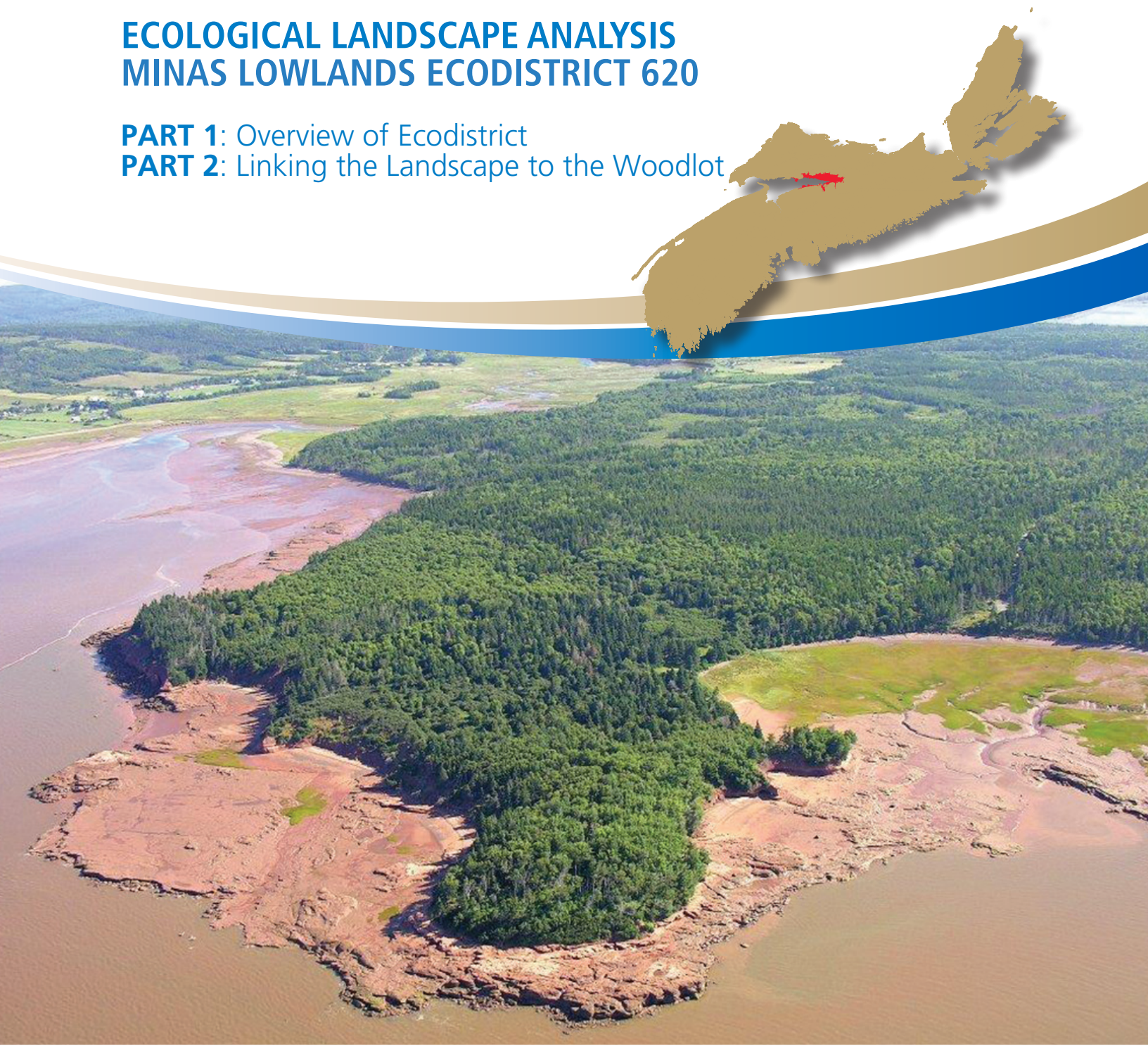
Department of Lands and Forestry

2019 Update

ECOLOGICAL LANDSCAPE ANALYSIS MINAS LOWLANDS ECODISTRICT 620

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



ELA 2019-620

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 620: Minas Lowlands
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 capabilityfor 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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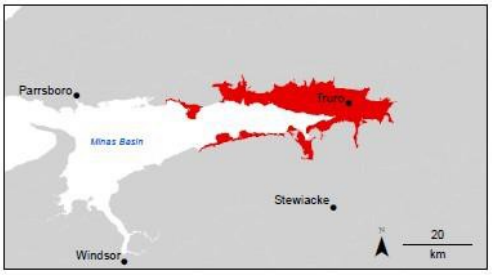
A NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES PUBLICATION

Ecodistrict Profile

Ecological Landscape Analysis Summary
Ecodistrict 620: **Minas Lowlands**



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 Minas Lowlands Ecodistrict 620. 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.

