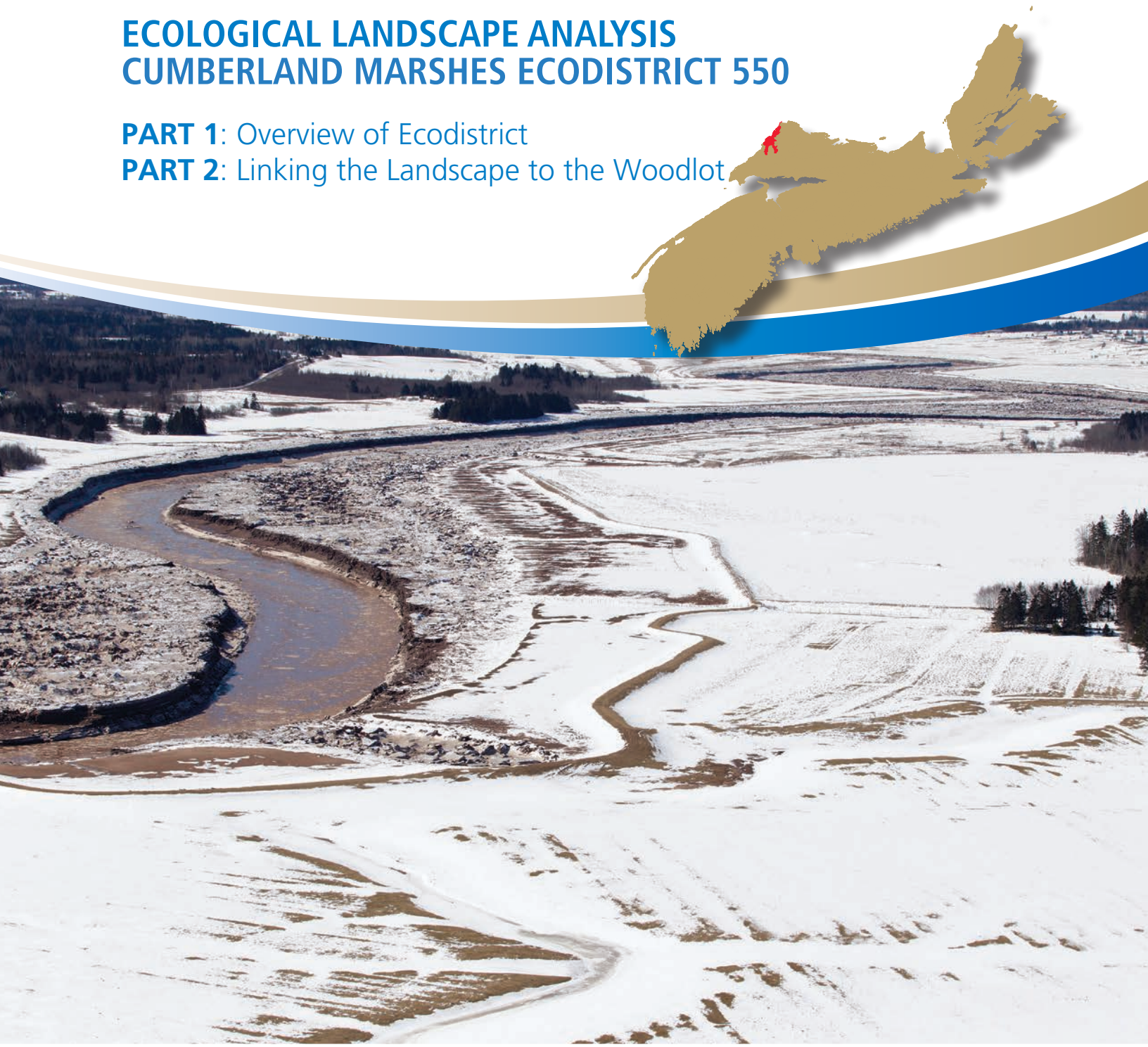
Department of Lands and Forestry

2019 Update

ECOLOGICAL LANDSCAPE ANALYSIS CUMBERLAND MARSHES ECODISTRICT 550

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



ELA 2019-550

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 550: Cumberland Marshes
2019 Update for Part 1 and 2

Prepared by the Nova Scotia Department of Lands and Forestry
Peter Bush and Courtney Baldo, Forestry Division

This report, one of 38 for the province, provides updated figures and tables to supplement the original Ecological Landscape Analysis documents.

Information sources and statistics (benchmark dates) include:

- Crown Lands Forest Model landbase classification (2017v.1)

Note this geodatabase includes the latest Forest Inventory Databases (FID), forest disturbance information, forest harvesting information, crown land purchases and new protected area designations. Forest harvesting, silviculture, and fire disturbance (including satellite updates) are current as of end of 2015.

As revision and peer-reviewing of Natural Disturbance Regimes mapping in Nova Scotia becomes available, any major changes will be incorporated in future updates.

Selected updated Tables and Figures

This document provides recalculated values for the following:

Table 1 (Figures may vary slightly from 2015 ELA because of new Forest Inventory Databases and change in the base geodatabase)
Table 3 (Figures may vary slightly from 2015 ELA because of new Forest Inventory Databases and change in the base geodatabase)
Table 5a (Figures may vary slightly from 2015 ELA because of new Forest Inventory Databases and change in the base geodatabase)
Table 5b (Figures may vary slightly from 2015 ELA because of new Forest Inventory Databases and change in the base geodatabase)
Development Class Targets by Elements – Only major forest elements are reported in the update. Wetlands and Valley Corridors are not reported in this update.

