Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS EASTERN SHORE ECODISTRICT 820

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

ELA 2015-820

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 820: Eastern Shore

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This report, one of 38 for the province, provides descriptions, maps, analysis, photos and resources of the Eastern Shore 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) – 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 2015-820

Table of Contents – Parts 1 and 2

Ecodistrict Profile 4

Forest Ecosystem Management for Eastern Shore Ecodistrict 6
Application 6

Part 1: An Overview of the Eastern Shore Ecodistrict 7
– Learning About What Makes This Ecodistrict Distinctive
Ecodistrict Characteristics 7
Land Area 9
IRM Resource Classification for Provincial Crown Lands 9
Forests 10
Water Resources 12
Minerals, Energy and Geology 13
Parks and Recreation / Protected Areas 14
Wildlife and Wildlife Habitat 16

Part 2: Linking the Landscape to the Woodlot 19
– How Woodland Owners Can Apply Landscape Concepts to Their Woodland

Forest Disturbances and Succession 19
Forest Disturbances 19
Natural Succession 20

Eastern Shore – Elements Defined 21
Map of Elements in Ecodistrict 22
Forest Stands Within Elements 23
Photos Illustrating Vegetation Types in Elements 26

Landscape Composition and Objectives 29
Natural Disturbance Regimes 29
Forest Composition 30
Forest Composition Objectives 31
Development Class Targets by Element 32

Summary of Parts 1 and 2 35
Glossary A: Terms in Parts 1 and 2 36

Tables

Table 1 Land Area by Ownership in the Eastern Shore Ecodistrict 9

Table 2 IRM Land Use Categories for Provincial Crown Lands in Ecodistrict 9

Table 3 Area Distribution by Land Category for All Owners 10

Table 4 Area of Forested Land by Land Capability Rating 12

Table 5a Elements Within Eastern Shore 24

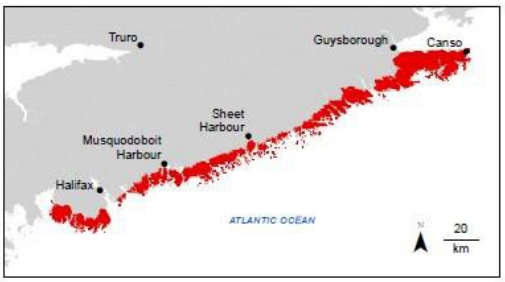
Table 5b Forest Vegetation Types Within Elements in Eastern Shore 26

Table 6 Landscape Composition Target Ranges 31

A NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES PUBLICATION

Ecodistrict Profile

Ecological Landscape Analysis Summary
Ecodistrict 820: **Eastern Shore**



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 Eastern Shore Ecodistrict 820. 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.

From the Chebucto peninsula of Halifax County to the Chedabucto peninsula in Guysborough County, this narrow coastal ecodistrict spans a variety of landforms, geology, and soils.

The cool moist climatic influence of the Atlantic Ocean creates conditions for a boreal-like coastal forest of spruce and fir. For most of the ecodistrict, the influence of the ocean extends inland for several kilometres but widens to encompass the entire Chedabucto peninsula.

This ecodistrict has several sites of ecological significance. Most of these are relatively undisturbed islands and important breeding sites for colonial nesting seabirds. The outer estuary of Musquodoboit Harbour is a wetland of international importance.

Eastern Shore is one of the most important ecodistricts in the province for breeding eiders. The endangered roseate tern has been reported from several sites. The endangered piping plover has nested on beaches in the ecodistrict.

Lakes are numerous in the ecodistrict and fresh water makes up nearly 6% of the area. Loons are known to breed in some of the larger lakes.

The distinctive landscape at East Quoddy forms part of the Eastern Shore Ecodistrict.

The coastal forests of the Eastern Shore Ecodistrict are primarily coniferous with an overstory dominated by black spruce and balsam fir with a lesser component of white spruce. Red maple and white birch occupy an intermediate position in the canopy.

White spruce will form pure stands on sites previously disturbed by activities such as farming. On severely exposed headlands, white spruce will form krummholz, a severely stunted forest condition due to constant exposure to coastal winds. Jack pine occurs on the granite barren lands of the Chebucto and Chedabucto peninsulas, indicating that drought and fire have played a role in this part of the ecodistrict.

Overlying the bedrock in most parts of Eastern Shore Ecodistrict are glacial deposits of ground moraine and streamlined drift. Many drumlins occur throughout the ecodistrict, helping shape the topography.

Private land ownership accounts for 53% of the total area of 171,604 hectares. Forty-one percent of the ecodistrict is under provincial Crown management.

The endangered piping plover has nested on some of the beaches in Eastern Shore.

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 10 key landscape elements – one dominant matrix element, a locally dominant co-matrix, seven smaller patch elements, and a corridor element– in the Eastern Shore Ecodistrict.

Coastal Spruce is the widely dispersed dominant matrix element, found on 26% of the ecodistrict, occurring on hummocks, drumlins, flats, ridges, and low hills. Soils are well to imperfectly drained, fine to medium-textured glacial tills supporting a typical coastal forest of black spruce, white spruce, and balsam fir. A few small areas of yellow birch, white birch, and red maple also occur.

Coastal Barrens is a locally dominant co-matrix element, covering 35% of the ecodistrict, associated primarily with the Chebucto and Chedabucto peninsulas. Soils are impoverished, derived from glacial till peppered with large granite boulders. Vegetation includes stunted spruce and woody shrubs. Often soils are shallow to bedrock and reindeer lichens form extensive mats.

Three large coastal elements, **Coastal Mixedwood Hills**, **Coastal Spruce Ridges,** and **Coastal Mixedwood Hills and Drumlins**, represent 34% of the ecodistrict. The four other patch elements, in order of size, are **Wetlands, Coastal Spruce Flats, Coastal Beach,** and **Salt Marsh**.

Valley Corridors is a linear element associated with the major watercourses in the ecodistrict.

Forest Ecosystem Management
For Eastern Shore 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 Eastern Shore Ecodistrict 820. 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 Eastern Shore 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
(see 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 Eastern Shore – *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 Eastern Shore Ecodistrict is a narrow, coastal-influenced landscape that extends from St. Margarets Bay in the west to Canso in the east. The climate of this ecodistrict is distinguished by high precipitation and low summer temperatures. Spring warm up is slow, but the frost-free period is longer than most other parts of Nova Scotia.

The area is dominated by the metasedimentary rocks with intrusions of plutonic rocks occurring at the west and east ends of the ecodistrict. There are several faults in the ecodistrict that run approximately north-south with most occurring at the west end associated with the plutonic rocks.

Overlying the bedrock in most parts of Eastern Shore Ecodistrict are glacial deposits of ground moraine and streamlined drift along with recent sediments. These contribute to the development of soils and have been used as a source of aggregate. Many drumlins occur throughout the ecodistrict.

