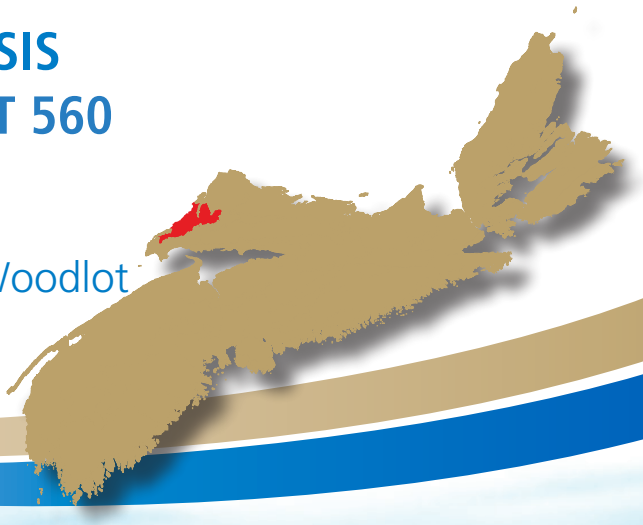
Department of Lands and Forestry

2019 Update

ECOLOGICAL LANDSCAPE ANALYSIS CHIGNECTO RIDGES ECODISTRICT 560

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



ELA 2019-560

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 560: Chignecto Ridges
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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A NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES PUBLICATION

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

This Ecological Landscape Analysis (ELA) provides detailed information on the forest and timber resources of the various landscape components of Chignecto Ridges Ecodistrict 560. 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 745-square-kilometre Chignecto Ridges Ecodistrict is part of the Northumberland / Bras d'Or Lowland Ecoregion that stretches from West Apple River in Cumberland County, to Glace Bay in Cape Breton County. In Chignecto Ridges, areas around Shulie Lake, Apple River, Muddy Plains, and the Barnhill River have elevations in the 140 to 160 metre range, but rarely do elevations exceed 120 metres above sea level.

Black spruce and jack pine forests occur on the better drained ridges of this ecodistrict with forests of red maple and tamarack on the wetter soils between the ridges.

Occupying most of western Cumberland County, this ecodistrict is a plain tilting toward Chignecto Bay. The western boundary is the Bay of Fundy. Ridging in this ecodistrict is easily observed on satellite imagery or aerial photography. This ridging of underlying grey sandstones, siltstones and shales, can be observed throughout the ecodistrict.

The Joggins Fossil Cliffs, located along the Chignecto Bay at Joggins, is a UNESCO (United Nations Educational, Scientific and Cultural Organization) World Heritage Site known for its world-class fossils.

Chignecto Ridges contains almost all of the Chignecto Game Sanctuary. This large sanctuary was established in 1937 partly to protect moose. Mainland moose are listed as endangered under the Nova Scotia Endangered Species Act and have been reported in low numbers throughout the area. *Most of the game sanctuary became part of the Kelley River Wilderness Area in 2012, when the Raven Head Wilderness Area also received provincial designation.*

The total area of Chignecto Ridges Ecodistrict is 74,550 hectares, with private land ownership totaling 37,285 hectares. A total of 36,414 hectares is under provincial management, which considers multiple values through an Integrated Resource Management (IRM) approach.

Nearly 87% of Chignecto Ridges is forested. Softwood stands of black spruce and jack pine dominate on imperfectly drained soils. Red spruce, jack pine and white pine thrive on side slopes and on well-drained soils. The remainder is hardwood and mixedwood stands. In the past, frequent disturbances driven by fire, insects or major storms have affected the development of forests in ecodistricts. Today, landscapes and forests have been further shaped other disturbances such as land clearing, forestry, agriculture, and highway development.

A distinct feature of Chignecto Ridges is the lack and size of fresh water lakes and wetlands. Overall, wetlands, such as bogs, swamps, and salt marshes, account for 8% of the landbase. The major rivers in this ecodistrict are the Maccan River and River Hébert.

Species at risk or of conservation concern include the wood turtle, mainland moose, Atlantic salmon that are part of the Bay of Fundy population, northern blueberry, and several fresh water mussel species.

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 Chignecto Ridges.

Red and Black Spruce Hummocks is the matrix element comprising more than two-thirds of the ecodistrict and dominated by late successional softwood stands of red and black spruce, with scattered jack pine and white pine.

Jack pine forests are typically associated with well drained sandy loams and bracken fern is abundant.

The largest patch is **Jack Pine Hummocks and Ridges**, distinctive because of the jack pine and parallel ridges. The Wetlands **element** is a series of small, medium, and large wetland patches that are extremely important for water collection, filtering, groundwater recharge, and moose habitat. **Tolerant Mixedwood Hills** is the only large patch where a significant amount of shade-tolerant sugar maple is found.

Tolerant Mixedwood Slopes has a mixedwood covertype but is now dominated by softwoods and some mature hardwoods. **Spruce Pine Flats** has several small softwood patches, dominated by black spruce, red spruce, and white pine. *Two tiny elements, Floodplain and Salt Marsh, are also part of the ecodistrict.*

Forest Ecosystem Management
For Chignecto Ridges 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 Chignecto Ridges Ecodistrict 560. 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 Chignecto Ridges 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 Chignecto Ridges – *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 745-square-kilometre Chignecto Ridges Ecodistrict is part of the Northumberland / Bras d'Or Lowland Ecoregion that stretches from West Apple River in Cumberland County, to Glace Bay in Cape Breton County. Areas around Shulie Lake, Apple River, Muddy Plains, and the Barnhill River have elevations in the 140 to 160 metre range, but rarely do elevations exceed 120 metres above sea level in the remainder of the ecodistrict.

Ridging in this ecodistrict is easily observed on satellite imagery or aerial photography. This folding of the underlying strata, made up of grey sandstones, siltstones, and shales, can be observed throughout the Chignecto Game Sanctuary, most of which in 2012 became part of the Kelley River Wilderness Area.