Table 2 was not updated as Integrated Resource Management Land Use Categories have not been updated.
Table 4 was not updated because the land capability for individual polygons has not changed since the original report. Land generally still has that same capability rating now as it did previously, regardless of any management activities at the site.

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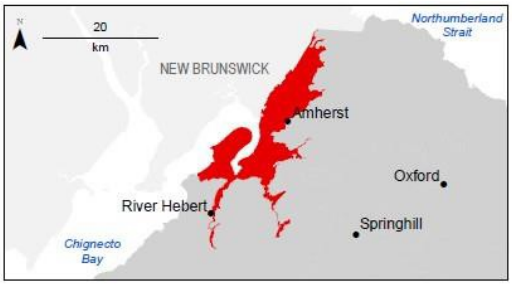
Tables

A NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES PUBLICATION



Ecodistrict Profile

Ecological Landscape Analysis Summary
Ecodistrict 550: **Cumberland Marshes**

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 Cumberland Marshes Ecodistrict 550. 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.

Cumberland Marshes, the smallest and one of the most distinctive ecodistricts in the province, provides a natural boundary between Nova Scotia and New Brunswick at the Chignecto Isthmus.

The Cumberland Marshes ecodistrict is a lowland complex of treed wetlands, bogs and marshes at the end of the Cumberland Basin.

Agricultural use accounts for 34% of the ecodistrict, followed by forested lands at 29% and wetlands at 28%.

The level terrain, much of it underlain by tidal sediments deposited from the Bay of Fundy, has created extensive salt marshes of cordgrass.

Acadian settlers, around 1700, constructed dykes to keep out the saltwater and to develop fertile farmland. Dyke construction and maintenance has continued to reduce the area of natural salt marshes.

In the past, the Cumberland Marshes and the Tantramar Marshes in New Brunswick were called the "World's Largest Hayfield." The hay, rich in iodine making it a valuable source of high quality fodder, was shipped to customers along the Eastern Seaboard and Europe as late as the 1930s.

The ecodistrict receives strong winds and experiences cooler than normal temperatures than elsewhere in the ecoregion due to its proximity to Chignecto Bay.

The Fort Lawrence ridge is the only portion of the ecodistrict where a tolerant mixedwood occurs. Areas that occur inland from the dykelands and marshes are dominated by black, red or hybrid spruce, red maple, and tamarack.

Private land ownership accounts for 68% of the Cumberland Marshes Ecodistrict area, which totals about 12,970 hectares. Eighteen percent, or about 3,371 hectares, is provincial Crown land. Almost 5% is under federal ownership. The remaining lands are in transportation corridors and inland waters.

Cumberland Marshes is one of the most important and valuable areas in the province for waterfowl habitat. The abundance of rich marsh soils and location along nearby bays are ideal habitat for a variety of wildlife species.

Eastern white cedar, a species at risk in Nova Scotia, occurs naturally in the Amherst Point Migratory Bird Sanctuary. As a sensitive species, other locations should be reported to Department of Lands and Forestry.

Coastal marshlands, tidal zones as well as extensive inland wetlands are significant areas for migratory waterfowl. The Chignecto National Wildlife Area and Amherst Point Migratory Bird Sanctuary are in this ecodistrict.

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, and five smaller patch elements – in Cumberland Marshes.

The matrix element **Marshes and Grasslands,** representing about one-third of the ecodistrict, has been extensively altered by human settlement, agriculture, wildlife management, roads, and utility corridors. From the early- to mid-1700s, Acadian settlers in the area built dykes on the extensive salt marshes to reclaim sediment-rich lands from the Bay of Fundy.

Red and Black Spruce Hummocks is the largest patch element, representing more than one-quarter of the ecodistrict. This patch is the most intact element in the ecodistrict. The other patches, in order of size, are **Wetlands**, **Spruce Pine Flats**, **Tolerant Mixedwood Hills**, and **Red Spruce Hummocks.** Most of the patch elements are under heavy land use pressure. *The small Salt Marsh element, formerly part of the Wetlands element, is also found in the ecodistrict.*

Forest Ecosystem Management
For Cumberland Marshes 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 Cumberland Marshes Ecodistrict 550. 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 represent inventory based off the Forest Inventory Database (FID) current as of the end of 2015 and the Crown Land Forest Model (CLFM) current as of 2017. The update provides a reference to compare to the baseline conditions provided in the ELA 2015, which in the case of the Cumberland Marshes 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 Department of Lands and Forestry, 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 Cumberland Marshes – *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 Cumberland Marshes are for the most part underlain by marine sediments and as such are usually imperfectly to poorly drained soils. Much of these areas were once salt marshes but dykes have created arable lands for farming.

A large proportion of the area comprises bogs, open wetlands, lakes, and peat lands. Most of the forested portion of the ecodistrict is frequently disturbed by stand-initiating events such as windstorm and insects (such as the spruce budworm).

The role of fire in this ecodistrict is unknown but during periods of excessive dryness it could be expected that portions adjacent to the Northumberland Lowlands Ecodistrict 530 could occasionally be burned.