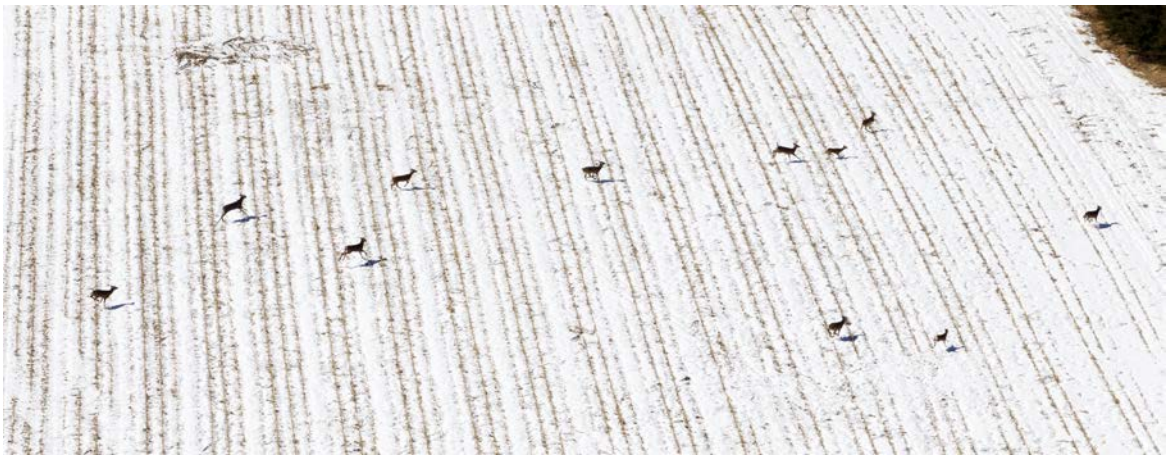
The Minas Lowlands Ecodistrict covers the lowland areas of the northern and southern shores of Cobequid Bay – at the eastern end of the Minas Basin – in Colchester and Hants counties.

Along the southern shore, the ecodistrict is fairly narrow until it approaches Truro, where it widens and extends inland following the valleys of the Salmon and North rivers to the slopes of the Cobequid Hills. Several other major rivers pass through the ecodistrict, including the Shubenacadie, Chiganois, Folly, Debert, and Bass. The highest elevation seldom exceeds 40 metres above sea level.

The climate, influenced by Cobequid Bay, is such that on the better soils conditions permit the growing of some crops associated with the Annapolis Valley, such as corn and strawberries.

Since European settlement, the construction of dykes has been used to claim farmland from the tidal salt marshes that surround the bay.

The daily tidal fluctuation creates extensive mud flats along Cobequid Bay and river estuaries. Farmland, forests of black spruce and wetlands covers the level topography of this ecodistrict at Lower Debert.



The farmlands in this ecodistrict are foraged extensively by the overwintering deer populations.

The ecodistrict is underlain by the Triassic era red siltstones and sandstones. On the north shore of the Cobequid Bay most of the ecodistrict has been covered by glacial deposits of sand and gravel that have formed deep beds. Along the bay the soft sandstones have been gradually eroding and extensive tidal flats on both sides of the bay are evidence of a once larger land mass.

Private land ownership accounts for 89% of the total Minas Lowlands Ecodistrict area of 43,695 hectares. Only 5% of the ecodistrict is under provincial Crown management.

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 eight key landscape elements – two dominant co-matrix elements, and six smaller patch elements – in Minas Lowlands.

Red and Black Spruce Hummocks is one of the co-matrix elements, representing 35% of the ecodistrict. **Spruce Pine Hummocks** is the other co-matrix, accounting for 35% of the area, and together representing nearly two-thirds of the ecodistrict. The dominant species in both ecodistricts is spruce – mainly black and red – with some pine and balsam fir.

Two patch elements – **Marshes and Grasslands** and **Salt Marsh** – are associated with the tidal action in Cobequid Bay and are mainly found at the mouths of major rivers that empty into the bay.

The other patch elements, in order of size, are **Spruce Hemlock Pine Hummocks and Hills**, **Red and Black Spruce Flats**, **Tolerant Hardwood Hills**, and **Wetlands**.

Forest Ecosystem Management
For Minas Lowlands 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 Minas Lowlands Ecodistrict 620. 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 Minas Lowlands 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 Minas Lowlands – *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

Surrounding Cobequid Bay and encompassing the adjacent lowlands, this ecodistrict covers an area of 43,695 hectares, or 11% of the Valley and Central Lowlands Ecoregion.

The ecodistrict is fairly narrow along the southern shore of the bay until it approaches Truro, where it widens and extends inland to the Cobequid Slopes Ecodistrict 350.

Evidence of glacial fluvial deposits can be seen in the extensive gravel and sand quarries outside of Truro.

Similar to the Annapolis Valley Ecodistrict, Minas Lowlands has very little in the way of lakes, with most of the freshwater resource (2% of the ecodistrict) occurring in streams and rivers and a few small ponds.