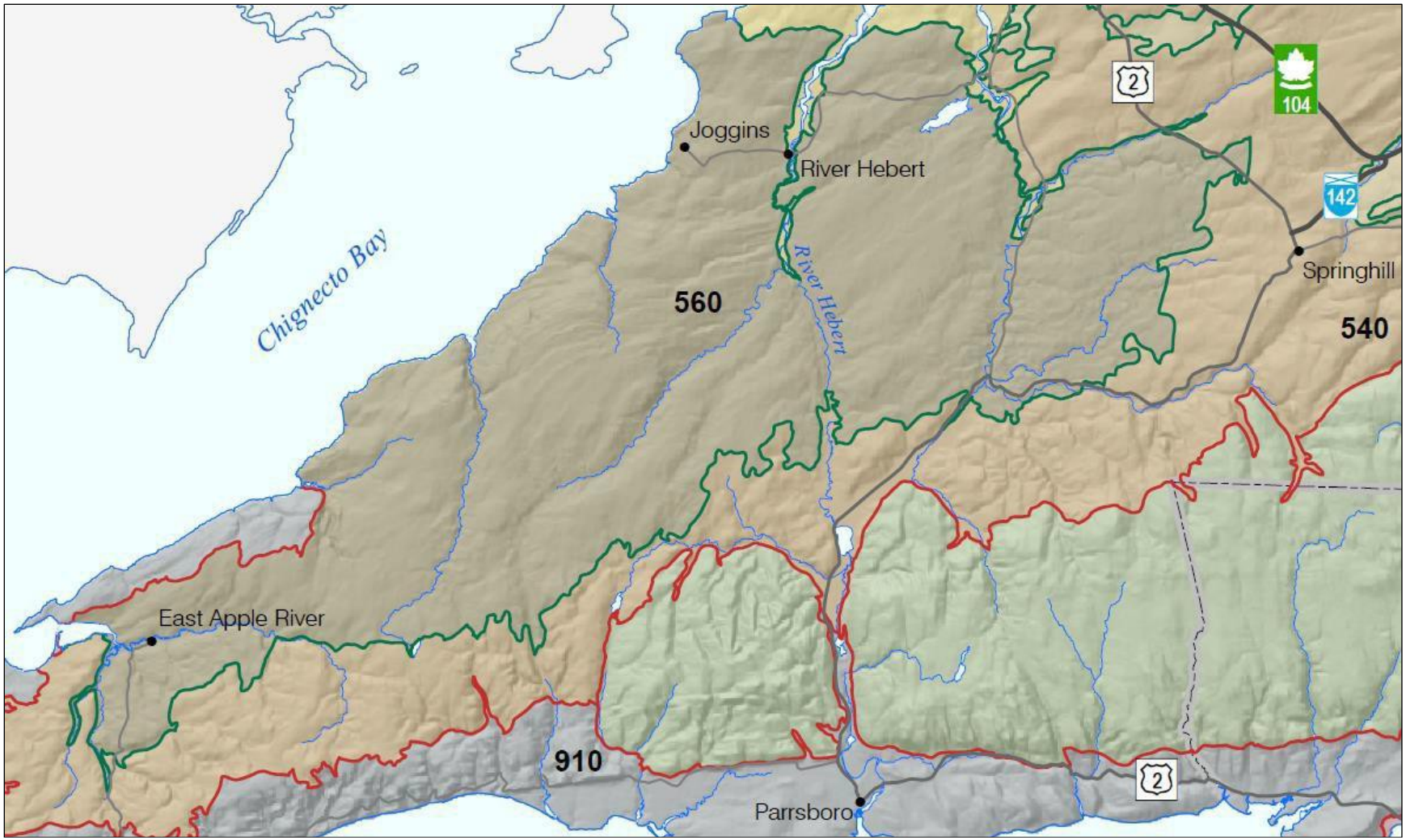
An intriguing glacial landform in this ecodistrict is the esker, a long, narrow and often winding ridge of sediments left by meltwater from a decaying glacier or ice sheet. The Boars Back Road through the Chignecto Game Sanctuary has been constructed on top of an esker.

Occupying most of western Cumberland County, this ecodistrict is a plain tilting toward Chignecto Bay. The western boundary is the Bay of Fundy and although the bay moderates climate near the coast, this effect is not reflected very far inland.

Underlying this ecodistrict are coal-bearing Carboniferous strata, with coal seams at Joggins, Springhill, River Hebert, and Maccan. These layers of rock include coarse- and fine-grained sandstones, which are exposed in some locations, such as the Chignecto Game Sanctuary, and overlain by sandy tills to the east of River Hebert. For the most part, this ecodistrict is characterized by shallow, imperfectly drained soils derived from sandstones. In much of the ecodistrict, drainage is influenced by the haphazard arrangement of the bedrock that creates a pattern of soils that drain slowly or poorly.

Glacial activity has resulted in large areas of thin soil and exposed bedrock in this ecodistrict. The better-drained, deeper soils inland produce high quality forests of red spruce. On the upper slopes and crests of well-drained ecosections, stands of tolerant hardwood include sugar maple and yellow birch.

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



Chignecto Ridges Ecodistrict 560 borders Chignecto Bay and stretches from East Apple River in the west to north of Joggins and nearly to Springhill in the east. (From Ecodistricts of Nova Scotia map 2007)

Land Area

Chignecto Ridges is one of six ecodistricts within the Northumberland / Bras d'Or Lowlands Ecoregion.

The ecodistrict is rural and ownership is divided between provincial Crown and private owners (Table 1).

Table 1 – Land Area by Ownership in the Chignecto Ridges Ecodistrict*

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	36,414	48.8
Private	37,285	50.0
Federal	0	0
Aboriginal land	41	0.1
Other (Includes inland water bodies and transportation corridors)	810	1.1
Total	**74,550**	**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 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	3,539	10.4
C2 – Multiple and Adaptive Use	30,539	89.5
C3 – Protected and Limited Use	11	<0.1
Sites of cultural, historic significance	12	<0.1
Total	**34,101**	**100**

Forests

Nearly 87% of the ecodistrict is forested. Less than 4% is non-forested, which includes agriculture, barrens, or urban sites (Table 3). The remainder of the land is wetland or river valleys – which can be corridors linking different elements – or roads.

The current forests are dominated by softwood stands, which represent more than three-quarters of all forest cover. Within these stands, black spruce and jack pine dominate on imperfectly drained soils.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	65,051	87.3
Wetland	6,283	8.4
Agriculture	1,411	1.9
Barrens	645	0.9
Urban	496	0.7
Road, Trail, Utility	300	0.4
Other	363	0.5
Total	**74,550**	**100**

Red spruce, jack pine, and white pine thrive on the side slopes and on better-drained soils.

Hardwood stands and mixedwood stands are nearly equal in the remaining forest cover. Red maple, white birch, and limited amounts of sugar maple are the common hardwood species.

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 4.1 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.

A little more than three-quarters of the forested land is within the LC 5 rating. This rating indicates the land is productive and has good potential for forestry.

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	5,517	8.6
3	9,920	15.5
4	19,496	30.4
5	27,364	42.7
6	1,729	2.7
7 or more	77	0.1
Total	**64,103**	**100**

*Based on growth rating for softwood species.