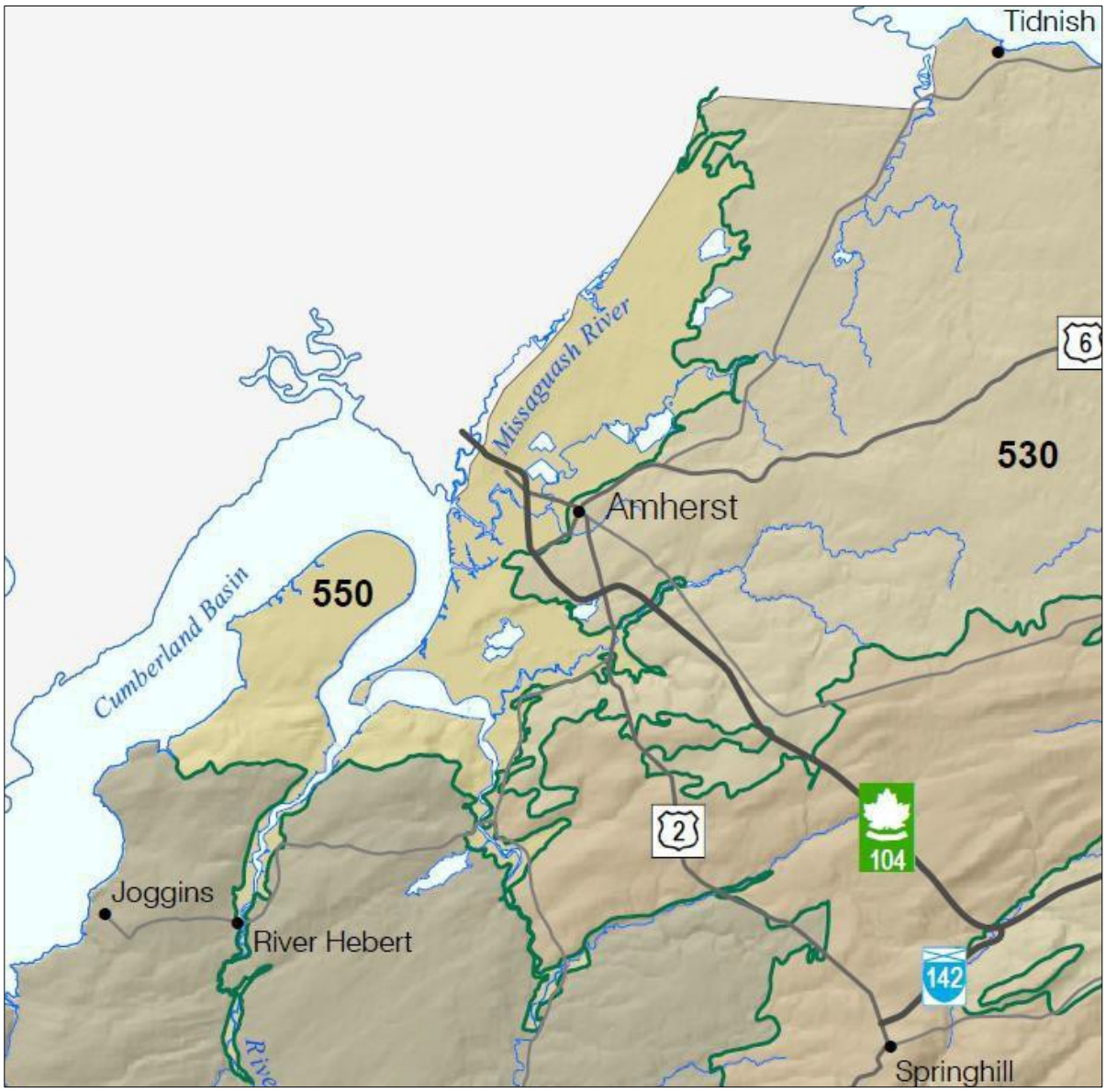
The Fort Lawrence Ridge is the only significant upland topographic feature in the ecodistrict. Forests on this ridge are infrequently disturbed by stand-initiating events with windstorms the most likely agent.

Approximately 8% of the Crown lands in this ecodistrict have been set aside as old growth under the Old Forest Policy.

From the early- to mid-1700s, Acadian settlers built dykes on salt marshes to reclaim lands from the Bay of Fundy. Drainage channels used freshwater from rain and snow from spring melts to remove salt from sediments. The dyking system kept saltwater out at high tide and drained freshwater at low tide. After several years, the marshes became valuable agricultural lands.

In the past, the Cumberland Marshes and the Tantramar Marshes in New Brunswick were called the “World’s Largest Hayfield.” The hay was shipped for sale along the Eastern Seaboard and Europe as late as the 1930s. The hay was rich in iodine, making it a valuable source of healthy, high quality fodder. In the 1800s, a system of tide channels and ditches transformed more of the marshland to fertile pastures. Where the dykelands have been maintained for agricultural use, they are covered by a variety of forage, grain, and introduced plants. Many of the farms on the Cumberland Marshes have been abandoned.

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



Cumberland Marshes Ecodistrict is the smallest in the province with its western boundary bordering New Brunswick.
(From Ecodistricts of Nova Scotia map 2007)

Land Area

Cumberland Marshes is rural and 68% under private ownership, with only 18% under the administration of the provincial Crown (Table 1).

About 5% is under federal ownership and the remaining 9% includes transportation corridors and inland lakes and other bodies of water.

Table 1 – Land Area by Ownership in the Cumberland Marshes Ecodistrict*

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	3,371	17.8
Private	12,970	68.3
Federal	918	4.8
Aboriginal	0	0
Other (Includes inland water bodies and transportation corridors)	1,723	9.1
Total	**18,983**	**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).

More than 95% of the ecodistrict is in the C2 class.

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	122	4
C2 – Multiple and Adaptive Use	2900	95.7
C3 – Protected and Limited Use	0	0
Unclassified	7	0.2
Total	**3,029**	**99.9**

The Cumberland Trails Association was issued a permit to construct, maintain, and operate a multiuse trail and related facilities. This trail is not yet constructed, but is part of the Trans-Canada Trail and will run through the Amherst Marsh towards New Brunswick.

