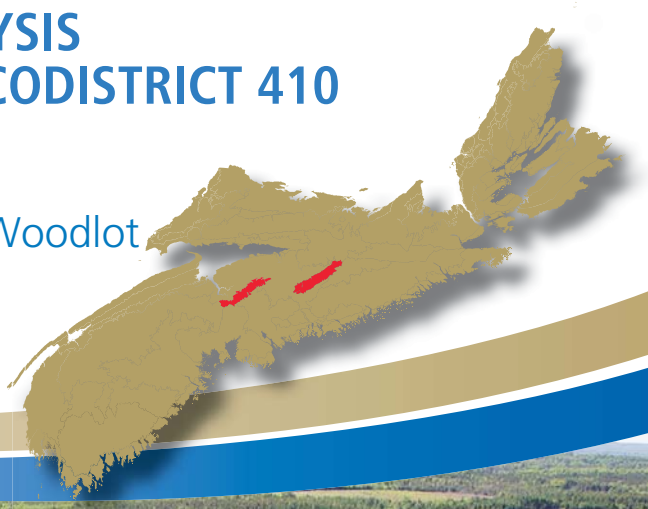
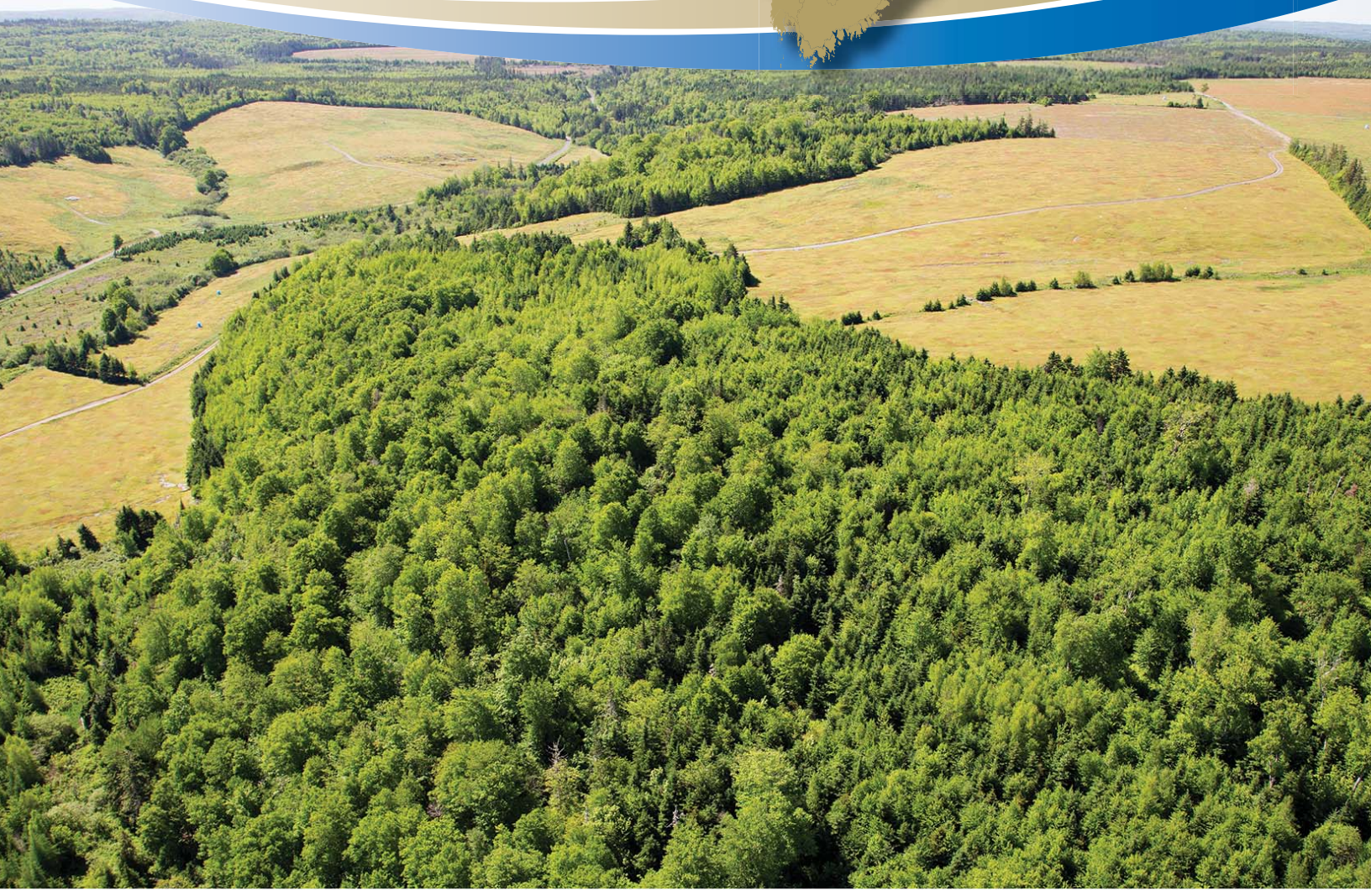
Department of Lands and Forestry