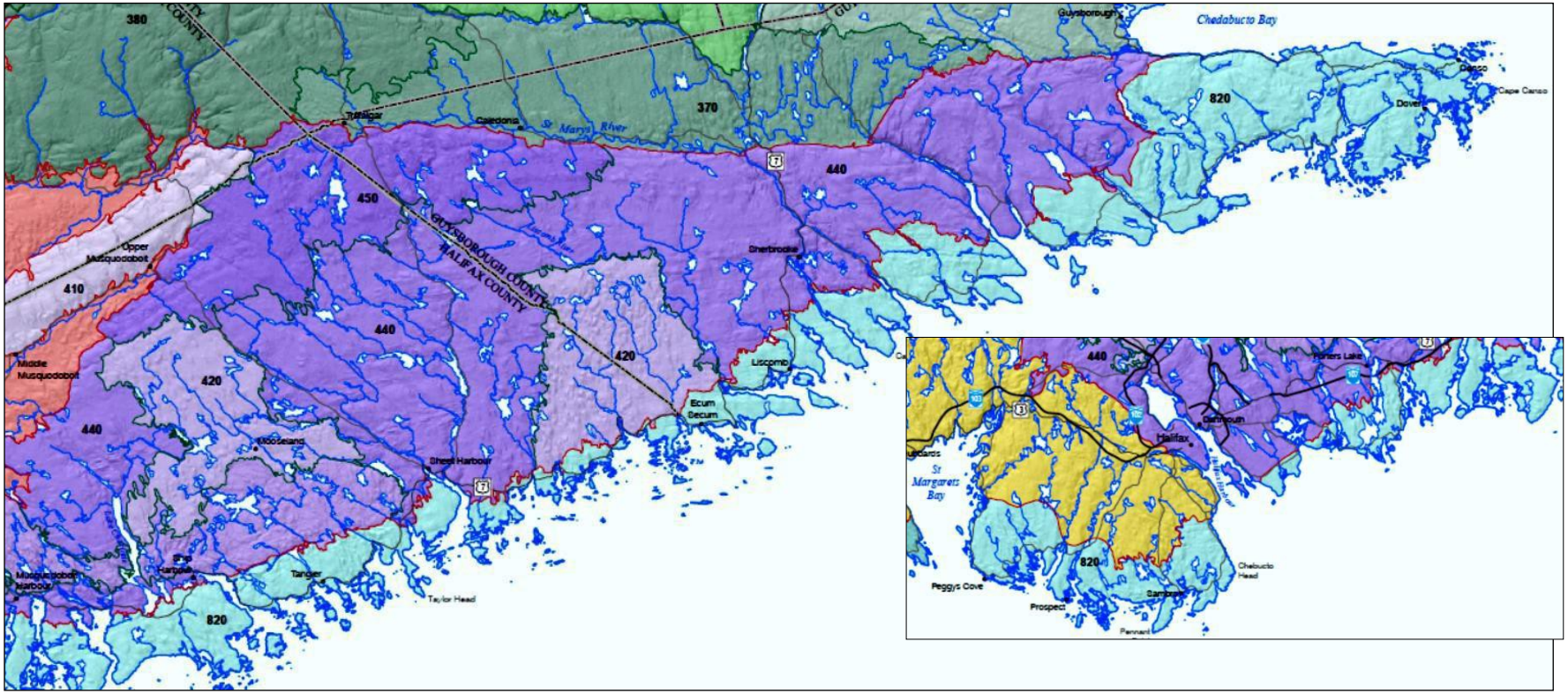
The absence or scarcity of shade-tolerant tree species of climatic climax Acadian Forest, such as red spruce, white pine, eastern hemlock, sugar maple, beech, and to a lesser extent yellow birch, can be used as indicators of coastal influence.

Limitations to growth, imposed by both the local climate (e.g. salt spray, exposure to winds, cool temperatures) and soil and site influences, such as moisture deficit and excess, and low nutrient availability give rise to a boreal-like forest of balsam fir and black spruce.

Frequent natural disturbances that include hurricanes, winter storms, fire, and insects maintain an even-aged forest condition over much of the ecodistrict.

Insect defoliation has not been a significant factor in forest disturbance although the balsam wooly adelgid is currently damaging and causing mortality in balsam fir forests throughout the ecodistrict.

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



Eastern Shore Ecodistrict 820 consists of a long, narrow band of land that runs from Canso in the east to St. Margarets Bay (inset) in the west. (From Ecodistricts of Nova Scotia map 2007)

Land Area

Private ownership accounts for 53% of the land base and the provincial Crown administers 41% of the ecodistrict (Table 1). Other land ownership at 6% accounts for the remainder.

Table 1 – Land Area by Ownership in the Eastern Shore Ecodistrict*

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	69,607	40.6
Private	91,014	53.0
Federal	32	0
Aboriginal	1	0
Other (Includes inland water bodies and transportation corridors)	10,951	6.4
Total	**171,604**	**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). In Eastern Shore, the most common land use categories for Crown lands are C1 and C3 (both 35%), followed by C2 (29%).

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	24,640	35.4
C2 – Multiple and Adaptive Use	19,933	28.6
C3 – Protected and Limited Use	24,535	35.2
Unclassified	499	0.7
Total	**69,607**	**100**

The long coastline within this ecodistrict means that DNR is kept busy dealing with many requests to work below the high water mark.

DNR staff follow a policy on submerged Crown land and work with the federal Department of Fisheries and Oceans to deal with requests to build wharves, skidways, and control coastal erosion.

There have also been a number of requests to harvest coastal plants (kelp) for commercial purposes. These plants are processed and used for beauty products, pharmaceuticals, and drinks.

There are 17 camps on Crown land within this ecodistrict. Most are on the Chebucto peninsula, near the metro area, but others are on the coastal islands along the Eastern Shore.

The abandoned rail bed in the Three Fathom Harbour and West Chezzetcook area is managed by a club for shared use.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	100,943	58.8
Wetland	15,688	9.1
Agriculture	208	0.1
Barrens	31,018	18.1
Urban	6,547	3.8
Road, Trail, Utility	1,392	0.8
Other	15,808	9.2
Total	**171,604**	**100**

Forests

Within this ecodistrict, forested land comprises 59% of the land base (Table 3), significantly below the provincial average of 77%. This can be attributed to the 18% of the ecodistrict classified as barrens compared to the provincial average of 4%.

Barrens account for 18% of the Eastern Shore Ecodistrict, more than four times the provincial average.

The covertype of the Eastern Shore comprises 81% softwood, 11% mixedwood, and 4% hardwood, which is indicative of the softwood-dominated boreal-like forest created from the influence of the cool moist Maritime climate associated with this ecodistrict. The remainder of the land is unclassified. Provincially, the softwood covertype represents about half of the forest types.

