disturbance regimes is contained in the report “Mapping Nova Scotia’s Natural Disturbance Regimes” available from the DNR website (http://novascotia.ca/natr/library/forestry/reports/NDRreport3.pdf).

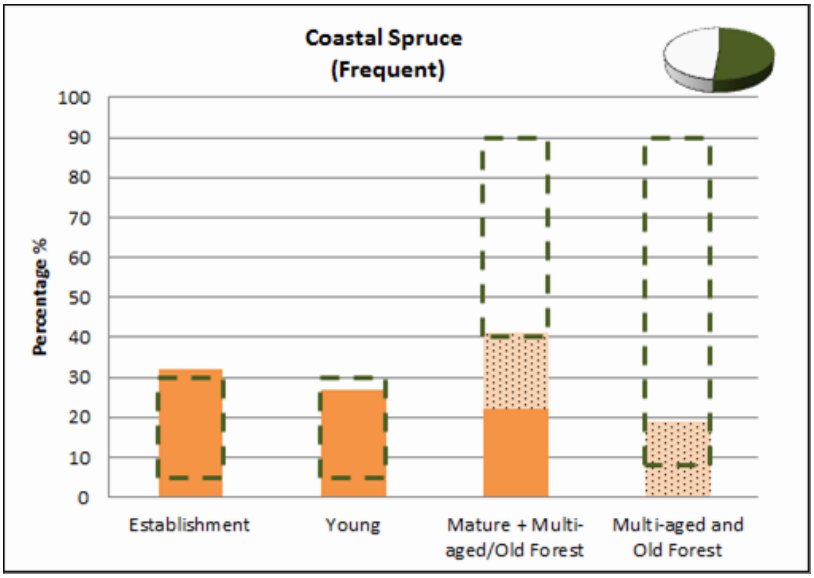
Table 6 - Landscape Composition Target Ranges (by Development Class / Disturbance Regime)				
Natural Disturbance Regime	**Development Class**			
	Forest Establishment	**Young Competing Forest**	**Mature Forest (including multi-aged and old forest)**	**Multi-aged and Old Forest**
Frequent Stand Initiating	5 - 30%	5 - 30%	>40% early, mid, and late seral representation	>8%
Infrequent Stand Initiating	5 - 20%	5 - 20%	>60% most in mid and late seral stages	>16%
Gap Replacement	0 - 15%	0 - 15%	>70% most in late seral stage	>24%

Table 6 indicates that for frequent stand-initiating disturbances, both establishment and young development class forests would typically comprise between 5 and 30% of area, while mature forest – which includes multi-aged and old forest – would cover more than 40%. Mature forest should consist of a relatively even balance of early, mid, and late successional stands. At least 8% of the mature forest should be in the multi-aged and old forest class. The targets for the other disturbance regimes are shown in Table 6. Forest planning should strive to maintain composition within these targets, and identify corrective and mitigating measures when outside these ranges.

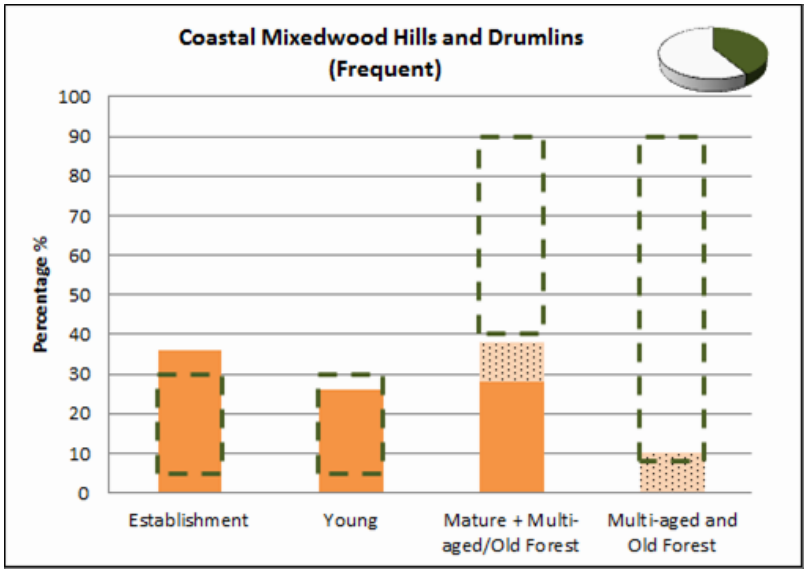
Development Class Targets by Element

The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime. The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage of each development class at the time the original data was gathered. The dotted area in the mature class shows the amount of multi-aged and old forest area included. The coloured portion of the small pie chart in the corner of the graphic shows the relative size of the element within the ecodistrict.