2019 Update

ECOLOGICAL LANDSCAPE ANALYSIS
RAWDON WITTENBURG HILLS ECODISTRICT 410

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





ELA 2019-410

NOVA SCOTIA

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Ecological Landscape Analysis, Ecodistrict 410: Rawdon Wittenburg Hills
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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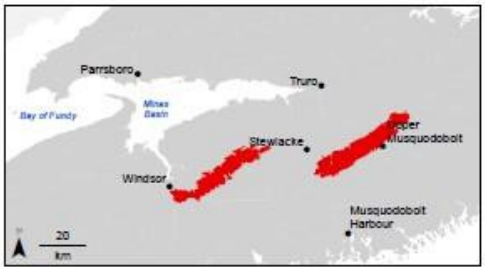
A NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES PUBLICATION

Ecodistrict Profile

Ecological Landscape Analysis Summary
Ecodistrict 410: **Rawdon Wittenburg Hills**



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 Rawdon Wittenburg Hills Ecodistrict 410. 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.

Rawdon Wittenburg Hills consists of a pair of inland, elongated ridges forming a series of flat-topped hills. The ridge in Wittenburg, with elevations of 180 to 210 metres, runs northeast-southwest separating the Stewiacke River Valley in Colchester County from the Musquodoboit River Valley in Halifax County. Rawdon Hills, with similar elevation and orientation, is located in Hants County. The total area of this ecodistrict is 61,221 hectares.

Most of the area is rural. Forestry and, to a lesser extent, agriculture are the main land uses.

The rock in the deeply dissected hills and ridges is mainly slate. On top of the hills, well-drained soils of sandy loams will be found. Sandy clay loams and clay loams occur on the side slopes of the ridges.

Several rivers have their headwaters in the ecodistrict or pass through, including the St. Andrews, South Branch, Stewiacke, Musquodoboit, Herbert, Meander, Nine Mile, and Shubenacadie. Where rivers and larger streams leave the hills and enter the lowlands, extensive floodplains have formed and are often used for farming. Smaller floodplains occur in the hills and have natural forests, some with the potential for rare or endangered plants.

A blend of forest, farmland and wild blueberry fields dominate the hilly topography

The ecodistrict is underlain by slate which is often quarried for a variety of purposes. The slate quarry in the foreground is near Glenmore.

Red spruce forests are common, occurring predominantly on the hummocky terrain on top of the hills. Where soils are wetter, black spruce is dominant. Shade-tolerant hardwood forests with sugar maple favour the upper slopes where there are well-drained nutrient rich soils. On the middle and lower slopes, where soils are enhanced with moisture and nutrients, tolerant mixedwood forests of yellow birch and red spruce are prominent. Past forestry and clearing for agriculture have influenced forest composition – old field stands of white spruce are common. Much of the ecodistrict naturally supports long-lived forest communities typical of the Acadian Forest.

Private land ownership accounts for 94% of the total Rawdon Wittenburg Hills Ecodistrict area, with 5% under provincial Crown management and the rest is in other ownership.

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 five key landscape elements – one dominant matrix element, and four smaller patch elements, − in Rawdon Wittenburg Hills.

Tolerant Hardwood Hills is the matrix element, representing 72% of the area of the ecodistrict. The crests and upper slopes of the element support a forest of sugar maple and yellow birch with some beech and white ash. Lower slopes support a mixedwood forest of red spruce, hemlock, and yellow birch.

Tolerant Mixedwood Hummocks, the largest patch element, supports a climax forest of red spruce and includes a variety of hardwood species. Much of the element has been converted to other uses, and abandoned farmland has either reforested to white spruce or white pine or been cultivated into wild blueberry fields. The other patch elements, in order of size, are **Tolerant Mixedwood Slopes**, **Wetlands**, and **Floodplain**.

Forest Ecosystem Management
For Rawdon Wittenburg Hills 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 Rawdon Wittenburg Hills Ecodistrict 410. 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 Rawdon Wittenburg Hills 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 Rawdon Wittenburg Hills – *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 two slate ridges that comprise the Rawdon Wittenburg Hills Ecodistrict rise notably above the surrounding valleys of the Stewiacke, Musquodoboit, and Shubenacadie rivers in central Nova Scotia. With elevations of 180 to 210 metres, the ecodistrict contrasts with the neighbouring Central Lowlands Ecodistrict 630. The total area of Rawdon and Wittenburg Hills is about 612 square kilometres, or 10% of the Eastern Ecoregion.