The largest landowner in this ecodistrict is the province, which owns 49% of the landbase.

Harvesting and silviculture (planting and thinning) activities have been on-going in these areas since the 1940s. These activities were managed by Department of Lands and Forestry through the issuing of license agreements to sawmills, such as C.E. Harrison Lumber, Hoeg Brothers, Mactara, Irving, and other smaller contractors.

Water Resources

A distinct feature of this ecodistrict is the lack of fresh water lakes and their small size. The few lakes in the area include Harrison, Forty Puzzle, Round, Long, and Newville. Combined, these lakes account for 276 hectares. Overall, wetland, such as bogs, accounts for 9% of the area land base (Table 3).

The major rivers in this area are the Maccan River and River Hébert. Although the Kelley River is fairly large, it is considered a tributary that runs into River Hébert. The Maccan River and River Hébert both flow north into the Chignecto Bay and are influenced by the tides that extend inland for 10 to 15 kilometres. Other smaller rivers include the Barnhill, Apple, and Shulie rivers, which are located on the north coast of the ecodistrict and also flow toward Chignecto Bay.

Minerals, Energy and Geology

The Joggins Fossil Cliffs, located along Chignecto Bay at Joggins and part of the Chignecto Ridges Ecodistrict, is a world-class paleontological (fossil) site. Joggins has been designated a Special Place under the Province of Nova Scotia's Special Places Protection Act. *In 2008 the Joggins World Heritage Committee was successful in having Joggins designated as a UNESCO World Natural Heritage Site.*

The ecodistrict lies on the south-western end of the Cumberland Basin. The Cumberland Basin consists of a large lens-shaped subbasin that formed from an ancient inland sea north of the Cobequid-Chedabucto Fault System and is part of the larger Maritime Basin. This subbasin comprises Carboniferous Age sedimentary rocks (280 to 350 million years old) formed from sediments at the bottom of the inland sea and contain significant mineral resources.

The Chignecto Ridges bedrock geology is divided near the center by the Athol Syncline, which is the centre of a plunging lens-shaped fold in the rocks. Going north and south of the syncline the rocks are older and consist of Cumberland and Horton group sediments. The Cumberland Group of rocks is made up of sandstone, mudstone, with some conglomerate limestone, and rare, thin coal seams. The older Horton Group contains sandstone, conglomerate, and mudstone.

Natural ridging, a basin shape, and few lakes are among the distinctive features of Chignecto Ridges.

The lens-shaped basin has been fractured with several faults in the southern half of the ecodistrict. Overlying the bedrock in many parts of Chignecto Ridges are glacial deposits and recent sediments. These sediments contribute to the development of soils, and may be a source of aggregate, such as gravel and sand.

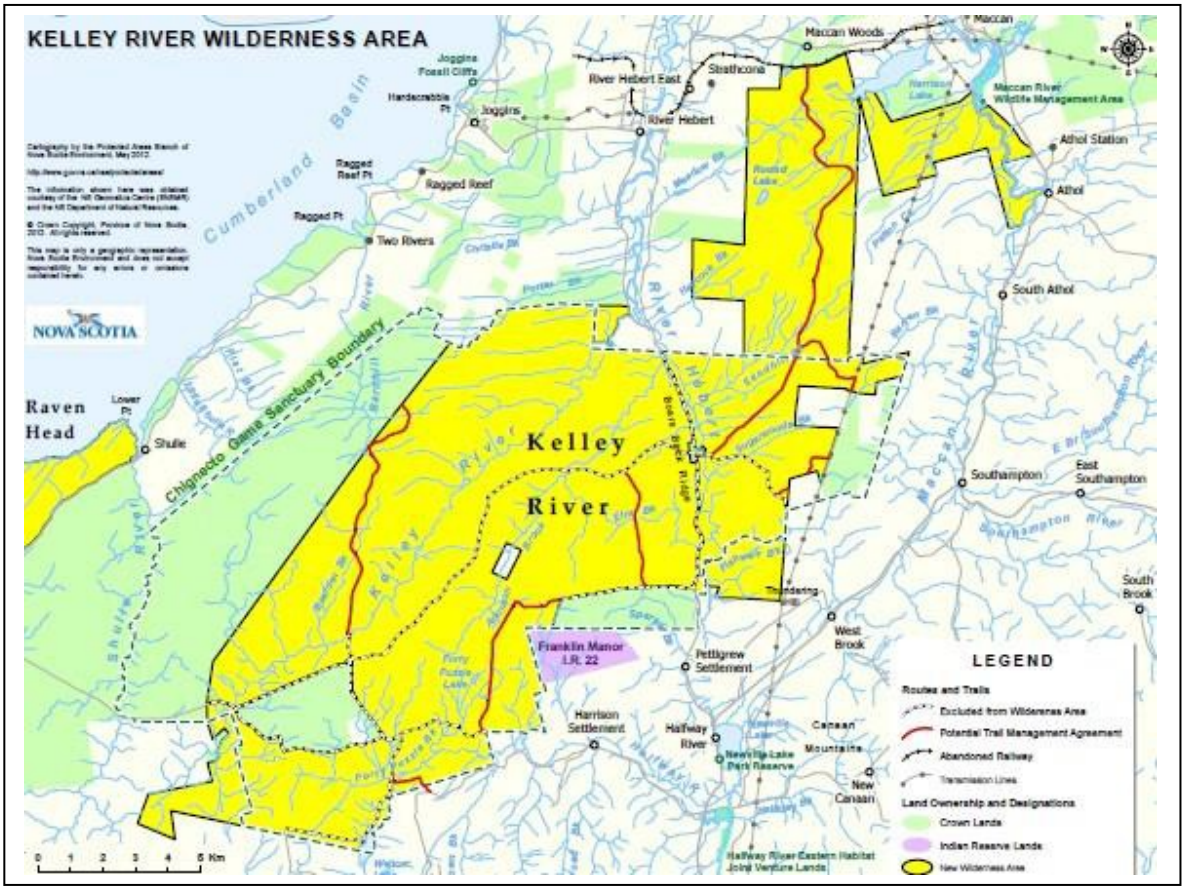
The sandstones and shales of the Horton Group are targets for oil and gas exploration in this part of the province since they provide a source of hydrocarbons and a geological reservoir for them. Seismic exploration has taken place in recent years, including 2003, and with high energy prices there is potential for future exploration. In the Joggins formation there are several coal seams that could be an important source of coal at some time and may provide a source for coalbed methane gas. Numerous aggregate and shale deposits occur throughout the ecodistrict. The deposits provide an important source of sand, gravel, and shale.