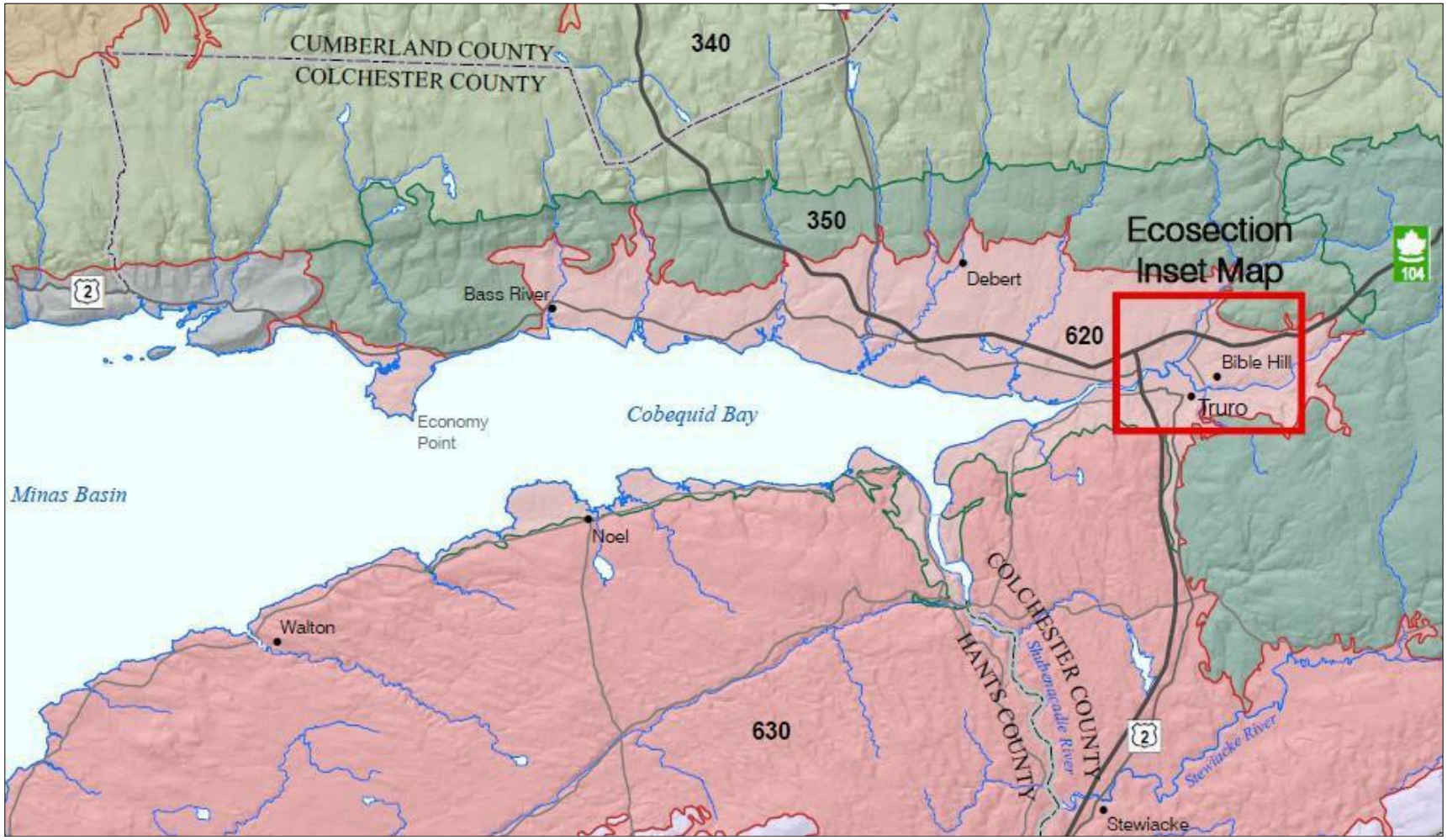
The forests of this ecodistrict predominantly comprise softwood species – such as red and black spruce – with very few stands of shade-tolerant hardwood.

Usually only on the well-drained hills will sugar maple, yellow birch, and beech be found. Elsewhere, the tolerant hardwoods will be found growing in mixedwood associations with red spruce, hemlock, and white pine, particularly on the steep slopes of the streams and rivers flowing to Cobequid Bay.

The current landscape patterns in the Minas Lowlands Ecodistrict are influenced by past land use – such as settlement and farming – insects and diseases, forest harvesting, and repeated fires and wind. The ecodistrict is almost evenly split between well-drained and imperfectly drained soils.

Fire and hurricanes have been the main natural disturbance agents in the ecodistrict. Occasional stand-level mortality will occur due to insect and disease epidemics, such as the spruce budworm and tussock moth. The damage caused by Hurricane Juan in 2003 was extensive in this ecodistrict and provides an example of the susceptibility of a forest with moist soils to wind storms.

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



The Minas Lowlands Ecodistrict 620 curls around the northern and southern coasts of Cobequid Bay, part of the Minas Basin.
(From Ecodistricts of Nova Scotia map 2007)

Land Area

The Minas Lowlands Ecodistrict is rural and mainly under private ownership at 89%, with only 5% under the administration of the provincial Crown (Table 1).

Table 1 – Land Area by Ownership in the Minas Lowlands Ecodistrict*

Ownership	Area* (hectares)	Percent of Total Area
Provincial Crown land	1,953	4.5
Private	38,786	88.8
Federal	520	1.2
Aboriginal	104	0.2
Other (Includes inland water bodies and transportation corridors)	2,332	5.3
Total	**43,695**	**100**

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

IRM Resource Classification for Provincial Crown Lands

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

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

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

IRM Land Use Category	Hectares	Percent of Crown Lands
C1 – General Resource Use	483	25.3
C2 – Multiple and Adaptive Use	1,121	58.8
C3 – Protected and Limited Use	230	12.1
Unclassified	73	3.8
Total	**1,907**	**100**

In Minas Lowlands, the most common land use category on Crown lands is C2 (59%), followed by C1 (25%), and C3 (12%), leaving 4% as unclassified.

Crown land in Minas Lowlands is not heavily encumbered by licenses and leases. Although the ecodistrict includes substantial coastline, there are only a small number of requests for coastal permits. The Bay of Fundy tides make it difficult to build wharves, skidways, and seawalls.

Crown leases in the ecodistrict include about 40 hectares each for growing blueberries on the west side of the Portapique River and as a recreational area for equestrian purposes in Murrays Siding. Both of these leases run for ten years with a ten-year renewal option.

Forests

Of the 43,695 hectares of land in the Minas Lowlands, 46% is forested (Table 3), which is less than many other ecodistricts in the province.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	20,265	46.4
Wetland	3,178	7.3
Agriculture	12,525	28.7
Barrens	16	0.04
Urban	5,041	11.5
Road, Trail, Utility	1,708	3.9
Other	963	2.2
Total	**43,695**	**100**

Agriculture plays a major role in this ecodistrict, accounting for 29% of the area.

Urban areas and wetlands make up the largest percentage of other land uses, accounting for 12% and 7%, respectively.

The forested covertypes of Minas Lowlands are 47% softwood, 22% mixedwood, and 12% hardwood, with the remainder unclassified.

Red and black spruce stands are the predominant feature of the forests, accounting for 46% of the forested area.

The second most common stand type is white spruce. This species has established itself on abandoned farmland. Only on the well-drained hills will sugar maple, yellow birch, and beech usually be found.