Climatically, temperatures are cooler, especially in winter and considerably more moist than the adjacent lowlands.

Red spruce forests are common on both of these slate ridges, occurring predominantly on the hummocky terrain. A significant feature of this ecodistrict is the occurrence of mixedwood forests, especially on hilly topography underlain by moist, fine-textured soils. In these areas, pure stands of either tolerant softwood or hardwood may occur or combine to form a classic mix of the sugar maple, yellow birch, beech, white ash, red spruce, and hemlock with scattered white pine indicative of the Acadian Forest. Old field forests of white spruce are common.

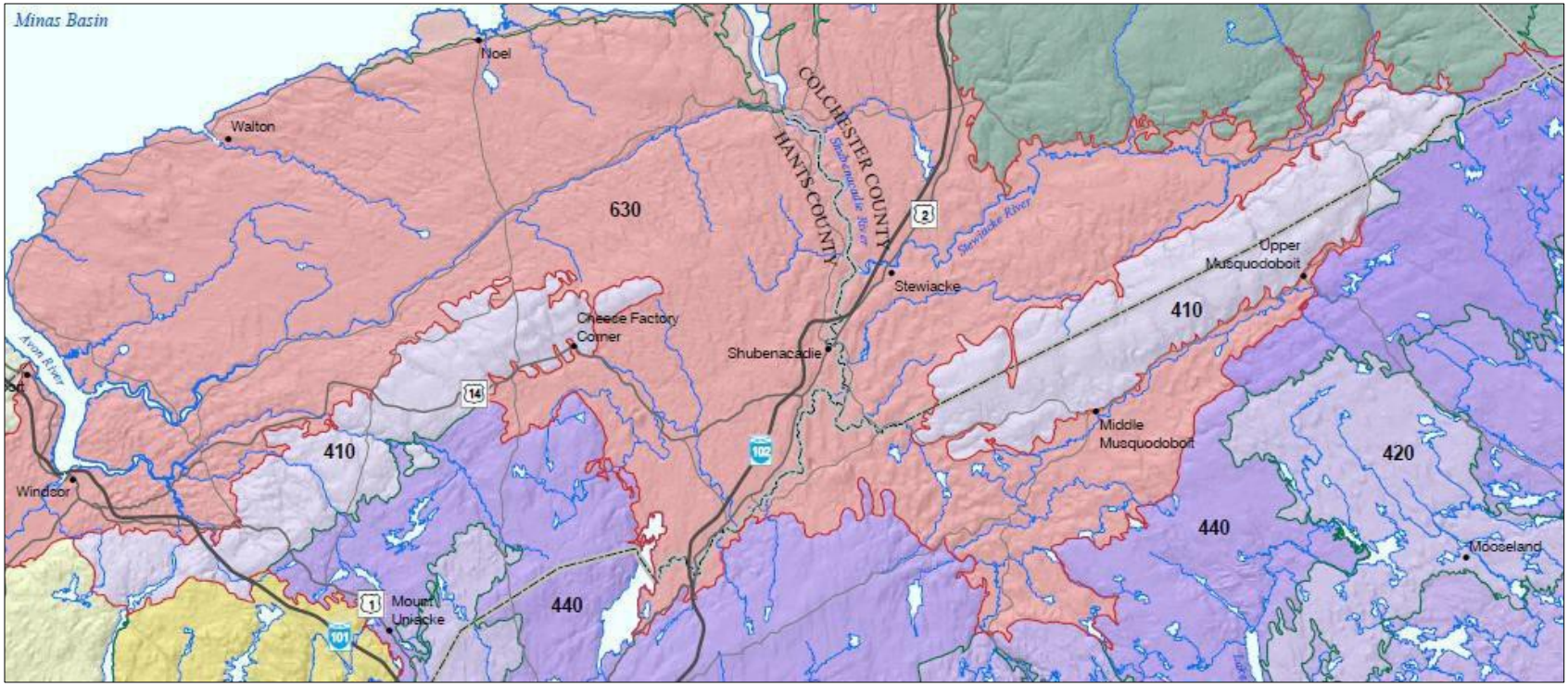
The deeply dissected northeast trending ridges comprise Meguma Group slate. Small streams along their margins flow down the deep indentations.

The north-facing slopes of the Wittenburg area supply the headwater streams for the St. Andrews River and the South Branch Stewiacke River. Streams leaving the south-facing slopes feed into the Musquodoboit River.

The north-facing slopes of the Rawdon Hills provide the headwater streams for the Herbert and Meander rivers and contribute to the Kennetcook River. The Nine Mile River comes off the south-facing slopes and feeds into the Shubenacadie River.

In total, freshwater only accounts for 0.5% of the ecodistrict.