Black spruce and balsam fir, with a lesser component of white spruce, dominate the coastal forests of the Eastern Shore Ecodistrict. Red maple and white birch occupy an intermediate position in the canopy and will only express dominance on sheltered sites with deep, well-drained soils or on sites greater than one to two kilometres from the coast.

Black spruce and balsam fir dominate the forests of the Eastern Shore Ecodistrict.

White spruce will form pure stands on sites previously disturbed by settlement activities such as farming and on severely exposed headlands will form krummholz, a severely stunted forest condition due to constant exposure to coastal winds. Jack pine occurs on the granite barren lands of the Chebucto and Chedabucto peninsulas indicating that drought and fire has played a role in this part of the ecodistrict.

Insect defoliation has not been a significant factor in forest disturbance although the balsam wooly adelgid is currently damaging and causing mortality in balsam fir forests throughout the ecodistrict. Other insect outbreaks have occurred sporadically throughout the ecodistrict, including those of the tussock moth and hemlock looper.

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 3.6 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.

The low productivity of this ecodistrict is a reflection of the inherent low fertility of the parent material and coastal exposure.

Some areas are not suitable for trees. These non-forested areas consist mainly of rock outcrops 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	17,005	16.8
3	20,677	20.8
4	48,816	48.4
5	13,850	13.7
6	566	0.6
7 or more	29	-
Total	**100,943**	**100**

*Based on growth potential for softwood species.

Most of the wood harvested in this ecodistrict is shipped to wood-using industries elsewhere in the province. A large hardwood chip-producing facility, Great Northern Timber, is located at Sheet Harbour, supplying hardwood chips to worldwide markets.

Water Resources

Lakes are numerous in the ecodistrict and make up 6% of the area. Many of these lakes are located behind barrier beaches and can have brackish water.

Many of the province's major rivers empty into the Atlantic Ocean along the coastline of this ecodistrict, including New Harbour, Country Harbour, St. Marys, Liscomb, Moser, East and West River Sheet Harbour, and Musquodoboit. Most of these rivers have critical populations of Atlantic salmon.

Other features include tidal marshes and mud flats associated with the estuaries and long inland harbours and coves that are critical to the passage of very large annual populations of migratory birds.

Water resources in the Eastern Shore Ecodistrict include lakes and tidal marshes.

Minerals, Energy and Geology

The Eastern Shore Ecodistrict extends from St. Margarets Bay in the west, parallel to the Atlantic Coast through to the community of Canso.

The area is dominated by the metasedimentary rocks of the Meguma Group – covering about two-thirds of the ecodistrict – which are 480 to 540 million years old. The metamorphic units in the ecodistrict are intruded by a suite of plutonic rock up to 392 million years old, with most of these plutonic rocks occurring at the west and east ends of the ecodistrict.

The Meguma Group comprises the metamorphosed sandstones of the Goldenville Formation and overlying Halifax Formation slates and argillites. These strata were metamorphosed and folded into a series of upright north to northeast and southwest plunging anticlines and synclines during the Acadian mountain-building period prior to the intrusion of the granitoid plutons.

The Halifax Formation consists mostly of black and grey slates that locally contain abundant pyrite, pyrrhotite, and arsenopyrite. The breakdown of these sulphides, when exposed at surface, can lead to acid drainage problems and possibly generate Acid Rock Drainage. This can affect water quality, sedimentation, integrity of building materials, and vegetation management. In

addition, the oxidation of high concentrations of arsenopyrite in the slate can adversely affect the quality of drinking water by liberating arsenic into the water table.

The Goldenville Formation comprises varying amounts of metamorphosed sandstones and siltstones and this type of formation is host to most of the gold deposits in Nova Scotia.

The remaining 34% of the ecodistrict consists of igneous rocks, formed when molton rocks cool.

There are several faults in the ecodistrict that run approximately north-south with most occurring at the west end associated with the plutonic rocks.

There are numerous mineral occurrences throughout this ecodistrict including many past gold producers at Clam Harbour, Cow Bay, East Chezzetcook, Ecum Secum, Gold Brook Lake, Goldboro, Harrigan Cove, Jewers Cove, Little Liscomb, Moosehead, Seal Harbour Lake, Spry Bay, Tangier, Terence Bay, and Wine Harbour. Much of the area is under exploration licence for gold.

Though the most abundant mineral occurrences contain gold, other occurrences include tungsten, copper, and fluorine.

From an industrial minerals perspective, the area holds great potential. In the western end of the ecodistrict, at Queensport, the granitic plutons are currently being quarried for aggregate. Slate units in the ecodistrict are also being used as a source of aggregate. Large boulders are used to construct breakwaters along waterways and coastlines. Glaciofluvial deposits (kames, eskers, and glacial outwash fans) occur in the ecodistrict and these are excellent sources of sand and gravel. There is also potential for peat throughout the ecodistrict.

Overlying the bedrock in most parts of Eastern Shore Ecodistrict are glacial deposits of ground moraine and streamlined drift along with recent sediments. These contribute to the development of soils and have been used as a source of aggregate. Many drumlins occur throughout the ecodistrict, helping shape the topography.

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 DNR office.

Parks and Recreation / Protected Areas

The Eastern Shore Ecodistrict is rich in parks and recreational land use. There are many provincial parks and park reserves running along this coastal zone, providing valuable access and recreation potential to Nova Scotia residents and visitors.

Many of the parks provide outstanding beach opportunities such as Clam Harbour Beach, Martinique Beach, and McCormacks Beach. Other parks provide camping and hiking, boating, and biking opportunities, such as Porter's Lake, Cole Harbour, Lawrencetown, Taylor Head and Liscomb Point.

There are several wilderness areas partly contained in the ecodistrict, from Terence Bay in the western end to the Canso Coastal Barrens and including Eastern Shore Islands. There are numerous high quality hiking trails within many wilderness areas. There are also many nature reserves and pending nature reserves along the ecodistrict that provide protection for the land and its resources.

A total of about 33,125 hectares of Crown land has been set aside under legal and policy reserves within the Eastern Shore Ecodistrict. This total includes 6,906 hectares of old forest under the Old Forest Policy and in three wilderness areas – Canso Coastal Barrens and Bonnet Lake Barrens, which are totally within the ecodistrict, and Terence Bay which is only partially within this ecodistrict.

In addition, there are also 797 hectares of legal reserves designated under the Canadian Heritage River program along the St. Marys River.

The Canso Coastal Barrens Wilderness Area, covering more than 8,000 hectares, protects one of Nova Scotia's most beautiful stretches of Atlantic coast and associated inland areas.

Hunting, fishing, boating, hiking, and off-highway vehicles (OHVs) are traditional outdoor recreational activities pursued in the ecodistrict. There are a large number of water bodies and watercourses that are available in the ecodistrict for various recreational uses such as fishing and boating. The coastline is covered by inlets and islands that provide a large variety of exploration destinations and ecotourism potential.