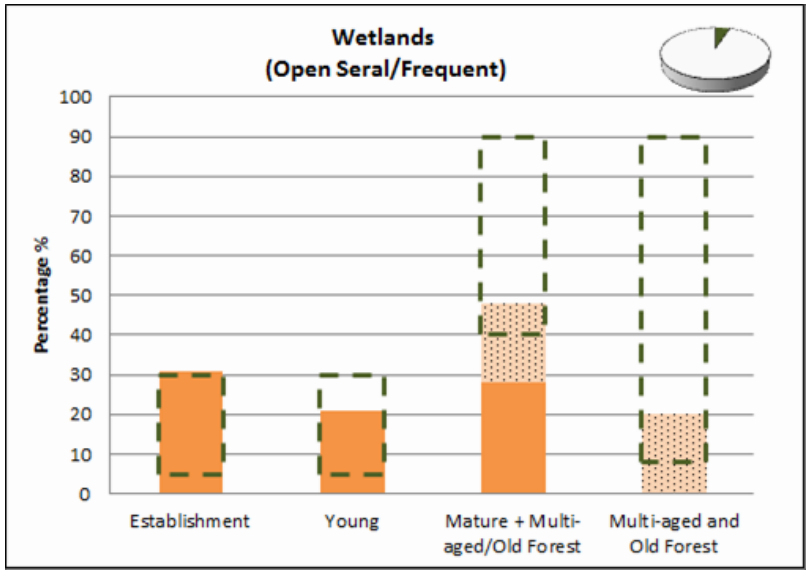
In **Coastal Spruce**, the establishment and young development classes are at or near their maximum target levels. Forest harvesting of rapidly declining stands can continue with patch sizes consistent with those created by natural disturbances. Adequate advanced regeneration of fir and spruce at time of harvest will aid ecosystem recovery.



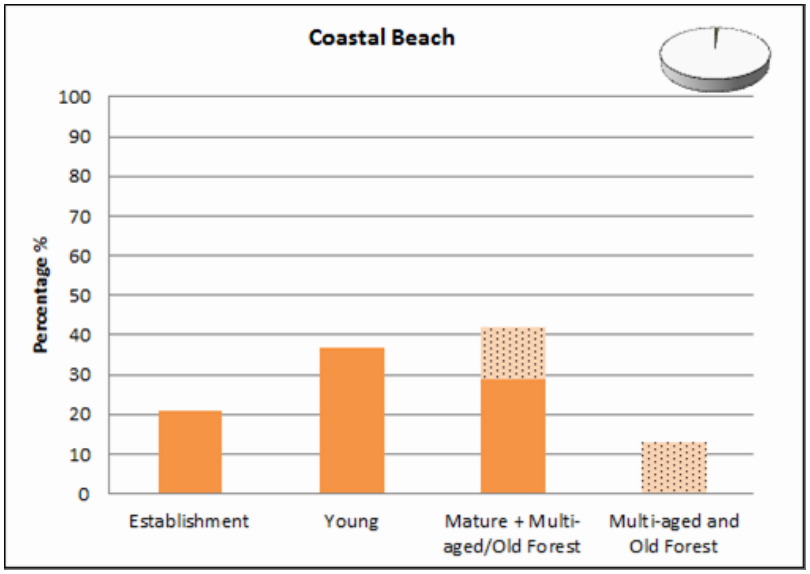
In **Coastal Mixedwood Hills and Drumlins**, the establishment and young development classes are at or near their maximum target levels. Mature and old forest classes are just below their lower target levels. Partial harvesting in wind-firm mixedwood and hardwood stands will help maintain mature forest cover. Removal of declining fir in mixedwood and softwood stands when adequate natural regeneration is present will hasten stand recovery.