There are two camp leases in the Amherst Marsh.

Forests

Within the Cumberland Marshes Ecodistrict, only 29%, or 5536 hectares, is forested (Table 3). This is considerably below the provincial average of 72%.

Wetland accounts for about 28% of the area. Most of this sector is found in dykelands or salt marshes. Agricultural lands account for 34% the area. The primary agricultural activity is hay production. About 2% of the area, or 283 hectares, is classed as urban.

The dominant covertype of the current forested area is softwood, accounting for 49% of the area. For the remaining area, 12% is classified as hardwood, 20% mixedwood and 14% unclassified.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	5,536	29.2
Wetland	5,300	27.9
Agriculture	6,402	33.7
Barrens	34	0.2
Urban	283	1.5
Road, Trail, Utility	258	1.4
Other	1,169	6.2
Total	**18,983**	**100**

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 4.5 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.

The most common forest community within this ecodistrict is softwood stands dominated by red and black spruce. These species represent about half of the forested area and are considered late successional.

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	216	4.2
3	434	8.5
4	1,564	30.6
5	2,296	44.9
6	575	11.2
7 or more	31	0.6
Total	**5,116**	**100**

*Based on growth potential for softwood species.

Within this ecosditrict, these softwood species are commonly found growing on imperfectly drained, medium-textured, hummocks. One of the few cedar stands in the province is located in this area within the Amherst Point Migratory Bird Sanctuary.

Early successional hardwood stands (white birch, poplar, and red maple) account for one-third of the forested area. These species establish quickly after a disturbance and are primarily located on imperfectly drained, moderate-textured, hummocks.

Very little tolerant hardwood (yellow birch or sugar maple) is found in this area. Less than 1% of the forested area is suited for this species. The next largest community group is white spruce, which accounts for 14%. In this ecodistrict, these stand types are found near or on dykelands and near well-drained sites associated with abandoned agricultural fields.

Only 29% of the Cumberland Marshes Ecodistrict is forested. More land is in wetland or used for agriculture than forested.

Water Resources

Cumberland Marshes is a low-lying area heavily influenced by the tides of the Cumberland Basin. The low areas are home to several marshes, bogs, and sanctuaries. Some of the larger marshes include the Amherst Marsh and the John Lusby Marsh. The Missaguash Bog is a unique area scattered with a number of small lakes. Two sanctuaries are also located here. The first is situated near the mouth of the River Hébert referred to as Amherst Point Migratory Bird Sanctuary. The second, called the Hackmatack Lake and Round Lake Game Sanctuary, is located on Crown land in the middle of Chignecto Isthmus.

The major rivers in this area are the River Hébert, Maccan, Missaguash, and LaPlanche. There are many small lakes in this area particularly along low lying area of the Nova Scotia / New Brunswick border. The two largest lakes are Round Lake and Long Lake.

Minerals, Energy and Geology

The Cumberland Marshes Ecodistrict lies on the northwestern end of the Cumberland Basin. The Cumberland Basin comprises a large subbasin that formed north of the Cobequid-Chedabucto Fault System and is part of a larger Maritimes Basin. This subbasin comprises Carboniferous age sedimentary rocks (about 280 to 350 million years old) and contains significant mineral and geological resources.

The bedrock geology comprises sedimentary rocks of Carboniferous age (300 to 350 million years old) of the Pictou, Cumberland, Mabou, and Windsor groups. Pictou Group redbeds – sedimentary rocks that are usually red in colour because of the presence of iron oxides – dominate in the north. These early to late Carboniferous rocks are an important source rock for coal, salt, gypsum and, to a lesser extent, base metals.

Wind energy provided by turbines in Cumberland Marshes is becoming increasingly important.

The Pictou Group comprises mudstone, sandstone, and conglomerate redbeds and rare limestone. The Cumberland Group of rocks is made up of grey and red sandstone, mudrock and conglomerate, as well as coal seams and thin limestone. The Mabou Group comprises reddish mudstone, siltstone, shales, and sandstone with rare conglomerate and limestone.

The Windsor Group includes red mudstone and sandstone, and rocks formed by the evaporation of water, such as limestone, salt, and gypsum.

Overlying the bedrock in the flat, lower areas of Cumberland Marshes are post-glaciation marine and organic deposits while the slightly elevated areas consist of streamlined glacial drift deposits that comprised ground moraine from the last vestiges of glaciation prior to 10,500 years ago. Along the rivers, glacial fluvial and alluvial deposits contribute to the development of soils, and are a good source of aggregate. The river estuaries recycle Pictou Group redbeds as mud in the twice-daily tidal cycle.

Sandstones and shales of the Horton Group, believed to underlie the younger Carboniferous rocks at depth, are considered important in oil and gas exploration, providing a potential source and reservoir of hydrocarbons.

Economically important salt and associated gypsum deposits are concentrated in an east-west ridge. A salt company has been extracting deep salt in the Nappan area for half a century. Coal seams of the Joggins-Chignecto coalfield cross in the upper reaches of the Hébert and Maccan rivers. In the younger Carboniferous rock, concentrations of barite, lead, and other base metals have been found.

There are shale and clay deposits throughout the ecodistrict with aggregate in the glacial fluvial and alluvial deposits along the river valleys. The southwestern limit of the ecodistrict abuts the proposed Joggins World Heritage property at Downing Cove.

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.

Parks and Recreation / Protected Areas

For the parks and protected areas within your ecodistrict, please refer to the Park and Protected Areas website (http://novascotia.ca/parksandprotectedareas/plan/interactive-map/) and the Provincial Landscape Viewer, at the following url: https://nsgi.novascotia.ca/plv/.