Other areas of ecological and recreational significance include offshore islands currently part of the Eastern Shore Island Wildlife Management Area and scattered areas near Terence Bay, Liscomb Point, Country Harbour Head, and New Harbour Head. Additional representation could come from private lands in the form of programs of Eastern Habitat Joint Venture, Nature Conservancy of Canada, and Nova Scotia Nature Trust.

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 Eastern Shore 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 Eastern Shore 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. About 10% of the Crown land in the ecodistrict is old forest. Almost all of it is located in provincial parks and wilderness areas.

About 41% of the land in this ecodistrict is owned by the Crown.

Longer lived species such as tolerant hardwoods and white pine are found in a few locations. These species should be maintained or encouraged, where possible, to provide diversity.
Climax species for the ecodistrict include those that are early successional species in other ecodistricts, such as white spruce, fir, and red maple.

This ecodistrict has 11 sites listed in a provincial atlas of nature reserves and sites of ecological significance. Seven of them are islands: Tobacco, Brokenback, Bickerton, Little White, Pumpkin, Long, and Horse. These are relatively undisturbed islands and important breeding sites for colonial nesting seabirds. A bog at Bear Cove is a representative example of a coastal bog. Duncans Cove is a granite headland. Conrods Beach is a good example of a beach dune system. West Dover is a coastal barren.

The outer estuary of Musquodoboit Harbour is a Ramsar site, a wetland of international importance. It and other harbours in the ecodistrict are important wintering areas for waterfowl.

The endangered roseate tern has been reported from several sites in the ecodistrict. In recent years they have bred on Country Island, which is the second most important colony of this species in Canada. The endangered piping plover has been known to nest on beaches in the ecodistrict.

The ecodistrict is probably the most important in Nova Scotia for breeding eiders.

This ecodistrict is probably the most important in the province for breeding eiders. Several species of seabirds nest on islands in the ecodistrict. Great blue herons nest on some of the islands. Colonies on islands are not likely to be disturbed by forestry, but DNR has special management practices in place for heron colonies should activities pose a potential threat.

Lakes are numerous in the ecodistrict and fresh water makes up 6% of the area. Loons are known to breed in some of the larger lakes. Both eagles and osprey are known to nest in the ecodistrict.

Several rivers in the ecodistrict have salmon runs to and from the Atlantic Ocean, although the population of Atlantic salmon known to this region (Southern upland population) are considered to be endangered by the Committee on the Status of Endangered Species in Canada (COSEWIC).

Moose are found in some of the more remote parts of the ecodistrict. Special management practices for forestry activities on Crown lands are required in known moose concentration areas.

Several white-tailed deer wintering areas are known in the ecodistrict. Much of the ecodistrict has a frequent natural disturbance regime, which is often a benefit to the local deer herd.

Several rare plants are also found in the ecodistrict. Most are found on seashores or in wetlands and coastal barrens, although some also occur where forestry activities may take place. In these areas, depending on their rarity and/or species at risk status, harvesting disturbances will be avoided

outright with buffers or incorporated into legacy clumps to be left on the landscape following harvesting.

For more detailed and more 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.

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
- and 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 provide a model to compare with managed forests.

Natural disturbances are frequent on the Eastern Shore and include hurricanes, winter storms, insects, disease, and to a lesser extent, fire. The moist climate is conducive to regeneration and establishment by balsam fir and black spruce, and most stands will have already established an abundance of advanced regeneration ready to reforest sites immediately after a stand-initiating disturbance. Stands of even-aged structure and composition are typical. Insect defoliation by balsam wooly adelgid, tussock moth, spruce beetle, and hemlock looper can occur locally.

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.

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

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.

Eastern Shore – 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 10 distinctive elements in the Eastern Shore Ecodistrict – one dominant matrix, a locally dominant co-matrix, seven 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 widely dispersed dominant matrix element, found on 26% of the ecodistrict, occurring on hummocks, drumlins, flats, ridges, and low hills. Soils are well to imperfectly drained, fine to medium-textured glacial tills supporting a typical coastal forest of black spruce, white spruce, and balsam fir. A few small areas of yellow birch, white birch, and red maple also occur.

Coastal Barrens is a locally dominant co-matrix element, covering 35% of the ecodistrict, associated primarily with the Chebucto and Chedabucto peninsulas. Soils are impoverished, derived from glacial till peppered with large granite boulders. Vegetation includes stunted spruce and woody shrubs. Often soils are shallow to bedrock and reindeer lichens form extensive mats.

Three large coastal elements, **Coastal Mixedwood Hills**, **Coastal Spruce Ridges,** and **Coastal Mixedwood Hills and Drumlins**, represent 34% of the ecodistrict. The four other patch elements, in order of size, are **Wetlands, Coastal Spruce Flats, Coastal Beach,** and **Salt Marsh**.

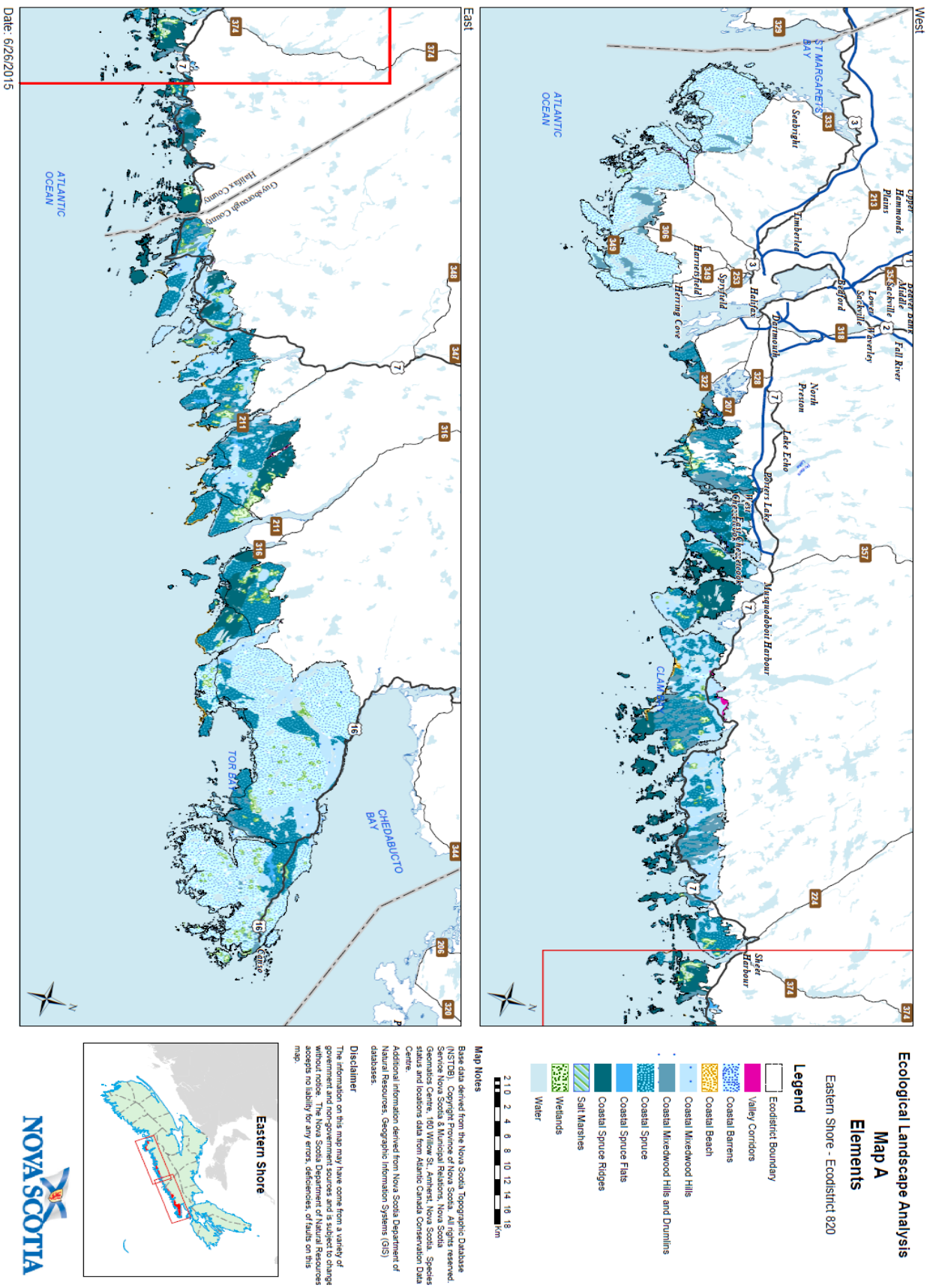
Valley Corridors is a linear element associated with the major watercourses in the ecodistrict.