By their nature, mineral and hydrocarbon deposits are mostly hidden, difficult to find, and expensive to measure. Any simple assessment cannot take into account continual change in demand and advances in scientific understanding and technology. For example, since 2003 there has been greatly heightened interest in the Cobequid-Chedabucto Fault Zone for deposits of iron oxide, copper, and gold. This interest arose from the development of a new geological model based on characteristics of deposits being explored and mined in other parts of the world.

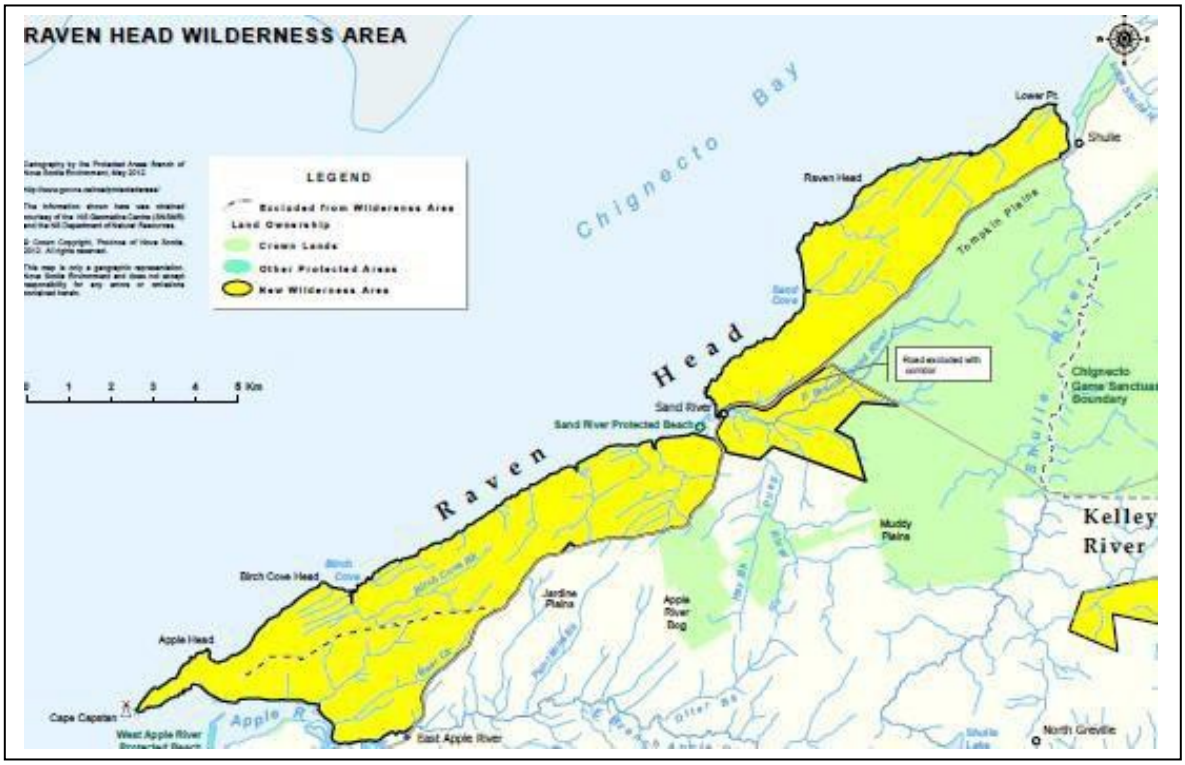
Potential geohazards, such as abandoned mine openings, potential karst areas, flood risk areas, sulphide-bearing slates, and underground coal workings, can be viewed at the following web sites: http://gis4.natr.gov.ns.ca/website/nsgeomap/viewer.htm
http://gis4.natr.gov.ns.ca/website/mrlu83/viewer.htm
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/.



These maps show the locations of the Kelley River and Raven Head wilderness areas included in parts of the Chignecto Ridges Ecodistrict.



Wildlife and Wildlife Habitat

Endangered mainland moose are found in the Chignecto Game Sanctuary.

Wildlife in the Chignecto Ridges 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 Chignecto Ridges 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.

This ecodistrict contains almost all of the Chignecto Game Sanctuary. This large sanctuary was established in 1937 partly to protect moose. Mainland moose are listed as endangered under the Nova Scotia Endangered Species Act and are reported to occur throughout the area in low numbers. *In June 2012, most of the game sanctuary became part of the Kelley River Wilderness Area.*

Moose may be associated with forested habitats that have been altered by a disturbance, such as fire, wind, disease, and timber harvesting, provided that additional suitable habitat conditions remain close by.

Historically in this ecodistrict fire played an important role in providing beneficial habitat for the moose population. Now, modern fire suppression has reduced this role by limiting the spread of fire and with it disturbances to the forest ecosystem.

Early successional trees and shrubs provide important browse while mature conifers, such as spruce, fir, and pine, are valuable for shelter and protection. Secluded wetland areas with an abundance of emergent vegetation are used for both feeding and cooling during the summer. The availability of suitable habitat for mainland moose is crucial in maintaining the species' existence. Well planned timber harvesting may be designed to promote the presence of foraging habitats and partially replace the role of fire as a disturbance agent.

The Forest / Wildlife Guidelines and Standards for Nova Scotia provide minimum habitat specifications for moose on Crown land through the 8% retention for forest, retention of a 20-meter buffer zone along water bodies and watercourses, and through the management of forest communities and age and class distribution. Additional measures to provide for specific habitat needs of moose have been identified and special management practices are in place on Crown land.

Several species at risk and species of conservation concern are associated with the rivers that flow through this ecodistrict. These include the wood turtle, with populations in the River Hébert and Maccan River areas, endangered Atlantic salmon that are part of the Bay of Fundy population, three species of freshwater mussels, and rare species of interval plants that grow in the rich alluvial soils.

The Maccan and River Hébert are the two major rivers in the ecodistrict. Both are tidal rivers that flow north into Chignecto Bay. Historically, Atlantic salmon have utilized these rivers for spawning and continue to make some use of the available habitat they present. The Inner Bay of Fundy salmon population has steadily declined over the last 20 years and has been designated as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and protected under the federal Species at Risk Act.

The decline in Atlantic salmon is not well understood but evidence suggests that low marine survival is a primary cause that may be due to ecological changes in the Bay of Fundy. Other threats to this species include environmental contaminants, habitat loss and degradation, lack of riparian buffers along waterways, water passage obstruction and lack of pools.