Wildlife and Wildlife Habitat

Wildlife in the Cumberland Marshes 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 Cumberland Marshes 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 Department of Lands and Forestry staff. Information on important sites is documented by Department of Lands and Forestry 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.

Cumberland Marshes is one of the smallest ecodistricts in the province and mainly comprises rich marsh and dykeland in northwestern Nova Scotia. The ecodistrict is a vital connection to New Brunswick and is known as the Chignecto Isthmus.

Cumberland Marshes is one of the most important and valuable areas in the province for waterfowl habitat. The abundance of rich marsh soils and location along nearby bays are ideal habitat for a variety of wildlife species.

Several wetlands have been improved, and constructed to enhance waterfowl presence and as well to act as a management tool. The John Lusby Marsh is a large salt marsh which, with the Amherst Point Migratory Bird Sanctuary, has been designated the Chignecto National Wildlife Area. A provincial wildlife management area at Maccan includes a portion of the Maccan River and Harrison Lake. There is a proposal to create a wildlife management area that would include the Missaguash Bog and Amherst Marsh. This proposal would include the existing provincial sanctuary at Round Lake and Hackmatack Lake.

The Maccan River and River Hébert are significant rivers that flow in this ecodistrict. They provide valuable habitat for endangered Bay of Fundy salmon. Several rare species of freshwater mussel are known to occur in these rivers. Rare interval plants are identified along these rivers, including small white leek, blue cohosh, and Canada lily. Black ash has been found along the Maccan River.

An important special occurrence of cedar has been identified in the Amherst Point Migratory Bird Sanctuary. Cedar therefore may be found in other areas of this ecodistrict that have not yet been reported. Further surveys in this area are required to determine any additional pockets of cedar.

Three eagle nests are identified along the Maccan River and Meadow Brook.

Eagles, such as these young birds, nest in the Cumberland Marshes Ecodistrict.

Mainland moose are transient in this ecodistrict, likely moving across the provincial boarder east of the Fort Lawrence area. This is an extremely important area for movement and allows more genetic diversity within the mainland moose population.

Designated species at risk found within the Cumberland Marshes Ecodistrict include Atlantic salmon, mainland moose, black ash, and several bird species (red knot, common nighthawk, olive-sided flycatcher, bobolink, and Canada warbler).

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 Department of Lands and Forestry 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 woodland 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 provide a model to compare with managed forests.

Most of the forested portion of the ecodistrict is frequently disturbed by stand-initiating events such as windstorms and insects (spruce budworm). Forests on the Fort Lawrence Ridge are infrequently disturbed by stand-initiating events, with windstorms the most likely agent.

The role of fire in the ecodistrict is unknown but during periods of excessive dryness portions adjacent to the Northumberland Lowlands Ecodistrict 530 could occasionally be burned.

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.

Cumberland Marshes – Elements Defined

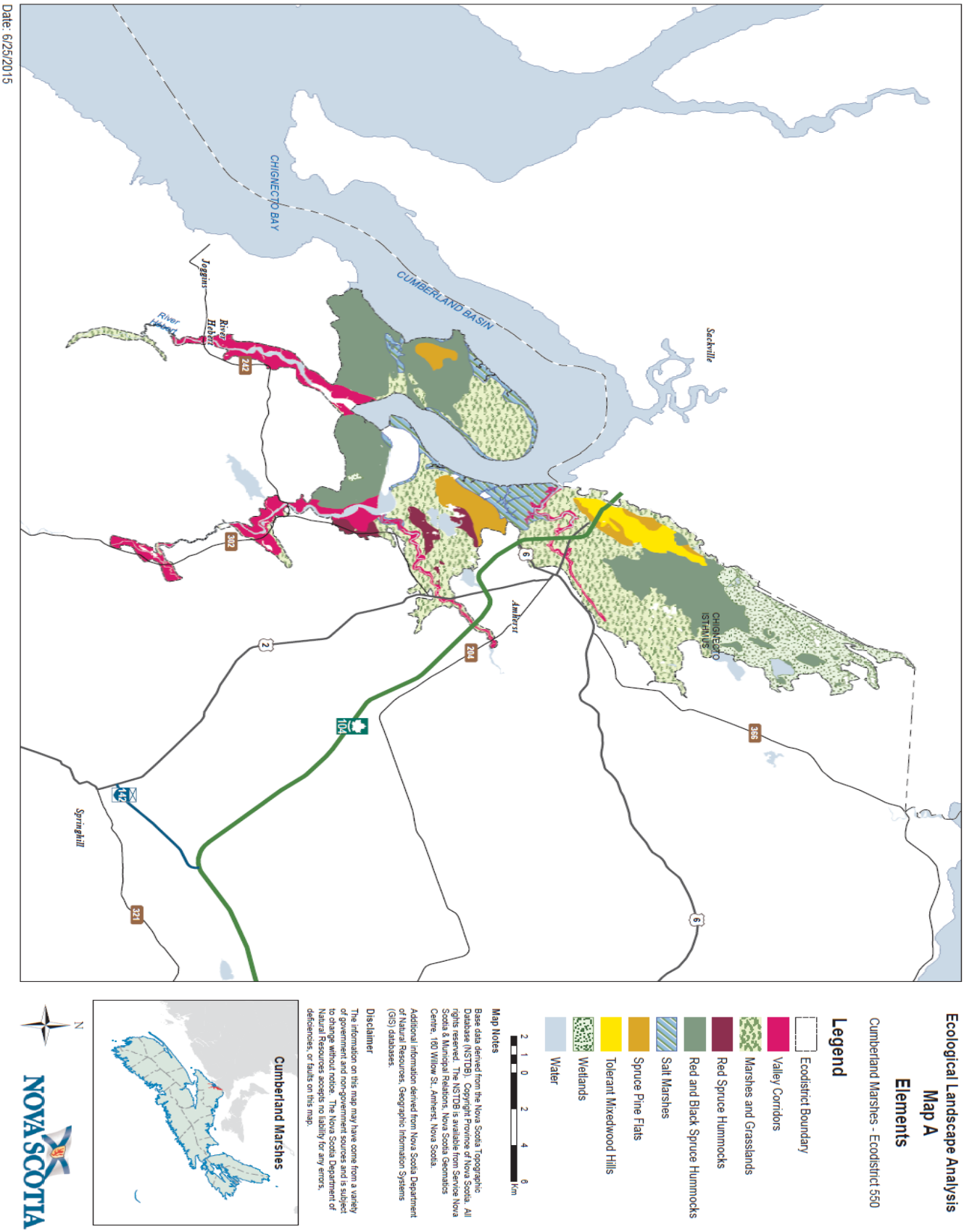
Landscapes are large areas that function as ecological systems and respond to a variety of influences. Landscapes are composed of smaller ecosystems, known as elements. These elements are described by their physical (e.g. soil, landform) and ecological features (e.g. climax forest type). These characteristics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