The main corridor systems follow the major river valleys. These systems dissect the ecodistrict but also provide linkages to the Eastern Interior, Eastern Granite Uplands, and the St. Margarets Bay ecodistricts.

These corridors are usually associated with long narrow saltwater inlets from the ocean and provide a valuable linkage to the coastline for many interior species of wildlife.

Some of these corridors have been significantly altered by human land use, settlement, transportation and utility systems, agriculture, and forestry.

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.

Table 5a – Elements Within Eastern Shore		
Element	**Size (Hectares)**	Element Description
Coastal Spruce (Matrix)	42,467 26.2%	This matrix element occurs on moderately well-drained to imperfectly drained medium to fine-textured soils on hummocky terrain. The typical zonal climax forest of black and white spruce with balsam fir is dominant. As soil drainage gets progressively poorer, wet forests of red maple, black spruce, tamarack, alders, false holly, winterberry, and ericaceous woody shrubs are common. Embedded within this element are wet open woodlands, bogs, swamps, fens, and seasonally flooded flats. This element is frequently disturbed by windthrow and insects and stand-level natural senescence which limit the potential for old growth forest development. Earlier successional forests will have red maple and white birch but these species are quickly over-topped by the spruce. Further inland, the hardwood species will form part of the canopy and on the sheltered and better sites, coastal hardwood forests are possible.
Coastal Barrens (Co-Matrix)	56,203 34.7%	The barrens and woodlands form a localized co-matrix element, primarily on the ecodistrict bookends – the Chebucto and Chedabucto peninsulas. This element is underlain by coarse-textured, imperfectly to well-drained soils derived from granite glacial till. Usually the hummocky to ridged terrain is peppered with large granite boulders that rise above the stunted spruce and woody shrubs. Often the soils are shallow to bedrock and reindeer lichens form extensive mats. The barrens tend to comprise ericaceous woody shrubs such as lambkill, rhodora, huckleberry, and blueberry with false holly and wild raisin. These species create thick root mats that restrict regeneration by black spruce. Regeneration to black spruce is usually vegetative by layering except where seedbeds of mineral soil can be provided through the reduction of the thick root mat by fire.
Coastal Mixedwood Hills (Patch)	26,717 16.5%	Sloping toward many of the extended inland harbours, low hills make up the majority of this large patch element. Along the coastline, these slopes end abruptly as headlands and banks. Inland, away from the direct coastal exposure and on more sheltered sites, mixedwood forests of yellow and white birch, red maple, and balsam fir dominate. Black and white spruce with balsam fir retain their dominance on sites exposed to the ocean. Red spruce and white pine are also possible on the sheltered inland sites. Frequent stand-level disturbances due to windthrow and insects and natural senescence create opportunities for the usually abundant advanced regeneration of spruce and fir to quickly start the next forest.
Coastal Spruce Ridges (Patch)	17,533 10.2%	Coastal Spruce Ridges occurs primarily on bedrock-ridged terrain and is a significant patch element in the ecodistrict. Large areas of well and imperfectly drained terrain create forests of black spruce and balsam fir with open woodlands of stunted black spruce interspersed where soils are very shallow over bedrock. Similar soil and terrain conditions exist on the offshore islands between Clam Harbour and Ecum Secum where wind-swept forests of black spruce and white spruce dominate. The occurrence of red maple and white birch in the canopy is limited to only the best of the sheltered sites. Wetlands are embedded within this element and as soil drainage gets progressively poorer, wet forests of red maple, black spruce, and tamarack with alders are common.

Table 5a – Elements Within Eastern Shore		
Element	Size (Hectares)	Element Description
Coastal Mixedwood Hills and Drumlins (Patch)	12,321 7.2%	Well-drained drumlins make up the majority of this patch element. Black and white spruce with balsam fir are the dominant forest on sites exposed to the ocean but further inland and on more sheltered sites mixedwood forests of yellow and white birch, red maple, and balsam fir are possible. Red spruce and white pine are also possible on the sheltered inland sites. As soil drainage gets progressively poorer, especially on the flat terrain between drumlins, wet forests of red maple, black spruce, tamarack, alders, false holly, winterberry, and ericaceous woody shrubs are common.
Wetlands (Patch)	4,778 2.8%	The wetlands element comprises freshwater bogs, fens, swamps, and poorly drained areas (salt marshes are excluded). It may occur as a large wetland complex associated with rivers and lakes, as narrow linear communities associated with flow accumulations and small streams, as a community of hydrophytic vegetation associated with level terrain where drainage is impeded, or as a depression in the landscape where water remains in excess year round. Smaller wetlands are often embedded in other elements.
Coastal Spruce Flats (Patch)	674 0.4%	This small patch element occurs primarily on imperfectly drained soils of medium texture (sandy loams) on flat terrain sometimes associated with lakes and watercourses. Wetlands are embedded within this element. Forests of slow-growing black spruce are typical. As soil drainage gets progressively poorer, wet forests of red maple, black spruce and tamarack with alders, false holly, winterberry, and huckleberry are common.
Coastal Beach (Patch)	656 0.4%	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 formed from the accumulation of sands during deglaciation and are common along the Eastern Shore with examples at Martinique, Clam Bay, and Lawrencetown.
Salt Marsh (Patch)	279 0.2%	Along the coast, salt marshes have formed from sediments deposited in low-lying, sheltered, intertidal areas or behind spits, bars or islands and protected bays. The best examples are at Cole Harbour, near West Lawrencetown, and in Chezzetcook Inlet with smaller examples near Marie Joseph and Harrigan Cove. These salt marshes are marine deposits of silt and silt loam sediments with semi-decomposed grasses along the tidal shores.
Valley Corridors (Corridor)	324 0.2%	This is a linear element associated with the major watercourses in the ecodistrict. The corridors in this element are usually associated with long narrow saltwater inlets from the ocean and provide a valuable linkage to the coastline for many interior species of wildlife. Some corridors have been significantly altered by human land use, such as settlement, transportation, agriculture, and forestry.
Total	**161,952**	*Area is not the same as in Table 1 because water has not been included.