The present inventory indicates there are 132 hectares of shade-tolerant hardwood forest community types. The tolerant hardwoods will also sometimes be found growing in mixedwood associations with red spruce, hemlock, and white pine, particularly on the steep slopes of the streams and rivers flowing to the bay.

Intolerant hardwood mixedwood associations account for 2,331 hectares.

A few areas of the ecodistrict have deep, coarse sandy soils where red pine and white pine occur, which have originated after fire. Pine-dominated forests account for 173 hectares.

White elm, black ash, and occasionally sugar maple and beech, may be found along the river systems.

Several small sawmills are located in this ecodistrict in Debert, Belmont, and Old Barns.

One of the largest sawmills in the province, owned by Irving, is located in Valley.

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

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	733	3.8
3	1,523	7.8
4	1,972	10.1
5	7,394	38.8
6	7,472	38.2
7 or more	444	2.3
Total	**19,538**	**100**

*Based on growth potential for softwood species.

Softwood forests of black and red spruce are most common in the Minas Lowlands Ecodistrict.

Water Resources

This ecodistrict has few bodies of water. Two worth noting are MacElmons Pond near Debert and Little Dyke Lake, near Little Dyke.

Rivers flowing through this area include the Shubenacadie, Salmon, Chiganois, Folly, Debert and Bass.

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

The Environmental Goals and Economic Prosperity Act, which was enacted in early 2007, has committed the province to prepare a comprehensive water strategy. This strategy will include a high-level evaluation of water resources.

Nova Scotia's water strategy can be found at
http://www.novascotia.ca/nse/water.strategy/docs/WaterStrategy_Water.Resources.Management.Strategy.pdf

The Folly and Debert rivers help shape a winding and changing landscape of land and water in the Glenholme area as the rivers flow into Cobequid Bay.

Minerals, Energy and Geology

The Minas Lowlands Ecodistrict comprises mostly Triassic Age, Wolfville Formation sedimentary rocks, up to 240 million years old.

The southern part of the Minas Lowlands is made of Early Carboniferous terrestrial sedimentary rocks of the Horton Group that have hydrocarbon potential. These rocks are between 340 and 365 years old.

This ecodistrict also contains minor areas underlain by the Early Carboniferous marine sedimentary rocks of the Windsor group, Late Carboniferous Parrsboro Formation, and the North Mountain Formation basalts.

These early to late Carboniferous rocks are important hosts for coal, salt, gypsum and, to a lesser extent, base metals. There has been past production of iron in Old Barns and Birch Hill and coal in Staples Brook.

The structural geology is influenced slightly by the Cobequid-Chedabucto Fault System that runs east to west along the northern part of the ecodistrict. Along this fault system there are numerous mineral occurrences and good potential for mineral deposits, particularly iron-oxide, copper, and gold deposits. Several small faults run southeast to northwest, south of the fault.

Overlying the bedrock in many parts of Minas Lowlands are mostly late glaciation, ground morraine, streamlined drift, and glacial fluvial deposits. These contribute to the development of soils, and have been used as a source of aggregate with numerous gravel and sand pits located in these glacial fluvial deposits.

Several gravel and sand pits operate in the ecodistrict.

Exploration and development drilling for conventional oil and gas, gas shales, and for coalbed methane is ongoing in the Carboniferous rocks. The Carboniferous rocks of the Minas Lowlands have been explored by seismic surveys exploration. The Cumberland Group rocks contain numerous coal seams and may provide a future source for coalbed methane gas. *In 2014, the Nova*

Scotia government announced it would be continuing a moratorium on hydraulic fracturing, also known as fracking, for coalbed methane that had already been in place for two years.

The sandstones and shales of the Horton Group are of particular interest in oil and gas exploration in this part of the province since they provide a source of hydrocarbons and in areas of structural traps, where overlain by Windsor Group salt and gypsum, provide a geological caprock for them.

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/.

Anthony Provincial Park (above) and MacElmons Pond Provincial Park (below) are located in the Minas Lowlands Ecodistrict.

Wildlife and Wildlife Habitat

Wildlife in the Minas Lowlands 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 Minas Lowlands 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.

The Minas Lowlands Ecodistrict encompasses Cobequid Bay, stretching from Lower Economy to Tennycape. The southern portion along the bay is fairly narrow and widens as the ecodistrict approaches Truro and the Cobequid Slopes Ecodistrict to the east.

This ecodistrict provides diverse wildlife habitat that includes a combination of forested and open land, as well as intertidal habitat. There are significant salt marshes along the coast and much of it has been dyked for agricultural practices. Orchards and old fields are also found in the ecodistrict.

The extensive salt marshes, dykeland, tidal flats, and estuaries along the coast of the Cobequid Bay provide habitat for many species of wildlife. Tidal flats, bars, and beaches are important feeding areas for migratory shorebirds while dykelands provide roosting sites at high tide.

The estuaries in this ecodistrict provide breeding and staging areas for waterfowl, and are important habitat to several species of fish, including sturgeon, striped bass, and shad.

Bald eagles use these estuaries for winter habitat, most notably in the Shubenacadie River where they feed on fish.

Several major rivers pass through this ecodistrict including the Shubenacadie, Salmon, Chiganois, Folly, Debert, and Portapique. These river systems once had healthy salmon runs.

However, Bay of Fundy salmon are now a designated endangered species under federal legislation. This emphasizes the need for special management practices along watercourses to protect the habitat for salmon and other aquatic species.

Wood turtles are identified in the Chiganois River and are designated as threatened status under federal law.

Smelt runs occur regularly each spring in the Portapique River, attracting many fishing enthusiasts. This river gives rise to steep cliffs and ravines with exposed rock faces and unique microhabitat. Some rare plants are known to occur on the Portapique River including long-bracted green orchid and pubescent sedge.