A landscape profile identified and mapped seven distinctive elements in the Cumberland Marshes Ecodistrict – one matrix, and five patches (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types.

The matrix element **Marshes and Grasslands,** representing about one-third of the ecodistrict, has been extensively altered by human settlement, agriculture, wildlife management, roads, and utility corridors. Acadian settlers in the area in the early- to mid-1700s built dykes on the extensive salt marshes to reclaim sediment-rich lands from the Bay of Fundy.

Red and Black Spruce Hummocks is the largest patch element, representing more than one-quarter of the ecodistrict. This patch is the most intact element in the ecodistrict. The other patches, in order of size, are **Wetlands**, **Spruce Pine Flats**, **Tolerant Mixedwood Hills**, and **Red Spruce Hummocks.** Most of the patch elements are under heavy land use pressure. *The small Salt Marsh element, formerly part of the Wetlands element, is also found in the ecodistrict.*

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 Department of Lands and Forestry 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 Department of Lands and Forestry, 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 Cumberland Marshes		
Element	**Size (Hectares)**	**Element Description**
Marshes and Grasslands (Matrix)	7,386 42.3%	In the matrix element, the twice daily tidal actions of the Bay of Fundy create extensive areas of salt marsh along the floodplains of rivers such as the Maccan, Hébert, and Missaguash. The Minudie Marsh was also once salt marsh before the extensive land reclamation. Deposits of silty clay loam sediments with semi-decomposed grasses and sedges trapped in the accumulating layers, formed along the tidal shores and in estuaries found at the mouths of rivers and streams subjected to tidal conditions. A history of reclamation first started by the Acadians more than 300 years ago has resulted in most of these marshes being drained and protected from daily salt water flooding. They have become some of the most fertile agricultural areas in the province. Forests of black spruce occur on poorly drained lands that have not been subjected to tidal flooding due to natural channel alterations or lands that were unsuitable for agriculture. Dykeland that is no longer being farmed will develop shrub species such as alders and willows and will revert to poor to very poor drainage. Waterfowl habitat improvement has been done on many areas where freshwater marshes have been established.
Red and Black Spruce Hummocks (Patch)	4,932 28.2%	The largest patch element occurs on moderately well and imperfectly drained sandy loams and loams on gently undulating terrain. The compact subsoil resists penetration of water and tree roots and during the summer the surface layers of these soils commonly dry out for considerable periods. Softwood forests of red, black and hybrid red-black spruce are dominant with an extensive understory of ericaceous shrubs. On the flatter terrain between hummocks, the soils are poorly drained and support a forest of black spruce, red maple, and tamarack. Black ash has been found on these wetter soils. Following frequent stand-level natural disturbances such as fire, windstorm, or insect defoliation early successional forests may include shade intolerant hardwoods such as red maple, white birch, grey birch, and aspen.
Wetlands (Patch)	2,068 11.8%	The wetlands element is a patch-level ecosystem comprising freshwater bogs, fens, swamps, and poorly drained areas providing some of the most important migratory waterfowl habitat in the province. This element most often occurs here as a series of medium and large wetland complexes associated with level terrain along rivers and larger streams. It may also occur as narrow linear communities associated with flow accumulations and small streams, as a community of hydrophytic vegetation (sedges, sphagnum moss, false holly, and winterberry) associated with level terrain where drainage is impeded, or as a depression in the landscape where water remains in excess year round. Smaller disjoint wetlands are often embedded within other elements, especially the Spruce Pine Flats element. Wetlands are generally treeless or sparsely forested woodlands of black spruce, tamarack, black ash, and red maple. This element plays a critical role in water collection, filtering, and groundwater recharge. Drainage improvements have been made in this element for agriculture and as waterfowl habitat enhancements.