Table 5b – Forest Vegetation Types[1] Within Elements in Eastern Shore

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Coastal Mixedwood Hills and Drumlins	OF1, OF2, OF4	3	CO5	12	**CO4, CO6**	73
Coastal Mixedwood Hills	OF1, OF2, OF4	3	CO4, CO5	10	**CO1, CO2, CO6**	68
Coastal Spruce	OW1, OW2, CO5, SP1				**CO1, CO2, CO4,** SP4	82
Coastal Barrens	**CO1**, CO2, CO4, OW1, OW2, SP1					
Coastal Spruce Flats	CO1, **SP7**, WC1, WC2					
Coastal Spruce Ridges	**CO1**, CO2, CO4					
Salt Marsh	Grasslands of *Spartina spp.*					
Coastal Beach	CO7, Beach grass, Bayberry, Rose spp., White spruce					
Wetlands	WC1, WC2, WC3, WC6, WC7, WD2, WD3, 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.

White birch – Balsam fir / Foxberry – Wood aster (CO5) is a mid-successional vegetation type found in the Coastal Spruce matrix element.

Balsam fir / Foxberry – Twinflower (CO4) is a late successional vegetation type found in the Coastal Mixedwood Hills and Drumlins patch element.

Black spruce – Balsam fir / Foxberry / Plume moss (CO1) is a vegetation type found in the Coastal Spruce Ridges patch element.

Jack pine / Huckleberry / Black crowberry / Reindeer lichen (OW1) is a site restricted vegetation type scattered along the coast found in the Coastal Barrens co-matrix element.

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

Black spruce / False holly / Ladies' tresses sphagnum (SP7) is a vegetation type found in the Coastal Spruce Flats element.

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

Red maple / Sensitive fern – Lady fern / Sphagnum (WD3) is a 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.

Natural disturbances are frequent on the Eastern Shore and include hurricanes, winter storms, insects and disease, and to a lesser extent, fire. The forest ecosystems that arise from this disturbance type are balsam fir, white and black spruce with minor components of red maple and white birch.

These disturbances remove the overstory and release a layer of advanced regeneration to create stands of even-aged structure and composition. Since stand-initiating events are frequent and the longevity of the dominant species short, uneven-aged forests are rare.

While hurricanes and storms can be attributed for most of the significant stand-level disturbances, fires have been common but they have appeared to have been started by European settlers to extend pasture land. The presence of jack pine in several places on the Canso peninsula and Chebucto peninsula suggests that the constant winds of the coastal zone 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 / Old Forest Policy)

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 (see 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 (see http://novascotia.ca/natr/library/forestry/reports/NDRreport3.pdf).

Table 6 - Landscape Composition Target Ranges (by Development Class / Disturbance Regime)

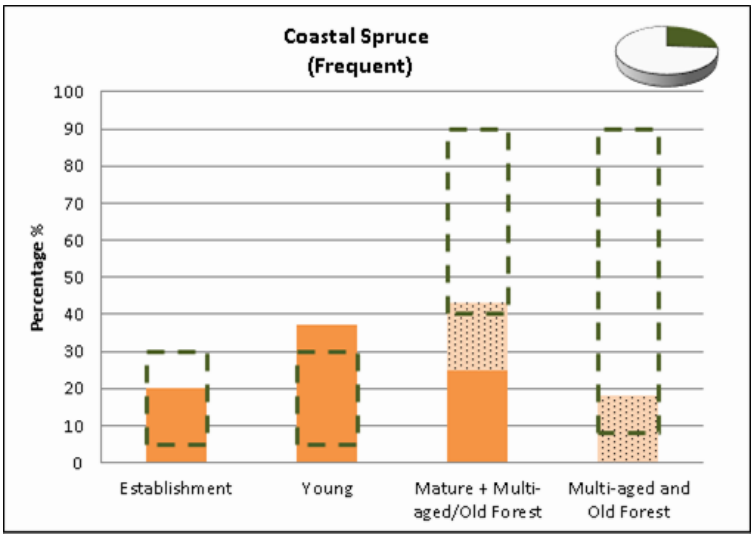
Natural Disturbance Regime	Development Class			
	Forest Establishment	Young Competing Forest	Mature Forest (including multi-aged and old forest)	Multi-aged and Old Forest
Frequent Stand Initiating	5 - 30%	5 - 30%	>40% early, mid, and late seral representation	>8%
Infrequent Stand Initiating	5 - 20%	5 - 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.

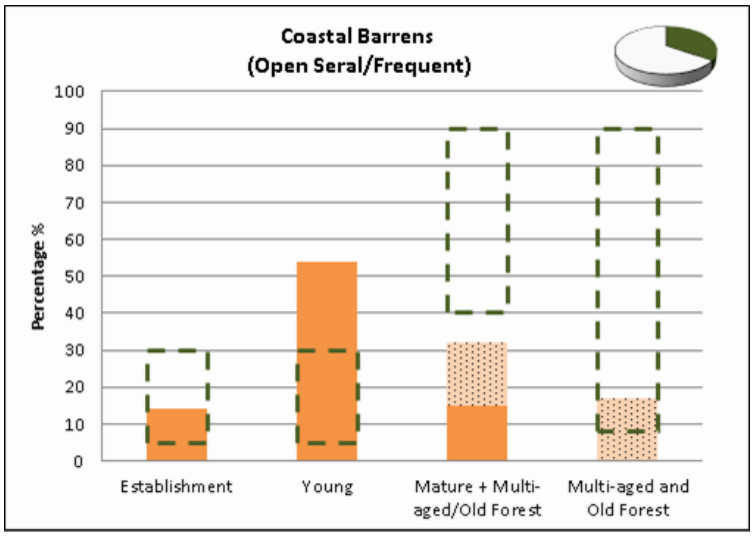
Development Class Targets by Element

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.