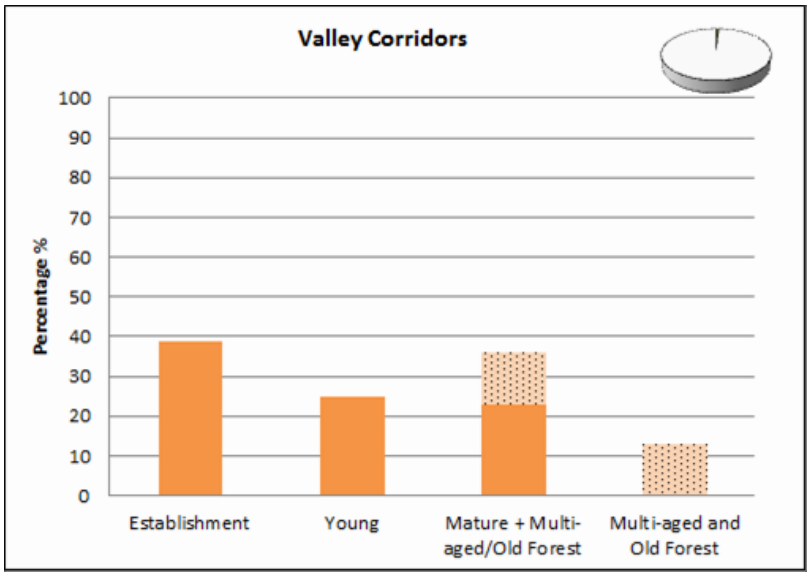
The **Wetlands** element is variably composed of forest interspersed with woodlands and open wetlands. Disturbances are often patchy, reflecting the diverse structure. The relatively high amount of establishment and young may reflect height growth limitations in poor sites, as well as past harvesting. Some thinning opportunities may exist, as well as potential for small patch harvesting.



The small amount of forest associated with the **Coastal Beach** element has a balance of development classes. This uncommon habitat provides important interface to the coastal ecosystems. Forestry operations should employ special practices to protect sensitive sites.



In **Valley Corridors**, a corridor element that can include parts of the other elements and therefore does not have a dominant disturbance regime, the establishment class is close to 40% of the total. When combined with the young class, these two groups represent more than 60% of the total.



Summary of Parts 1 and 2

This ends the first two parts of this report, which are available online to anyone who wants to view them. The intent was for the first part to provide a general overview of the ecodistrict for members of the public. The second part was designed for woodland owners to show how landscape ideas, such as elements, can be applied at the woodlot level.

The third part of the report, which includes more detailed information, maps, appendices, glossary, and literature citations, is designed for forest planners, managers, ecologists, analysts, and interested woodland owners.

Changing light on the coast of the Cape Breton Coastal Ecodistrict.

Glossary A: Terms in Parts 1 and 2

Biodiversity	The diversity of plants, animals, and other living organisms, in all their forms and level of organization, including genes, species, ecosystems, and the evolutionary and functional process that link them.
Canopy	The uppermost continuous layer of branches and foliage in a stand of trees.
Climax forest community	A relatively stable and self-perpetuating forest community condition that maintains itself (more or less) until stand-level disturbance causes a return to an earlier successional stage. The final stage of natural succession for its environment.
Climax vegetation	A forest or non-forest community that represents the final stage of natural succession for its environment.
Coarse filter approach	A habitat-based approach to conserving biodiversity by maintaining a natural diversity of structures within stands, and representation of ecosystems across landscapes. The intent is to meet the habitat requirements of most native species over time. Usually combined with a fine filter approach to conserve specific rare species and ecosystems.
Composition	The proportion of biological components within a specified unit such as a stand or landscape: **Stand or Species Composition.** The proportion of each plant species in a community or stand. May be expressed as a percentage of the total number, basal area, or volume of all species in that community. **Landscape Composition.** The proportion of each community type within a landscape. Community type may be defined by vegetation type, covertype, seral stage, or development class (age).
Connectivity	The way a landscape enables or impedes movement of resources, such as water and animals.
Converted	Lands removed from a natural state (e.g. forest) and changed to other uses (e.g. agriculture, urban, settlement, road).
Corridor	Corridors are natural linear communities or elements, such as river valleys, that link parts of the ecodistrict. They are a fundamental feature of the "matrix, patch, corridor" concept of landscape structure.