Table 5a – Elements Within Cumberland Marshes		
Element	**Size (Hectares)**	**Element Description**
Spruce Pine Flats (Patch)	859 4.9%	This patch-level element is associated with smooth, imperfectly drained terrain underlain by sandy loams and loams. Forests of black spruce are typical. As soil drainage gets progressively poorer, wet forests of red maple, tamarack, and black spruce with alders, false holly, winterberry, and other woody shrubs are common. Open wetlands are also prominent within this element. Due to the shallow rooting of trees on the moist to wet soils, forest stands are frequently disturbed by windthrow. The potential for old growth forest development is low. Earlier successional forests will be of similar species composition to later stages although on the better sites aspen, red maple, white birch, and balsam fir are common. Much of this element has been converted to agricultural uses with drainage improvements and, when abandoned, old fields will reforest to white spruce and tamarack.
Tolerant Mixedwood Hills (Patch)	545 3.1%	The Fort Lawrence Ridge, an area of undulating to gentle rolling topography, comprises this entire patch-level element in the ecodistrict. The ridge is underlain by well and imperfectly drained fine to medium-textured sandy loams. These productive soils have been extensively used for agriculture. The forests tend to comprise shade-tolerant hardwood and softwood species. Early and mid-successional forests will have red maple, white birch, aspen, and balsam fir. Even with the increased exposure to winds due to the location of this element at the end of the Bay of Fundy, stand-level disturbances are infrequent and gap disturbances create opportunities for uneven-aged forests. Abandoned agricultural lands tend to reforest to white spruce, tamarack, and aspen.
Red Spruce Hummocks (Patch)	518 3.0%	This small patch-level element occurs on gently undulating terrain near Amherst. The well-drained soils are underlain by sandy loams and loams. These productive soils have been extensively used for agriculture. The forests tend comprise red spruce and balsam fir. Where soils are imperfectly drained, black spruce and the hybrid red-black spruce are more common. Early and mid-successional forests will have red maple, white birch, aspen, and grey birch with balsam fir. Abandoned agricultural lands tend to reforest to white spruce, tamarack, and aspen.
Salt Marsh	1,146 6.6%	There are only small isolated patches of original salt marsh remaining which support the dominant natural grasslands vegetation. Salt water cordgrass dominates the lower marshes.
Total	**17,466***	*Area is not the same as in Table 1 because water has not been included.

Table 5b – Forest Vegetation Types[1] Within Elements in Cumberland Marshes

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Red Spruce Hummocks	IH4, IH5, IH6	5.9	MW4, MW5, SH5, SH6, SH7, SH8	7.5	**SH3**	2.7
Spruce Pine Flats	IH4, IH6, SP1	9.9		5.8	**SP7**	10.9
Tolerant Mixedwood Hills	IH5, IH6	5.7	IH7, MW4, MW5, SH5, SH6, SH8	4.3	**MW1,** MW2, SH3	2.9
Red and Black Spruce Hummocks	IH4, IH5, IH6	14.5	CE2, MW4, MW5, SH5, SH6, SH7, SH8	17.4	**SH3, SP7**	31.0
Marshes and Grasslands	Cultivated fields and freshwater wetlands (cattails, willows, alders)					
Salt Marsh	Grasslands of Spartina spp.					
Wetlands	CE1, WC1, WC2, WC3, WC5, WC6, WC7, WD2, WD3, WD5, WD6, WD8					

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 Department of Lands and Forestry 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.

Eastern white cedar – Balsam fir / Stair-step moss (CE2) is a mid-successional vegetation type found in the Red and Black Spruce Hummocks patch element.

Red maple – Balsam fir / Wood aster / Sphagnum (WD6) is one of three wet mixedwood forests in Nova Scotia that is found in the Wetlands patch element.

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

Red spruce – Balsam fir / Schreber's moss (SH5) is a mid-successional vegetation type found in the Tolerant Mixedwood Hills element.

Trembling aspen – Wild raisin / Bunchberry (IH4) is an early successional vegetation type found in the Red Spruce Hummocks 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 Department of Lands and Forestry is employing to try and realize this objective. Department of Lands and Forestry 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 Cumberland Marshes, frequent stand-initiating disturbance is one of the dominant natural disturbance regimes. These disturbance intervals are generally shorter than the average longevity of the dominant species where we see a rapid mortality of existing stands and quick establishment of new stands of even age. In these disturbance regimes it is favourable to have the forest in a relatively balanced development class and seral stage.

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 Department of Lands and Forestry 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 Department of Lands and Forestry 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

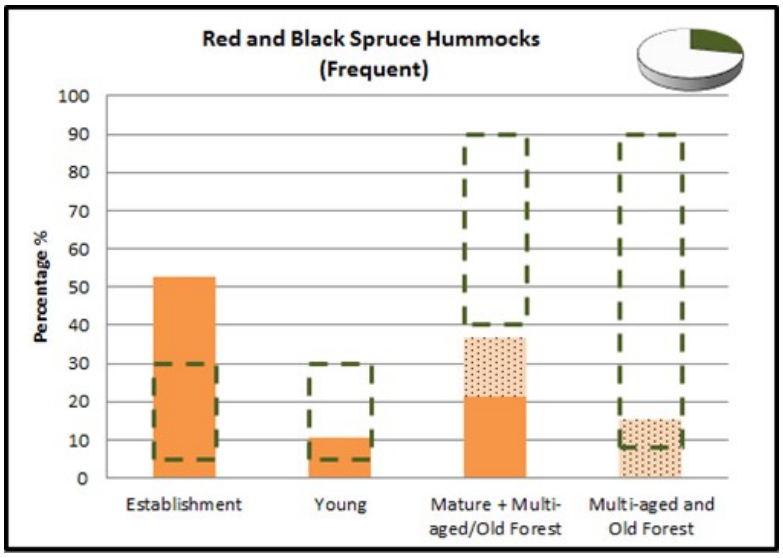
disturbance regimes are shown in Table 6. Forest planning should strive to maintain composition within these targets and identify corrective and mitigating measures when outside these ranges.