Many of the rivers that flow through the ecodistrict have fertile intervales that are habitat for several rare plants including Canada lily. Interval land along the Salmon River has records for showy tick-trefoil, bird's-eye primrose, and common alexanders. If forestry operations are conducted near fertile intervals, the special management zone should include the whole interval.

Wetlands, representing 7% of the ecodistrict, provide important wildlife habitat. These wetlands are at Hoegs Corner.

This ecodistrict includes part of the Cobequid slopes deer wintering area. Deer need mature softwood forest for winter cover.

The ecodistrict provides important wintering areas for white-tailed deer.

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

With much of the ecodistrict privately owned, effective wildlife management will to a great extent rely on active, informed stewardship by the many landowners. The 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 woodlot level. The starting point is an introduction to natural disturbances and succession to provide a foundation for better understanding forest ecosystems. The focus then shifts to elements that make up each ecodistrict and the forest groups and vegetation types at the stand level. This allows woodland owners to move between elements and stands to see how their woodland fits in with the larger landscape.

Forest Disturbances and Succession

Forest Disturbances

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

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

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

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

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

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

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

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

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

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

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

Fire and hurricanes are the main natural disturbance agents in Minas Lowlands.

Natural Succession

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

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

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

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

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

Another Definition of Succession

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

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

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

Minas Lowlands – 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 eight distinctive elements in the Minas Lowlands Ecodistrict – two co-matrix, and six patches (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.

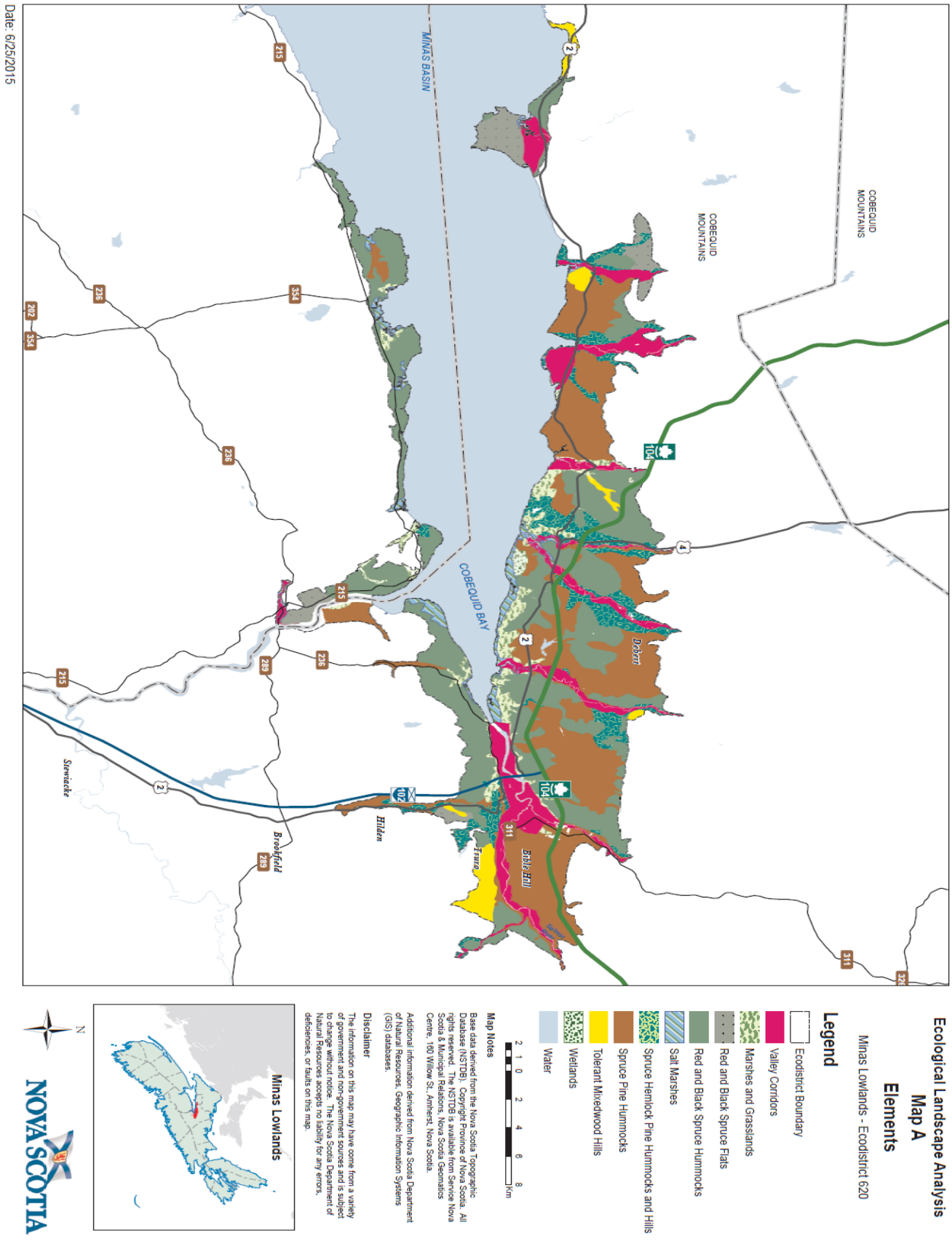
Red and Black Spruce Hummocks is one of the co-matrix elements, representing 35% of the ecodistrict. **Spruce Pine Hummocks** is the other co-matrix, accounting for 35% of the area, and together representing nearly two-thirds of the ecodistrict. The dominant species in both ecodistricts is spruce – mainly black and red – with some pine and balsam fir.