Crown land and Provincial Crown land	Used in these Ecological Landscape Analysis reports to include all land under the administration and control of the Minister of Natural Resources under the Forests Act, Section 3; as well as the lands under the administration and control of the Minister of Environment under the Wilderness Areas Protection Act. Also includes Federal Parks in the accounting of protected area representation.
Covertype	Refers to the relative percentage of softwood versus hardwood species in the overstory of a stand. In this guide, covertype classes are: **Softwood:** softwood species compose 75% or more of overstory **Hardwood:** hardwood species compose 75% or more of overstory **Mixedwood:** softwood species composition is between 25% and 75%
Development class	The description of the structure of forests as they age and grow (e.g. establishment forest, young forest, mature forest, multi-aged / old forest).
Disturbance	An event, either natural or human-induced, that causes a change in the existing condition of an ecological system.
Ecodistrict	The third of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecoregions. Characterized by distinctive assemblages of relief, geology, landform, and vegetation. Used to define the landscape unit for these Ecological Landscape Analysis reports.
Ecological land classification	A classification of lands from an ecological perspective based on factors such as climate, physiography, and site conditions. The Ecological Land Classification for Nova Scotia Volume 1 delineates ecosystems at five hierarchical scales: ecozone, ecoregion, ecodistrict, ecosection, and ecosite.
Ecoregion	The second level of the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecozone. Used to characterize distinctive regional climate as expressed by vegetation. There are nine ecoregions identified in Nova Scotia.
Ecosection	The fourth of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecodistricts. An ecological land unit with a repeating pattern of landform, soils, and vegetation throughout an ecodistrict.
Ecosite	The fifth of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecosections. Characterized by conditions of soil moisture and nutrient regimes. Although not mapped, the Acadian and Maritime Boreal ecosites of the province are fully described in the Forest Ecosystem Classification for Nova Scotia (2010).

Ecosystem	A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size – a log, pond, field, forest, or the Earth's biosphere – but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, such as a forest ecosystem, old-growth ecosystem, or range ecosystem. Can also refer to units mapped in the DNR Ecological Land Classification system.
Element	A landscape ecosystem containing characteristic site conditions that support similar potential vegetation and successional processes. Elements were mapped by combining ecosections with similar climax vegetation and natural disturbance interpretations. Depending on their role in the ecosystem, elements may be described as matrix, patch or corridor.
Endangered species	A wildlife species facing imminent extirpation or extinction. A species listed as endangered under the federal or Nova Scotia endangered species legislation (NS Endangered Species Act or federal Species at Risk Act).
Even-aged	A forest, stand, or vegetation type in which relatively small age differences exist between individual trees. Typically results from stand-initiating disturbance.
Extinct species	A species that no longer exists. A species declared extinct under federal or Nova Scotia endangered species legislation (NS Endangered Species Act or federal SARA).
Extirpated species	A species that no longer exists in the wild in Nova Scotia but exists in the wild outside the province. A species declared extirpated under federal or Nova Scotia endangered species legislation (Nova Scotia Species at Risk Act or federal SARA).
Forest management	The practical application of scientific, economic, and social principles to the administration and working of a forest for specified objectives. Particularly, that branch of forestry concerned with the overall administrative, economic, legal, and social aspects and with the essentially scientific and technical aspects, especially silviculture, protection, and forest regulation.
Frequent stand initiating	Disturbances usually occur more frequently than the average lifespan of the dominant species and are of sufficient intensity to destroy most of the existing trees, promoting a new forest within relatively short periods of time.

Gap replacement	An absence of stand-initiating disturbances supports the development of a dominant overstory that is sustained through dynamic processes of canopy gap formation, understory development, and overstory recruitment. Gap formation ranges from individual tree mortality to periodic gap formation events that are rarely of a stand-initiating intensity.
Habitat	The place where an organism lives and/or the conditions of that environment including the soil, vegetation, water, and food.
Impact assessment	A study of the potential future effects of resource development on other resources and on social, economic, and/or environmental conditions.
Infrequent stand initiating	The time between stand-initiating disturbances is usually longer than the average longevity of dominant species, thereby supporting processes of canopy gap formation and understory development in mature forests.
Inherent conditions	Refers to the natural condition of ecosystems based on their enduring physical features. This is the potential condition expected in the absence of human influence.
Integrated Resource Management (IRM)	A decision-making process whereby all resources are identified, assessed, and compared before land use or resource management decisions are made. The decisions themselves, whether to approve a plan or carry out an action on the ground, may be either multiple or single use in a given area. The application of integrated resource management results in a regional mosaic of land uses and resource priorities which reflect the optimal allocation and scheduling of resource uses.
Land capability (LC)	LC values represent the maximum potential stand productivity (m^3/ha/yr) under natural conditions.
Landform	A landscape unit that denotes origin and shape, such as a floodplain, river terrace, or drumlin.
Landscape	An expanse of natural area, comprising landforms, land cover, habitats, and natural and human-made features that, taken together, form a composite. May range in scale from a few hectares to large tracts of many square kilometres in extent.
Matrix	A widespread vegetation forest community which dominates the landscape and forms the background in which other smaller scale communities (patches) occur. The most connected or continuous vegetation type within the landscape, typically the dominant element. (Matrix is a fundamental feature of the “matrix, patch, corridor” concept of landscape structure.)