Black ash is the only documented plant species at risk in the Chignecto Ridges Ecodistrict. In 2013, black ash was listed under the NSESA as threatened; there are an estimated 1,000 individuals and only 12 mature trees provincially. The only known occurrence of black ash in Chignecto Ridges is identified along the northeastern fringe of this ecodistrict.

Six white-tail deer wintering areas have been identified in the ecodistrict. These areas provide important winter habitat and management should conform to the special management practices for deer wintering areas (http://novascotia.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_White-tailed_Deer.pdf) on Crown land.

The wintering areas are usually found away from the harsh climate of Chignecto Bay and within the river valleys at lower elevations where there is a mixture of cover, such as mid to late successional softwoods, and food, such as young hardwoods.

This ecodistrict includes large significant wetlands, including the 600-hectare Muddy Plains. Rare dragonflies and rare butterflies have been recorded from another large wetland at Round Lake/Long Lake. Bog birch, which may be particularly sensitive to human activities or natural events, has been identified along the road to Long Lake.

Notable species in the ecodistrict include northern goshawk, bald eagle, northern blueberry, fisher, beaver, and bear.

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 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.

A Natural Disturbance – Fire in Chignecto

The soils of this ecodistrict get dry during the months of June to August and have historically been prone to wildfires during periods of drought.

The Great Fire of 1921 (July 4 to August 10) resulted in extensive areas of mainly softwood forest being destroyed and replaced with red maple and white birch. The burned lands stretched along the Kelley River, Atkinson Brook, Porter Brook and Christie Brook, and east of River Hébert.

Fire is a major cause of natural forest disturbance.

The last of the large fires in this region occurred in 1934 and 1937, again burning lands along the Atkinson Brook and Kelley River. While some of these fires were caused by humans, some were the result of lightning. Since 1937, improved early detection and suppression techniques by Department of Lands and Forestry crews have significantly decreased fire disturbances in this ecodistrict.

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:

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

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.

The majority of the area within the Chignecto Ridges has a frequent stand-initiating disturbance regime that regenerates with an early successional vegetation type of grey birch, pin cherry, aspen, and sometimes jack pine.

Most of these short-lived pioneer species are replaced by mid successional vegetation types of red maple and white birch on the well-drained sites, and by black spruce with occasional red pine on the imperfectly or slowly drained areas.

The late seral vegetation types of hybrid red and black spruce, white pine, and hemlock follow on the well-drained sites.

Chignecto Ridges – 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.

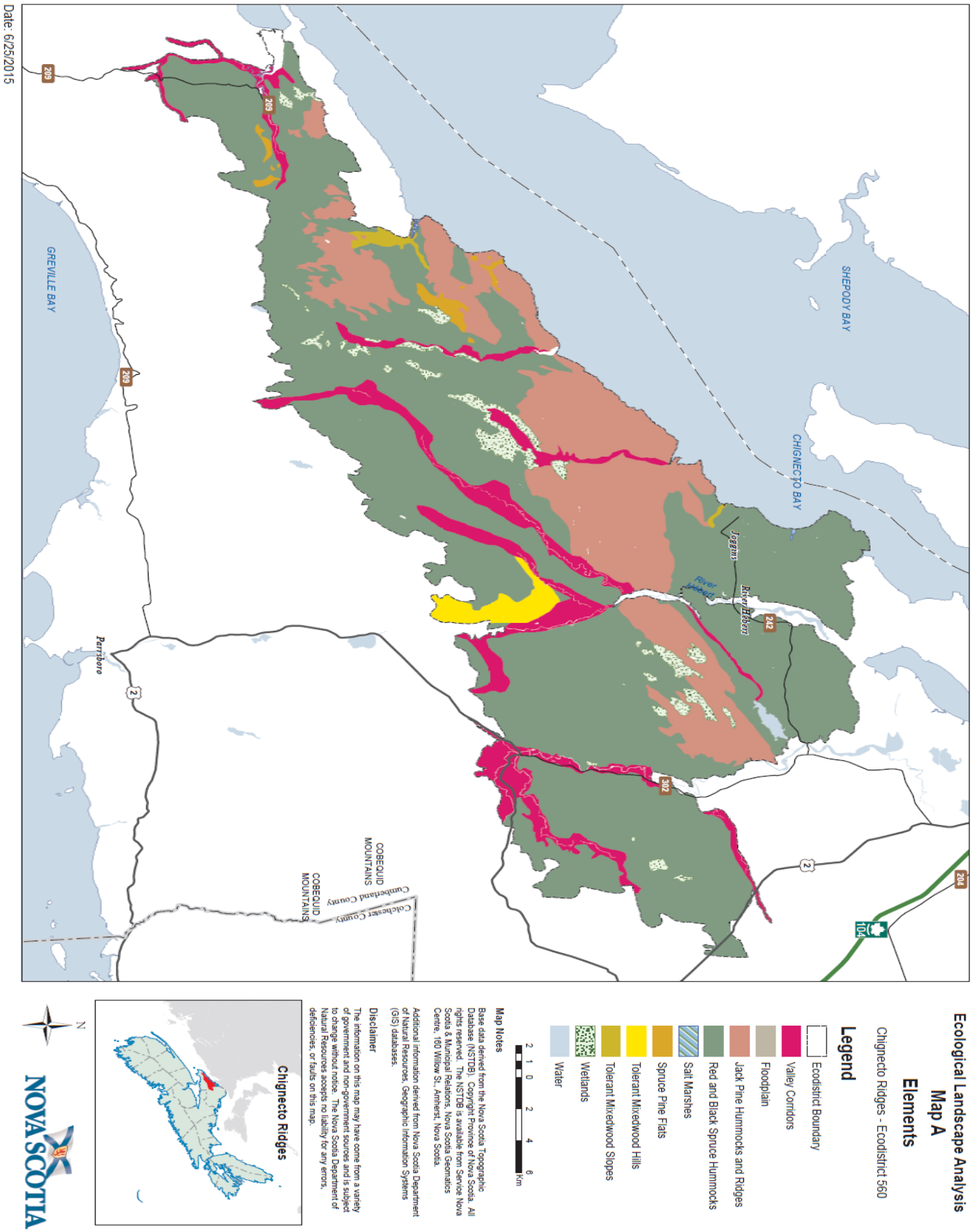
A landscape profile identified and mapped seven distinctive elements in the Chignecto Ridges Ecodistrict – one matrix, and five patches (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types.

Red and Black Spruce Hummocks is the matrix element comprising more than two-thirds of the ecodistrict and dominated by late successional softwood stands of red and black spruce, with scattered jack pine and white pine.