Two patch elements – **Marshes and Grasslands** and **Salt Marsh** – are associated with the tidal action in Cobequid Bay and are mainly found at the mouths of major rivers that empty into the bay.

The other patch elements, in order of size, are **Spruce Hemlock Pine Hummocks and Hills**, **Red and Black Spruce Flats**, **Tolerant Hardwood Hills**, and **Wetlands**.

The Folly River near Glenholme, are used for farming or settlement.

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 Minas Lowlands		
Element	**Size (Hectares)**	**Element Description**
Red and Black Spruce Hummocks (Co-Matrix)	15,137 35.3%	This is a co-matrix element occurring primarily on hummocky terrain and on well and imperfectly drained medium-textured soils derived from sandstones and siltstones. The moisture holding capability of these soils provide preferred conditions for red spruce on upper slopes. The flatter terrain between hummocks is usually imperfectly to poorly drained and supports a forest of black spruce and white pine which are susceptible to stand-level disturbances caused by windthrow due to the shallow rooting of spruce and the wetter soils. Balsam fir is a component of both site conditions. Shade-tolerant hardwoods are uncommon on these coarse-textured soils of low fertility. Following stand-level natural disturbances such as fire and hurricane, early successional forests may include shade intolerant hardwoods such as red maple, white birch, grey birch, and aspens. This element has been extensively cleared for agriculture as well as harvested for its forests products.
Spruce Pine Hummocks (Co-Matrix)	14,837 34.6%	This is the other co-matrix element and occurs primarily on imperfectly drained coarse-textured soil derived from sandstones. The inherent low soil fertility leads to a forest of black spruce and white pine with a significant understory of woody ericaceous shrubs. Near Debert where the soils are coarse, water deposited sands tend to have significant moisture deficit during the summer. Red pine and jack pine are also common. This element also occurs on level terrain associated with the larger rivers and streams. Here, the annual deposits of alluvium create a richer growing condition and floodplain forests of sugar maple and white ash occur. Often these sites are underlain by thick deposits of gravelly glacial fluvial outwash and are mined for aggregate, especially along the North River. With progressively poorer drainage, black spruce, tamarack, and red maple dominate the forest vegetation.
Spruce Hemlock Pine Hummocks and Hills (Patch)	5,203 12.1%	This is a linear patch element found mostly on the north shore of Cobequid Bay. Where soils are well-drained, forests of red spruce and white pine are dominant. However, drier and less fertile soils, usually very gravelly and sandy, support a forest dominated by white pine and black spruce with the hybridized red and black spruce prevalent. Frequent stand-level natural disturbances such as fire and hurricane create early successional forests that may include shade intolerant hardwoods such as red maple, white birch, and aspens. Much of this element has been cleared for settlement and agriculture and currently is being intensively used for blueberry production.
Marshes and Grasslands (Patch)	2,977 6.9%	The twice daily tidal actions of the Cobequid Bay has created extensive areas of salt marsh along the shoreline, most notably between Fort Belcher and Upper Onslow. Other salt marshes were created at the mouths of rivers and large streams such as the Great Village River, East Noel River, Selma Brook, and Beaver Brook. 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 has resulted in a large area of land being reclaimed through drainage and protection from daily salt water flooding. These lands have become some of the most fertile agricultural areas in the province.

Table 5a – Elements Within Minas Lowlands		
Element	**Size (Hectares)**	**Element Description**
Red and Black Spruce Flats (Patch)	1,767 4.1%	This patch element is associated with fine-textured soils on gentle hummocky and level terrain at a few scattered locations in the ecodistrict. On the well-drained soils on upper slopes, red spruce is dominant but as the drainage gets progressively moister black spruce and tamarack become more prominent with the poorest-drained sites supporting a wet forest of black spruce, red maple, and tamarack. Balsam fir can be a component on all sites in this element. Stand-level disturbances in the red spruce forests often revert to earlier successional stages of intolerant hardwoods such as grey and white birch, red maple, and a variety of woody shrubs.
Tolerant Mixedwood Hills (Patch)	1,283 3.0%	This small patch element occurs at a few isolated hilly areas in the ecodistrict. These low hills and slopes are usually adjacent to upland ecodistricts. It supports a late successional mixedwood forest dominated by the shade-tolerant species of the Acadian Forest such as sugar maple, yellow birch and beech, red spruce, balsam fir, and hemlock. Natural disturbances are infrequent and include small gaps or patches created in the stand canopy by individual tree mortality or windthrow. Due to the long life of the dominant species and the infrequent nature of stand-level disturbances, uneven-aged forests and old growth features can develop.
Salt Marsh (Patch)	1,354 3.2%	These salt marshes occur at the mouths of major rivers and streams that empty into Cobequid Bay. A history of reclamation first started by the Acadians in the early 1600s 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. There are only small isolated patches of original salt marsh remaining which supports the dominant natural vegetation of cordgrass.
Wetlands (Patch)	282 0.7%	The Wetlands element comprises bogs, fens, swamps, and poorly drained areas. In this ecodistrict, the element can occur as a large freshwater wetland complex underlain with fine-textured marine sediments along the Cobequid Bay with examples near Highland Village and Lower Debert. At these locations the saltwater tidal influence has been eliminated by the construction of dykes with some of the wetland improved for agriculture.
Total	**42,850***	*Area is not the same as in Table 1 because water has not been included.