Mature forest	A development class within the sequence of: 1) forest establishment; 2) young forest; 3) mature forest; and 4) multi-aged and old forest. Mature forests include multi-aged and old forest. Forests are typically taller than 11 metres, have an upper canopy fully differentiated into dominance classes, and regularly produce seed crops. Mature forests may develop over long periods, transitioning from early competitive stages where canopy gaps from tree mortality soon close, to later stages where openings persist and understories develop to produce multi-aged and old forest.
Natural disturbance	A natural force that causes significant change in forest stand structure and/or composition such as fire, wind, flood, insect damage, or disease.
Natural disturbance regimes	The patterns (frequency, intensity, and extent) of fire, insects, wind, landslides, and other natural processes in an area. Natural disturbances inherently influence the arrangement of forested ecosystems and their biodiversity on a given landscape. Three disturbance regimes recognized in Nova Scotia are: **Frequent:** Disturbances which result in the rapid mortality of an existing stand and the establishment of a new stand of relatively even age. The time interval between stand-initiating events typically occurs more frequently than the longevity of the climax species that would occupy the site – therefore, evidence of gap dynamics and understory recruitment is usually absent. This regime results in the establishment and perpetuation of early to mid-successional vegetation types. **Infrequent:** Stand-initiating disturbances which result in the rapid mortality of an existing stand and the establishment of a new stand of relatively even-age, but the time interval between disturbance events is normally longer than the average longevity of the dominant species – allowing gap dynamics and understory recruitment to evolve and become evident (eventually creating uneven-aged stands). This regime generally leads to the establishment and/or perpetuation of mid to late successional vegetation types. **Gap replacement:** Stand-initiating disturbances are rare. Instead, disturbances are characterized by gap and small patch mortality, followed by understory recruitment, resulting in stands with multiple age classes. This regime generally leads to the establishment and/or perpetuation of late successional vegetation types.
Old growth	Climax forests in the late stage of natural succession, the shifting mosaic phase, marked by mature canopy processes of gap formation and recruitment from a developed understory. Typical characteristics include a multi-layered canopy of climax species containing large old trees, decadent wolf trees, and abundant snags and coarse woody debris. In Nova Scotia, stands older than 125 years are classed as old growth.

Patch	A discrete community or element nested within a surrounding landscape, which is often a matrix forest. (Patch is a fundamental feature of the "matrix, patch, corridor" concept of landscape structure.)
Reserve	An area of forest land that, by law or policy, is usually not available for resource extraction. Areas of land and water set aside for ecosystem protection, outdoor and tourism values, preservation of rare species, gene pool and wildlife protection (e.g. wilderness areas, parks).
Riparian	Refers to area adjacent to or associated with a stream, floodplain, or standing water body.
Seral stage	Any stage of succession of an ecosystem from a disturbed, unvegetated state to a climax plant community. Seral stage describes the tree species composition of a forest within the context of successional development.
Species	A group of closely related organisms that are capable of interbreeding, and which are reproductively isolated from other groups of organisms; the basic unit of biological classification.
Species at risk	Legally recognized designation for species at federal and/or provincial levels that reflects varying levels of threats to wildlife populations. The four categories of risk are extirpated, endangered, threatened, and species of special concern.
Succession	An orderly process of vegetation community development that over time involves changes in species structure and processes.
Tolerance	The ability of an organism or biological process to subsist under a given set of environmental conditions. The range of these conditions, representing its limits of tolerance, is termed its ecological amplitude. For trees, the tolerance of most practical importance is their ability to grow satisfactorily in the shade of, and in competition with, other trees.
Vulnerable species	A species of special concern due to characteristics that make it particularly sensitive to human activities or natural activities or natural events. May also be referred to as "species of special concern." A species declared vulnerable under the federal or Nova Scotia endangered species legislation (NS Endangered Species Act or federal SARA).
Wilderness area	A part of the provincial landbase designated under the Wilderness Areas Protection Act (e.g. Canso Barrens).