The largest patch is **Jack Pine Hummocks and Ridges**, distinctive because of the jack pine and parallel ridges. The **Wetlands** element is a series of small, medium, and large wetland patches that are extremely important for water collection, filtering, groundwater recharge, and moose habitat. **Tolerant Mixedwood Hills** is the only large patch where a significant amount of shade tolerant sugar maple is found.

Tolerant Mixedwood Slopes has a mixedwood covertype but is now dominated by softwoods and some mature hardwoods. **Spruce Pine Flats** has several small softwood patches, dominated by black spruce, red spruce, and white pine. *Two tiny elements, Floodplain and Salt Marsh, are also part of 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.

Softwood species are common in many of the elements in the Chignecto Ridges Ecodistrict.

Table 5a – Elements Within Chignecto Ridges		
Element	**Size (Hectares)**	**Element Description**
Red and Black Spruce Hummocks (Matrix)	53,694 72.1%	The matrix-level element occurs on well and imperfectly drained soils of variable textures. On the well-drained soils, forests are dominated by red spruce and white pine. The flatter terrain between hummocks is usually imperfectly drained and supports a forest of black spruce and white pine. On the poorest of sites, especially where soils are very coarse and/or shallow to bedrock, jack, red and white pines are common along with black spruce and a thick understory of ericaceous (heath-like) shrubs. Balsam fir is a component of the element on all sites. Shade-tolerant hardwoods are uncommon. Following frequent stand-level natural disturbances such as fire and hurricane, early successional forests may include shade intolerant hardwoods such as red maple, white birch, and aspen. The ecodistrict has a long history of harvesting and uncontrolled and repeated wildfires both of which, when combined with the inherent low fertility of the soils, has impoverished some areas where this element could occur.
Jack Pine Hummocks and Ridges (Patch)	14,927 20.1%	Soils on the curvilinear ridging caused by the folding of the underlying bedrock are usually coarse-textured, shallow, and dry which leads to a forest of black spruce and jack pine and a significant understory of woody ericaceous shrubs. Where soils are deeper, red spruce and the red/black hybrid spruce are more prevalent. This patch level element may also occur in the spruce-dominated matrix element where soils are less fertile, dry, and shallow. With progressively poorer drainage, which occurs between the ridges, black spruce, tamarack, and red maple dominate the forest vegetation. The dominant natural disturbance is fire due to the fuel nature of pine and spruce litter and the ericaceous vegetation associated with this element. Fires of severe intensity can have a significant negative impact on site productivity, especially those sites where soils are shallow over bedrock.
Wetlands (Patch)	1,856 2.5%	The wetlands element is a patch-level ecosystem comprising freshwater bogs, fens, swamps, and poorly drained areas. This element may occur as a large wetland complex associated with rivers and lakes, as narrow linear communities associated with flow accumulations and small streams, as a community of hydrophytic vegetation (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 and red maple, and occasionally jack pine. For the most part, sites are underlain by poorly drained mineral soils derived from sandstone tills or organic soils derived from peat (sphagnum mosses) or sedges. On the higher ground with better-drained soils, softwood and mixedwood forests of red and black spruce, white pine, white birch, and red maple will occur. This element plays a critical role in water collection, filtering, and groundwater recharge.

Table 5a – Elements Within Chignecto Ridges		
Element	**Size (Hectares)**	**Element Description**
Tolerant Mixedwood Hills (Patch)	1,104 1.5%	This patch-level element occurs as a single occurrence on the west side of the Boars Back Road after entering through the south entrance of the Chignecto Game Sanctuary. Low hilly terrain provides well-drained soils which support a late successional forest of red spruce, yellow birch, and sugar maple. Much of the element has been heavily harvested and earlier successional forests of red maple, white birch, and balsam fir are common. 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.
Tolerant Mixedwood Slopes (Patch)	340 0.5%	A patch-level element associated with steep-sided slopes and ravines along watercourses and occurs at only two locations, Sand River and near Joggins. Often there are seepage sites along the slope where soils are wetter and richer with plants indicating this improved condition. Soils are of variable textures derived from glacial tills and yield mixedwood forest stands comprising shade-tolerant tree species such as sugar maple, yellow birch, beech, red spruce, hemlock, and white pine. However, depending on slope and soil conditions, forests of pure hardwood or softwood may prevail.
Spruce Pine Flats (Patch)	479 0.6%	Forests of black spruce, jack pine, red pine, and white pine are typical with scattered red spruce or hybrid spruce on deeper better-drained soils. 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. Embedded within this element are wet open woodlands where stocking to tree species can be very poor. This element is frequently disturbed by windthrow, fire, and/or natural senescence which limit the potential for old growth forest development.
Salt Marsh (Patch)	570 0.8%	The twice daily tidal actions of the Bay of Fundy created several small areas of salt marsh along the floodplains of the Apple and Sand Rivers. Deposits of silty clay loam sediments with semi-decomposed grasses and sedges trapped in the accumulating layers form along the tidal shores and in estuaries.
Floodplain (Patch)	1,455 2.0%	The largest floodplains occur along the Apple, Maccan, Hébert, Southampton and Little Forks Rivers.
Total	**74,441***	*Area is not the same as in Table 1 because water has not been included.

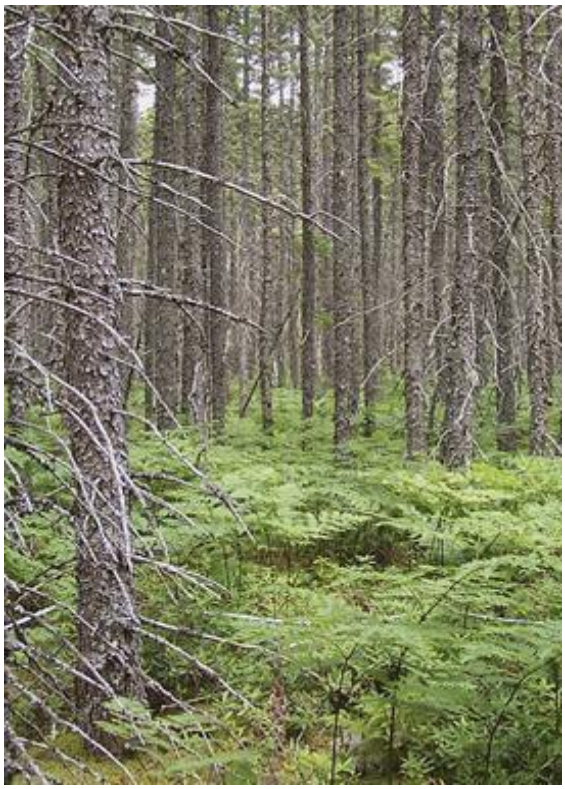
Table 5b – Forest Vegetation Types[1] Within Elements in Chignecto Ridges