Table 5b – Forest Vegetation Types[1] Within Elements in Minas Lowlands

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Spruce Pine Hummocks ---------- Floodplain ecosite	IH1, IH4, IH6, OW1, OW2, OW4, SP1, SP2, SP10 ---------- FP5, FP6	19.3	MW4, SP3, SP4, SP6, SP8 ---------- FP3	8.1	**SP5,** SP7 ---------- **FP1**	15.5
Red and Black Spruce Hummocks	IH1, IH4, IH6, MW5, OF1, OF2, OF4, OF5	19.4	MW4, SH5, SH6, SP4, SP6, SP8	7.0	SH3, **SH4, SP5,** SP7	7.5
Red and Black Spruce Flats	IH1, IH4, IH6, MW5, SP10	37.7	MW4, SH5, SH6, SP4, SP6, SP8	14.2	SH3, **SH4, SP5,** SP7	17.2
Spruce Hemlock Pine Hummocks and Hills	IH3, IH5, IH6, MW5, OF1, OF2, OF4, OF5	19.9	MW4, SH5, SH6, SH8	7.2	SH1, SH2, **SH3, SH4**	6.8
Tolerant Mixedwood Hills	IH3, IH5, IH6, OF1, OF2, OF4, OF5	34.6	MW2, MW4	7.5	**MW1, MW3**	7.3
Salt Marsh	Grasslands of *Spartina spp.*					
Marshes and Grasslands	Cultivated Fields and Freshwater Wetlands (cattails, willows, alders, WC, WD)					
Wetlands	WC1, WC2, WC3, WC4, WC5, WC6, WC7, WD1, WD2, WD3, WD5, WD6, WD7, 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.

Red spruce – Balsam fir / Schreber's moss (SH5) is a mid-successional vegetation type found in the Red and Black Spruce Hummocks co-matrix element.

Red pine – White pine / Broom crowberry / Grey reindeer lichen (OW4) is an early successional vegetation type found in the Spruce Pine Hummocks co-matrix element.

White birch – Balsam fir / Starflower (MW5) is an early successional vegetation type found in the Spruce Hemlock Pine Hummocks and Hills patch element.

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

Red spruce – Yellow birch / Evergreen wood fern (MW1) is a late successional vegetation type found in the Tolerant Mixedwood Hills patch element.

Black spruce / Lambkill – Labrador tea / Sphagnum (WC2) is a vegetation type found in the Wetlands patch 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.

The topography of the lowlands seldom exceeds 40 metres elevation and for the most part is characterized by imperfectly and poorly drained soils. These soils have been derived from siltstones and sandstone and the poor soil drainage is due to compaction of the parent material.

On Minas Lowlands, frequent stand-initiating disturbances are the predominant natural disturbance shaping the diversity of forest ecosystems. These disturbances occur frequently enough such that there is a rapid mortality of an existing stand and quick establishment of a new stand of relatively even age. Compacted soils and soil moisture deficit make portions of this ecodistrict especially prone to forest fires. Other areas with moist soils are prone to windthrow.

Since fire and hurricanes are the primary natural disturbance agents in the lowlands, infrequent stand-initiating disturbances are possible on the scattered hills and ridges throughout the ecodistrict. However, very few stands would have gap processes occurring in the canopy due to the frequency of fire and thus old growth forest is primarily restricted to steep sided slopes, sheltered coves, and in valleys along rivers and large streams.

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%

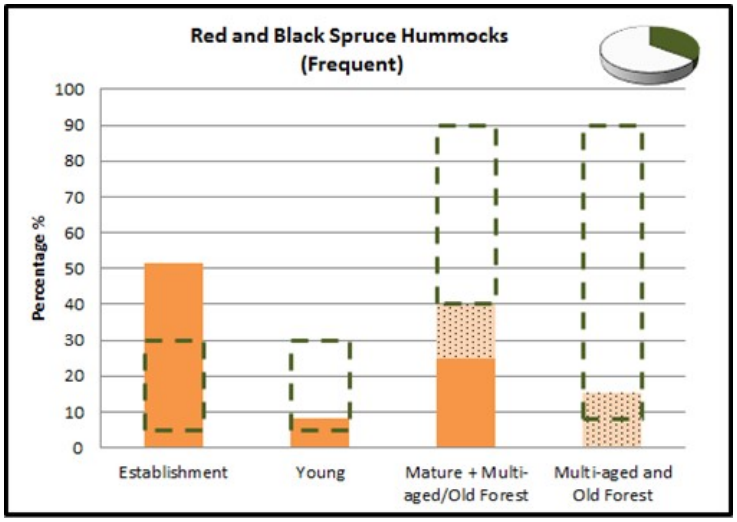
Table 6 indicates that for frequent stand-initiating disturbances, both establishment and young development class forests would typically comprise between 5 and 30% of area, while mature forest – which includes multi-aged and old forest – would cover more than 40%. Mature forest should consist of a relatively 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

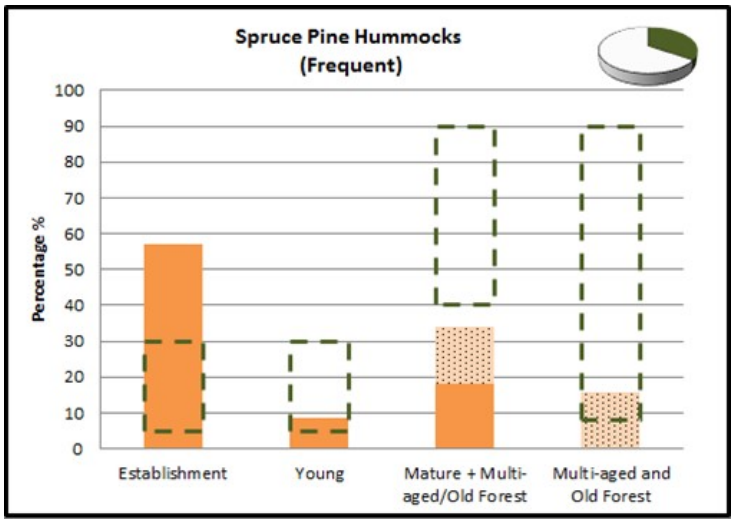
The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime. The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage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