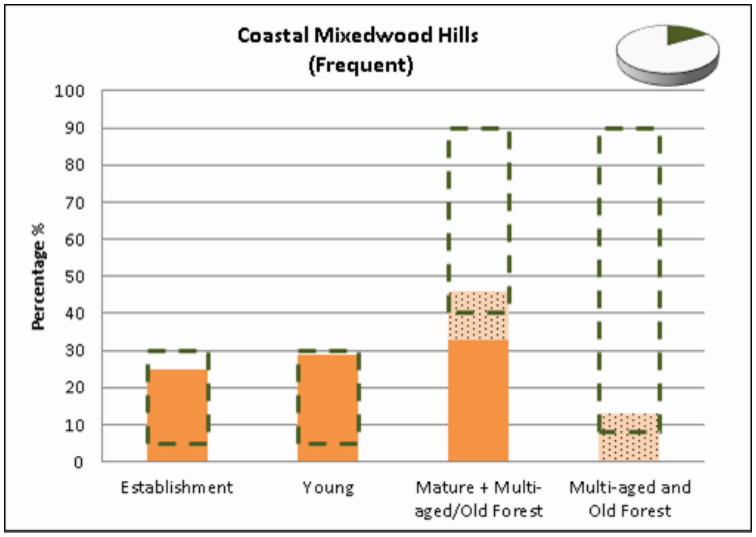
In **Coastal Spruce**, forest harvesting of mature and rapidly declining stands can continue with patch sizes consistent with those created by natural disturbances. Adequate advanced regeneration of fir and spruce at time of harvest will hasten ecosystem recovery. Young and mature forests on windfirm sites may be partially harvested to enhance and maintain mature and old forest conditions on the landscape.



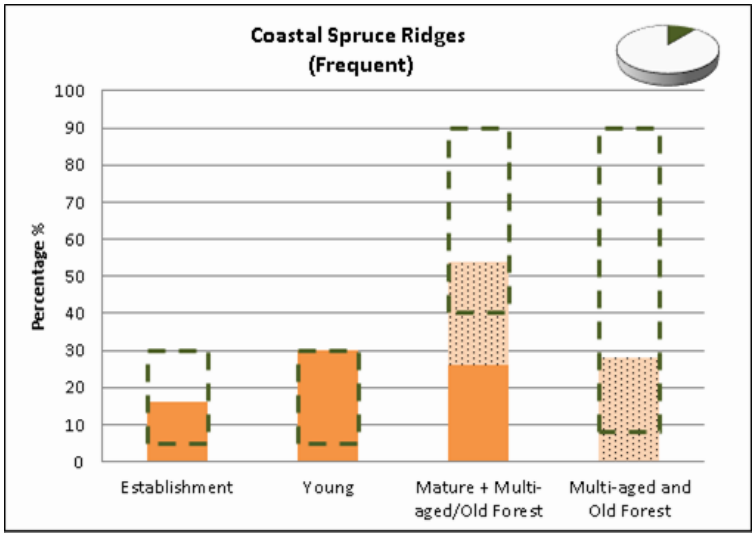
In **Coastal Barrens**, poor site fertility and frequent natural disturbance due to windthrow and fire limits the development of mature and old forests. Currently young forest development class exceeds target levels. Much of this element is windswept with shallow soils over bedrock supporting forests of low timber value. Harvesting mature forests can continue to limit losses to mortality but maintaining mature forest is desired if stands are healthy and windfirm.



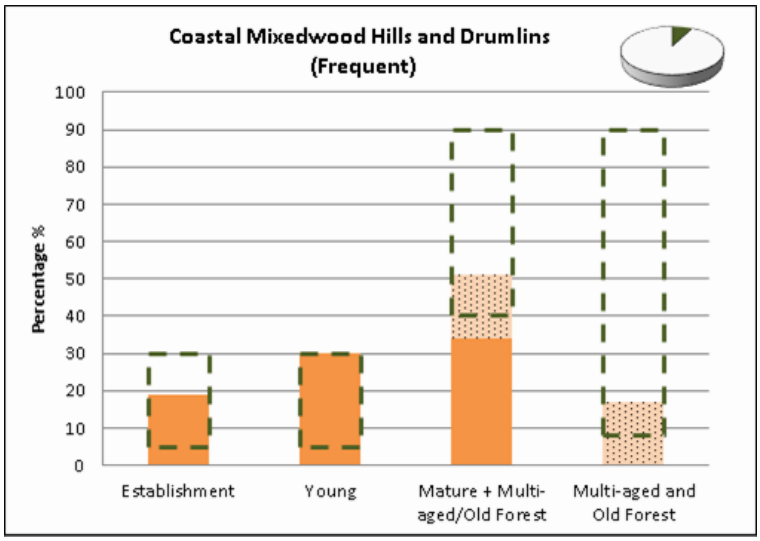
In **Coastal Mixedwood Hills,** all development classes are within target levels. Forest management options include clear-cut harvesting and partial harvesting (where stands are windfirm). Natural regeneration of harvested areas is desired. Thinning in young stands can enhance older forest features.



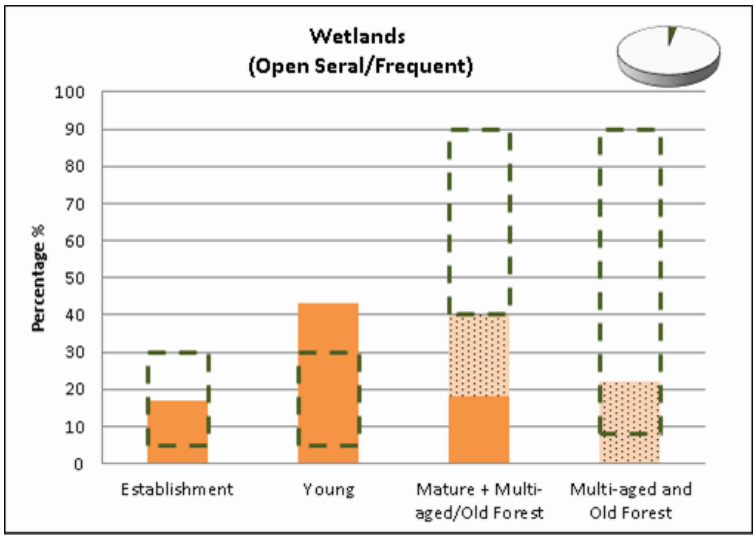
The **Coastal Spruce Ridges** element has all development classes within target ranges. Much of the element is windswept ridges with exposed bedrock and soils very shallow over bedrock supporting forests of low timber value. Sites further inland with better forests can be harvested by creating patch sizes consistent with those created by natural disturbances. With adequate advanced regeneration of fir and spruce at time of harvest, sites will reforest quickly.