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Red and Black Spruce Hummocks	IH1, IH4, IH5, IH6, SP10	12.1	MW4, MW5, SH5, SH6, SH7, SH8, SH10, SP4, SP6, SP8	26.9	SH1, SH2, **SH3,** SH4, **SP5,** SP7	41.5
Spruce Pine Flats	IH4, IH6, OW2, SP1, SP2, SP10	4.6	SH9, SP6, SP8	14.5	SP5, **SP7**	35.4
Jack Pine Hummocks and Ridges	IH1, IH6, OW1, OW2, SP1, SP2	6.5	SP3, SP4, SP6, SP8	31.9	SP5	42.2
Tolerant Mixedwood Hills	IH3, IH5, IH6	2.3	MW2, MW4, MW5, SH5, SH6, SH8, SH10	42.3	**MW1, MW3,** SH1, SH2, SH3, TH1, TH2, TH3, TH8	52.6
Tolerant Mixedwood Slopes	IH3, IH5, IH6	1.7	MW2, MW4, MW5, SH5, SH6, SH8, SH10	37.7	**MW1, MW3,** SH1, SH2, SH3, TH1, TH2, TH3, TH4,	50.8
Floodplain	FP5, FP6	10.5	FP3	19.8	**FP1**	22.8
Salt Marsh	Grasslands of *Spartina spp.*					
Wetlands	CE1, WC1, WC2, WC3, WC4, 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.



Black spruce / Lambkill / Bracken (SP5), an early to late successional vegetation type, is found in the Red and Black Spruce Hummocks matrix element.

The Jack pine / Bracken – Teaberry (Black spruce variant) (SP1a) early successional vegetation type is found in the Jack Pine Hummocks and Ridges patch element.

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

White birch – Balsam fir / Starflower (MW5) is an early and sometimes mid succcessional vegetation type found in the Tolerant Mixedwood Hills patch element.

The late successional vegetation type Red spruce – Hemlock / Wild lily of the valley (SH3) is part of the Tolerant Mixedwood Slopes patch element.

Red pine / Blueberry / Bracken (SP2) is an early successional vegetation type found in the Spruce Pine Flats 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.

On Chignecto Ridges, frequent stand-initiating disturbances are the predominant natural disturbances shaping forest ecosystems. These disturbances occur frequently enough that there is a rapid mortality of an existing stand and quick establishment of a new stand of relatively even age. The disturbance agents on the Chignecto Ridges associated with frequent disturbances include fire and insects, such as the budworm.

The forest ecosystems that arise from this disturbance type include softwood forests of pine, spruce, and fir. In areas of the ecodistrict where the interval between disturbance events is normally longer than the average longevity of the dominant species – infrequent stand-initiating disturbances – gap dynamics and understory recruitment evolve and become evident. These forests usually comprise tolerant species such as red spruce, hemlock, sugar maple, yellow birch, and beech. On Chignecto Ridges these types of forest ecosystems will occur on the better sites, where soils are of higher fertility and well-drained. Disturbances such as fire and insects are not influenced by topography.

Compared to the adjacent Cobequid Hills Ecodistrict, gap mosaic disturbances – supporting understory development and uneven-aged late successional forests – are unusual.

Concentrated in four parts of the ecodistrict are ecosystems where site conditions have created a self-perpetuating community of vegetation, which is usually treeless. Fire has increased the severity of the already poor growing conditions on these sites. The future development of community types is unknown.

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.

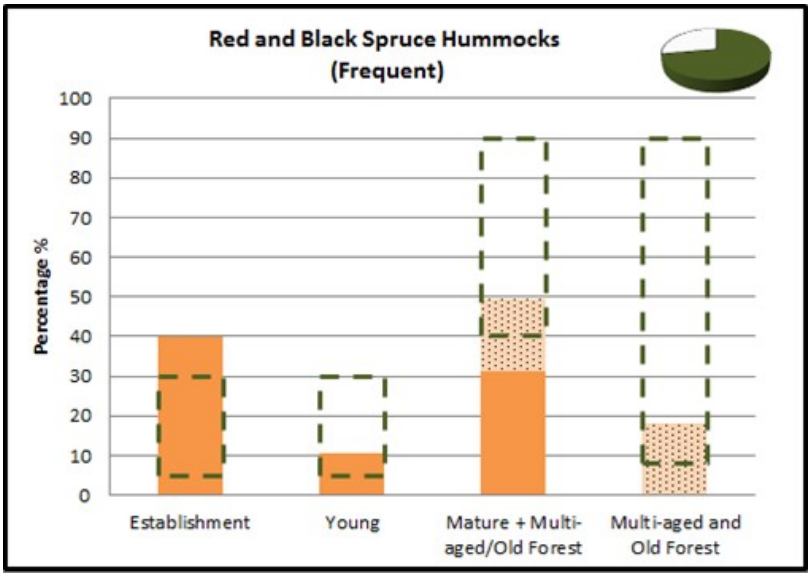
There is only a small area of multi-aged and old forest in Chignecto Ridges as a result of harvesting pressures, insect infestations in the late 1970s and early 1980s, and major forest fires in the 1920s and 1930s. Very little of the forest survived the fires except pockets near wet areas.

Development Class Targets by Element

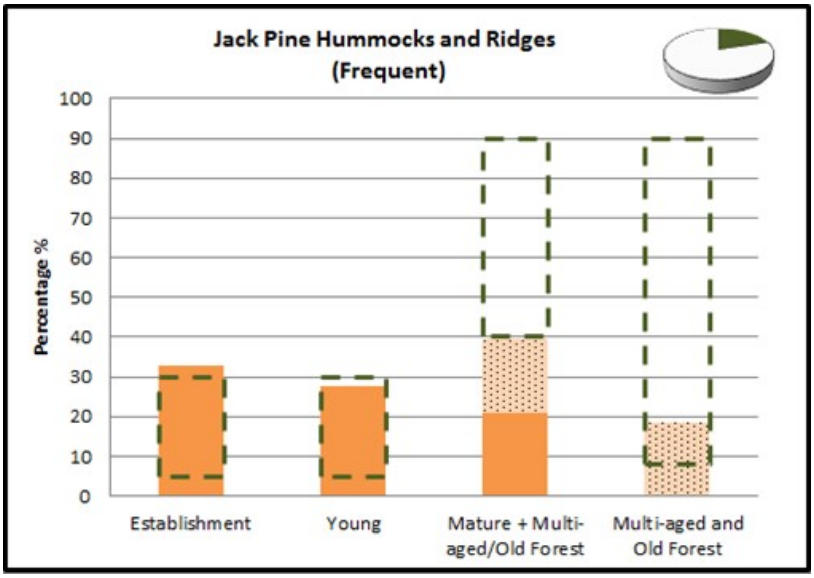
The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime. The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage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