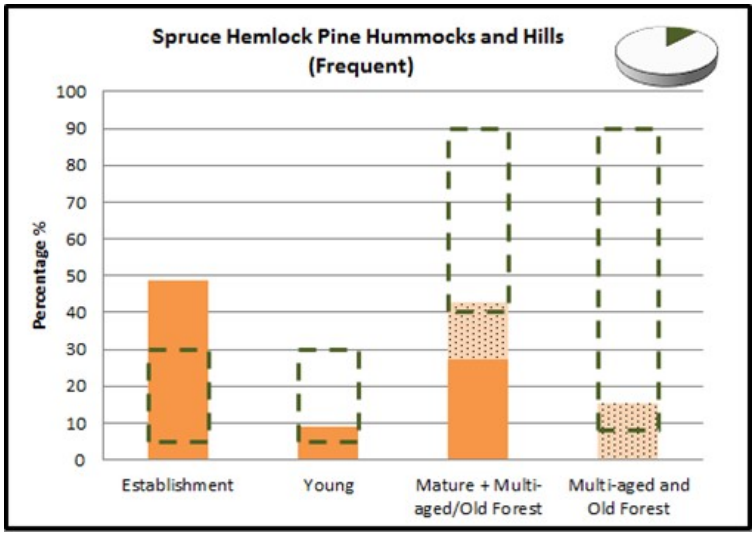
Most development classes in the **Red and Black Spruce Hummocks** co-matrix element are within target ranges, though the establishment class is slightly above its target. This range will support habitat diversity and continuity of mature forest, as well as provide management flexibility. Extended rotations, natural regeneration, late seral species, and uneven-aged practices are appropriate when forest conditions are suitable.



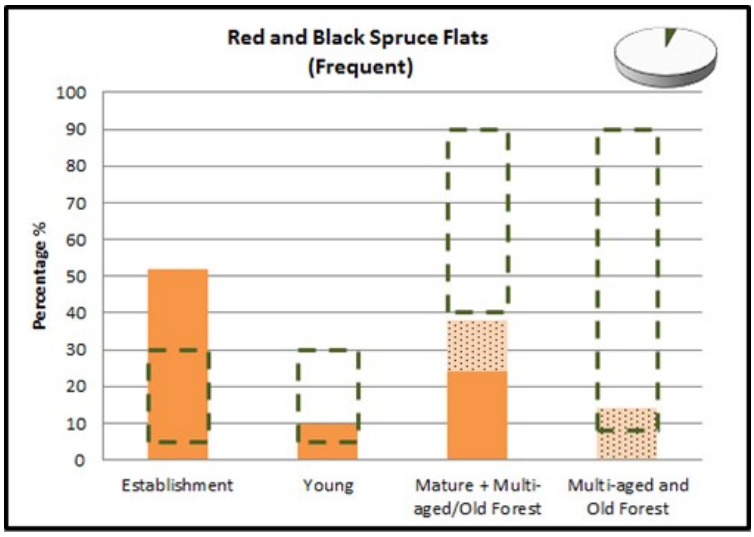
In the **Spruce Pine Hummocks** co-matrix element, young and multi-aged and old forest development classes are within their target ranges. Mature is below its target range and establishment is far exceeding its range. These frequent NDR forests support periodic stand- initiation events that favour establishment of an even-aged forest, often with scattered surviving mature pine that provide large seed trees and super canopy structure.



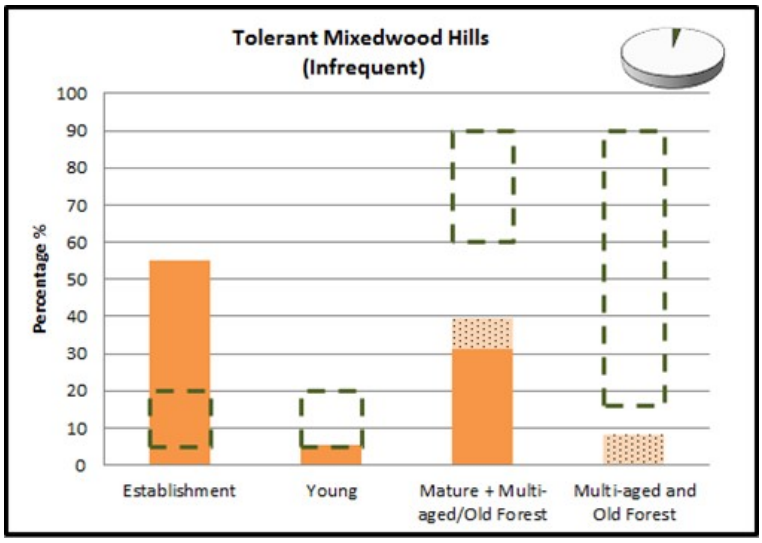
The **Spruce Hemlock Pine Hummocks and Hills** patch element meets the target range for mature forest, supporting continuity of mature habitat. The excess establishment may develop mature characteristics more quickly using silviculture to increase growth and climax species composition. Mature cover can be maintained with partial harvesting and extended rotations. Late seral species, large trees, and natural regeneration are most appropriate.



In **Red and Black Spruce Flats,** forest conditions are close to desired target levels except for mature which is slightly below. Forest treatments that use partial harvests can be used to enhance mature forest conditions in red spruce. However, windthrow hazard can be a factor in stand stability on moist soils prevalent in this element. Natural regeneration of black spruce stands can be achieved with patch harvesting and seedbed preparation.



The **Tolerant Mixedwood Hills** patch element has excessive establishment stage forest and is below desired levels of mature and multi-aged habitat. Partial harvests to favour climax species and retain large old trees, will promote multi-aged forest and maintain mature conditions. Managing immature stands to favour climax species will provide future mature forest opportunities.



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 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 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).