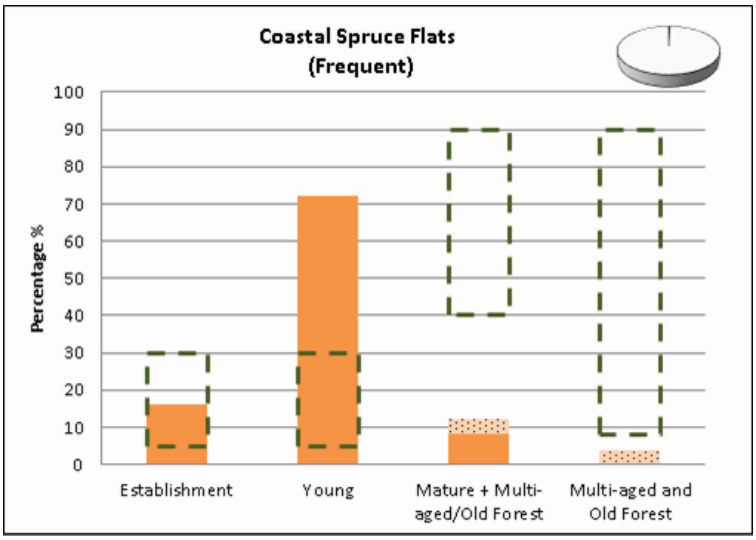
In **Coastal Mixedwood Hills and Drumlins**, all development classes are within target levels. Forest management options include clear-cut harvesting and partial harvesting (where stands are windfirm). Natural regeneration of harvested areas is desired. Thinning in young stands can enhance older forest features. Pure hardwood forests of birch and red maple can be promoted on upper slopes with partial harvesting and thinning.



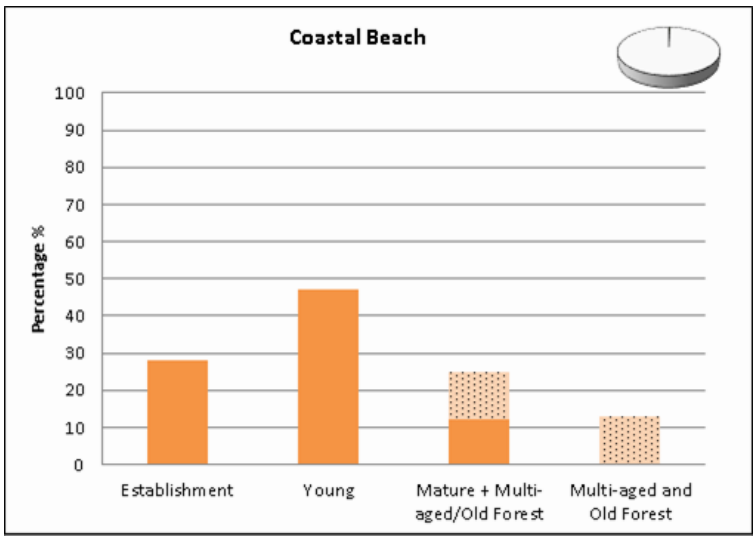
The **Wetlands** element is variably composed of forest, interspersed with woodlands and open wetlands. Disturbances are often patchy, reflecting the diverse structure. The relatively high amount of young forest may reflect height growth limitations on poor, wet sites, as well as past harvesting. Some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



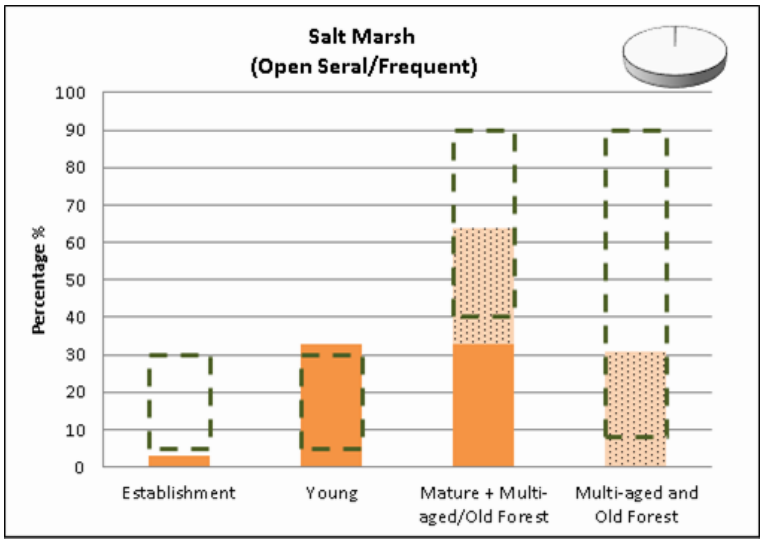
In **Coastal Spruce Flats**, forest harvesting of mature and rapidly declining stands can continue with patch sizes consistent with those created by natural disturbances. Adequate advanced regeneration of fir and spruce at time of harvest will hasten ecosystem recovery. Partial harvesting in this element is difficult due to the shallow rooting of spruce and fir on the imperfectly drained soils.



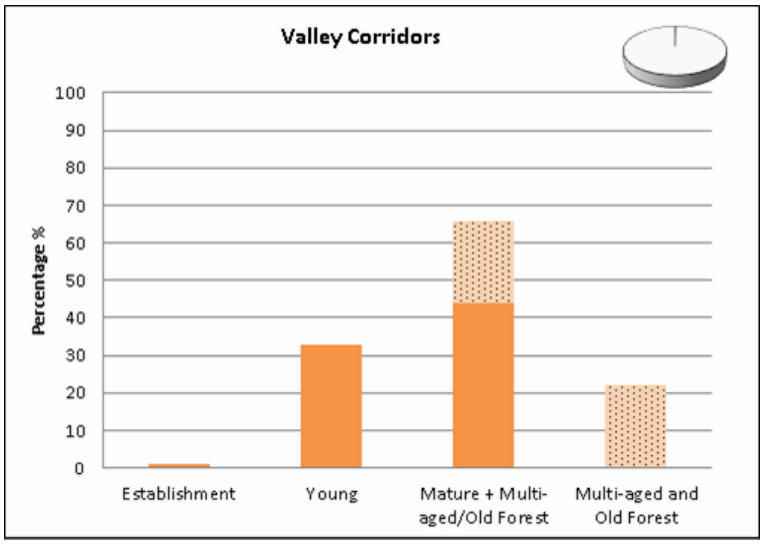
In the **Coastal Beach** element, the small amount of forest habitat included in this element is important for shore birds. Forestry operations are not applicable and any other land use activity should be aware of the need to protect these sensitive sites.



Isolated forests included in the **Salt Marsh** element create habitat and provide an important interface to the wetland ecosystems. Forestry operations should employ special practices to maintain forested ecosystems on these sensitive sites.



The **Valley Corridors** element includes parts of several elements and does not have a specific disturbance regime or composition target. The current dominance of mature conditions should enhance forest cohesion and support connectivity functions along this linear element feature. This is particularly valuable in riparian zones, where closed canopies and small openings are most appropriate.



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.

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 growth. Mature forests include multi-aged and old growth. 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 growth.
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).