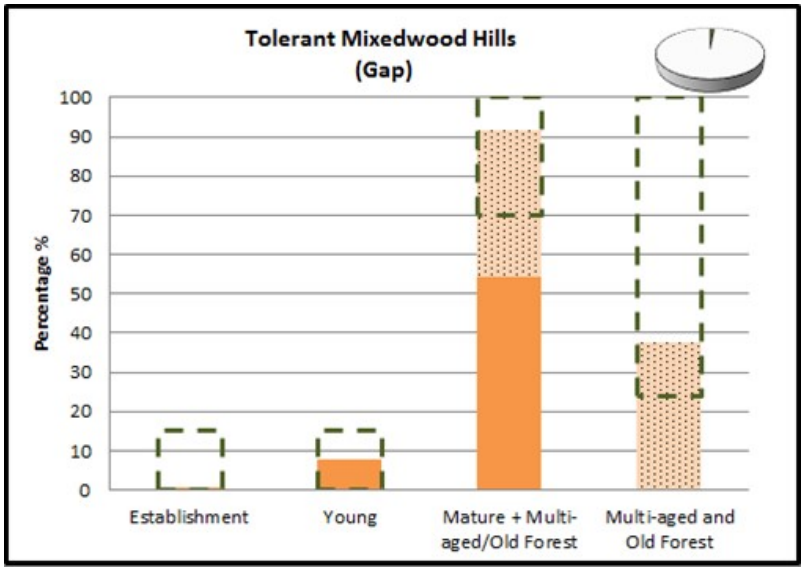
All development classes in the **Red and Black Spruce Hummocks** matrix element are within target ranges, except for establishment which exceeds. The more fertile red spruce sites should provide opportunities to maintain and restore mature forest with extended rotations and uneven- aged practices to favour climax species. Thinning in establishment and young forests can improve species' composition and growth rates.



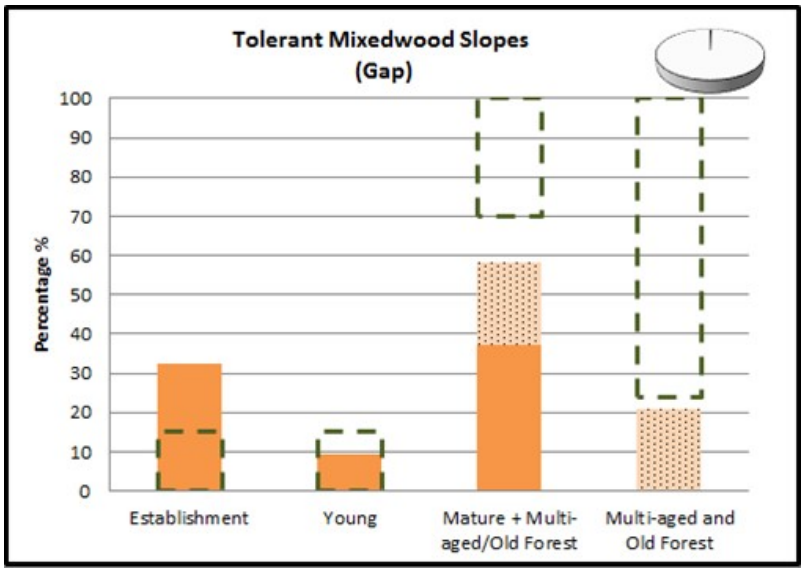
The **Jack Pine Hummocks and Ridges** element has a high proportion of young and establishment forest stage. Thinning in these development classes will increase diameter growth and may hasten the development of mature characteristics. Where opportunities exist, species selection should favour the early successional jack pine forests that have traditionally depended on fire disturbance for renewal.



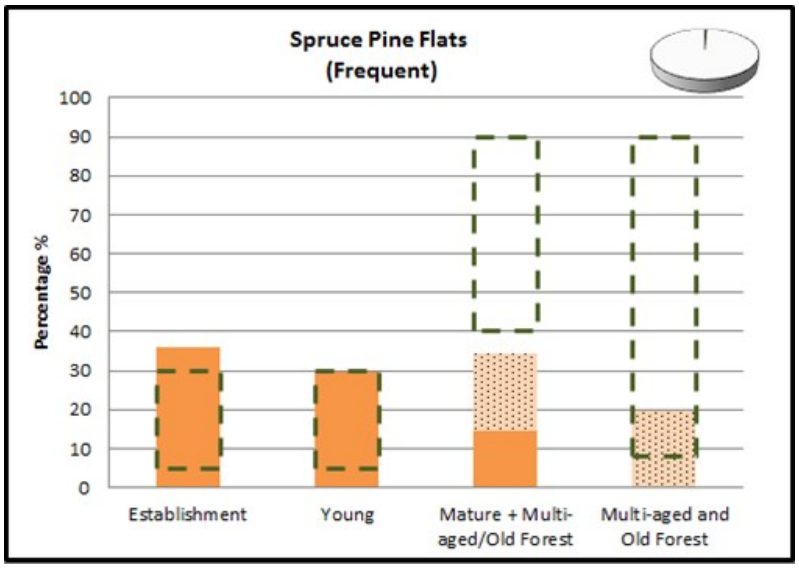
The **Tolerant Mixedwood Hills** element occurs as a single patch. This gap-disturbed ecosystem would typically support mature long-lived forests of mixed climax species. Using silviculture in young stands to increase growth rates and climax species will hasten restoration of mature forest. Partial harvests, including retention of large old trees, will promote multi-aged forests of mixed climax species.



The **Tolerant Mixedwood Slopes** is a small patch element occurring in two locations of steep slopes along watercourses. The small size makes the composition balance sensitive to local disturbances. Forest management opportunity is limited.



Spruce Pine Flats is a very small patch element that occurs in two locations. Due to the element's size and frequent natural disturbance regime, it is naturally susceptible to rapid shifts and imbalances in composition. Currently there is an overabundance of establishment and young forest which may provide a thinning opportunity. If present, the fire-dependent species red pine and jack pine should be favoured.



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).