Development Class Targets by Element

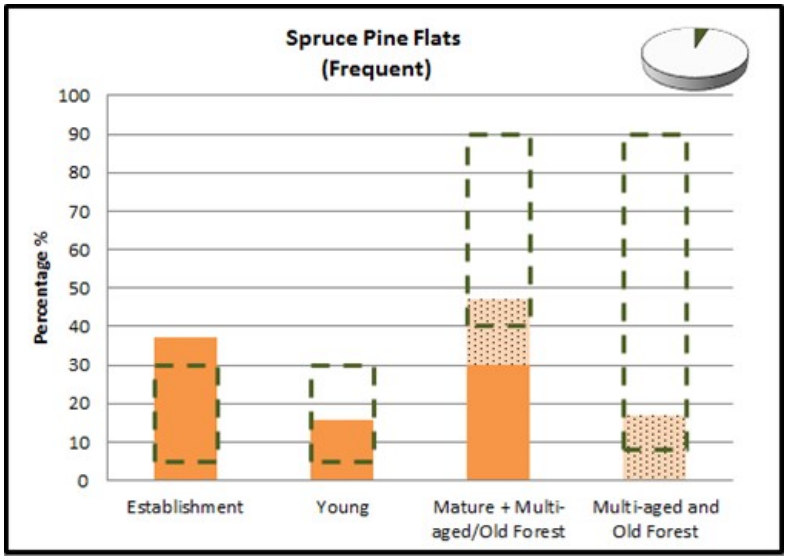
The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime. The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage 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.

All non-forest elements, (e.g. Rockland, Wetland, Beach, Urban, Marshes/Grasslands, Salt marsh) and the Valley corridor element have not been measured or included in the 2019 update.

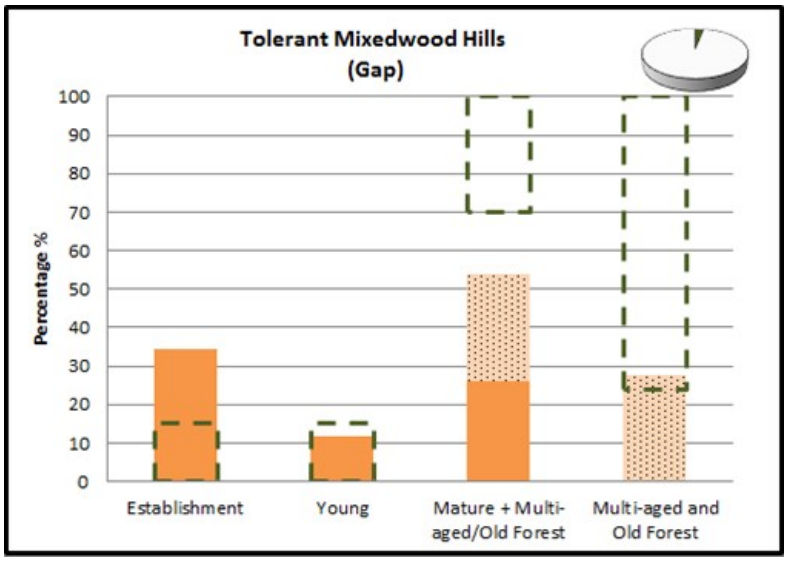
Forest composition in **Red and Black Spruce Hummocks** is close to target ranges, with some excess of establishment stage and slight deficiency of mature and multi-aged. The more fertile sites may provide opportunities for extended rotations and partial harvest practices. Thinning in the establishment and young forests can improve species' composition and diameter growth rates.



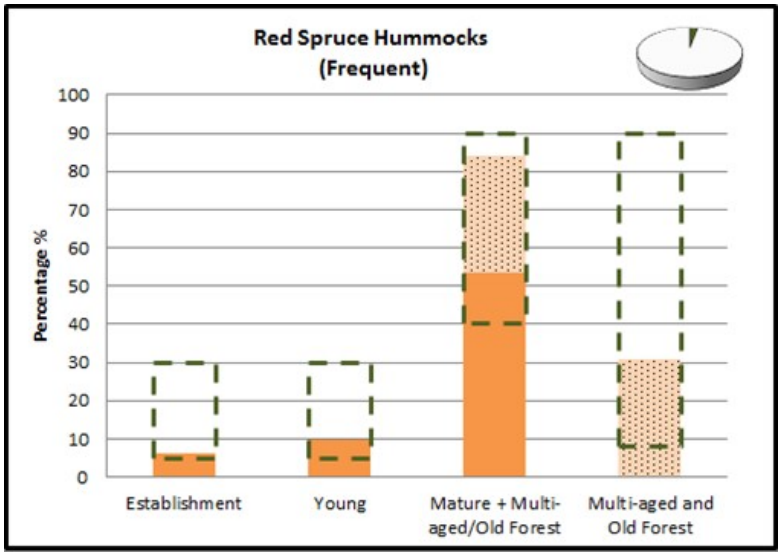
In the small **Spruce Pine Flats** patch element, there is an over- abundance of establishment forest. Pre-commercial thinning may hasten diameter growth and help restore this aspect of mature habitat. Due to the shallow rooting of trees on moist to wet soils mature stands are vulnerable to blowdown, particularly if thinned. Potential for old growth is low.



In **Tolerant Mixedwood Hills**, most of the land has been converted to farmland. Very little of the original forest area remains and most of this is in softwood stands. Efforts to develop maturehardwood composition in the forest would help restore the ecosystem.



Most of the small **Red Spruce Hummocks** patch element has been converted to farmland. The remaining forest has a good balance of development classes, dominated by mature forest. This ecosystem will favour the development of mature climax red spruce stands.



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 woodland 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 Department of Lands and Forestry 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 unde 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).