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



Rawdon Wittenburg Hills Ecodistrict 410 consists of two ridges. The western Rawdon Hills is in Hants County between Windsor and Mount Uniacke. The eastern ridge in the Wittenburg area is on both sides of the boundary of Colchester and Halifax counties between Stewiacke and Middle Musquodoboit.

(From Ecodistricts of Nova Scotia map 2007)

Land Area

The Rawdon Wittenburg Hills Ecodistrict is rural and predominantly under private ownership at 94%, with only 5% under the administration of the provincial Crown (Table 1).

Table 1 – Land Area by Ownership in the Rawdon Wittenburg Hills Ecodistrict*

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	3,313	5.4
Private	57,223	93.5
Federal	0	0
Aboriginal	23	0.04
Other (Includes inland water bodies and transportation corridors)	663	1.1
Total	**61,221**	**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	1,018	56.9
C2 – Multiple and Adaptive Use	691	38.6
C3 – Protected and Limited Use	0	0
Unclassified	79	4.4
Total	**1,788**	**100**

In Rawdon Wittenburg Hills, the majority of Crown lands are designated C1 (57%), followed by C2 (38%). The remaining lands (nearly 5%) are unclassified. There was no C3 classification at the time of this report. There is little Crown land in this ecodistrict and few long-term commitments for the private use of Crown lands.

Forests

Within this ecodistrict, 87% of the area is forested (Table 3). Agriculture is the second largest land use activity, representing 9% of the area. Only 1% is wetland.

The forests of this ecodistrict currently comprise a mixture of softwood (35%) and mixedwood stands (27%). Pure hardwood stands account for 21% of the forested area. The remaining 17% is unclassified.

Mixedwood forests, with varying portions of hardwood and softwood, are common on hilly topography underlain by moist, fine-textured soils.

Forests dominated by red and black spruce are also common, accounting for 22% of the forested area. Red spruce forests are found on both of the slate ridges (Rawdon and Wittenburg), occurring predominantly on hummocky terrain.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	53,112	86.8
Wetland	621	1.0
Agriculture	5,507	9.0
Barrens	10	0.02
Urban	1,018	1.7
Road, Trail, Utility	496	0.8
Other	456	0.7
Total	**61,221**	**100**

Wild blueberry production is one of the agricultural crops in the ecodistrict.

Hardwood and mixedwood forests are common in the ecodistrict.

Forests of sugar maple, yellow birch, and beech are also common to the slate ridges.

Harvest practices have converted tolerant hardwood-dominated forests to softwood. Over time, if managed carefully, these softwood sites could revert back to tolerant hardwood stands.

Old field stands of white spruce account for 5% of forests.

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 5.5 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.

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	315	0.6
3	767	1.4
4	4,713	9.0
5	14,331	27.4
6	29,519	56.4
7 or more	2,737	5.2
Total	**52,383**	**100**

*Based on growth potential for softwood species.

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

Water Resources

Significant rivers in this area include the St. Andrews River and South Branch Stewiacke River. Both of these rivers dissect the ridge in the Wittenburg area. Rivers dissecting the Rawdon Hills include the Herbert, Meander, and Nine Mile.

Fresh water accounts for 303 hectares of the ecodistrict.

Water is an important provincial resource that must be considered in the context of IRM 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*

Minerals, Energy and Geology

The Rawdon Wittenburg Hills Ecodistrict consists of two separate, elongated, plunging anticlines – folds where the strata dip away from the crest – running northeast to southwest.

There are numerous mineral occurrences throughout the ecodistrict, including a few past producers. The most abundant mineral occurrences contain gold and iron. Other occurrences include copper, lead, zinc, gypsum, barite, antimony, silver, and arsenic.

Much of the area is under exploration licence for gold. Locations of gold producers in this ecodistrict include Centre Rawdon, Upper Rawdon, and South Branch Stewiacke River. An antimony-gold mine was located in West Gore.

From an industrial minerals perspective, the area holds great potential in gypsum and limestone. In the Halifax Slates there was the Wittenburg Slate Quarry. A few glaciofluvial deposits (kames, eskers, and glacial outwash fans) occur in the ecodistrict and are excellent sources of sand and gravel.

Overlying the bedrock in most parts of Rawdon Wittenburg Hills Ecodistrict are glacial deposits of ground moraine and streamlined drift, along with recent sediments. These contribute to the development of soils and have been used as a source of aggregate.

A major concern in the Rawdon Wittenburg Hills Ecodistrict is the presence of sulphide-rich slates in the Halifax Formation. The physical disturbance of these sulphide-bearing slates can lead to oxidation of the sulphide minerals that can possibly generate acid rock drainage (ARD). This can threaten water quality, sedimentation, integrity of building materials, and vegetation management. In addition, the oxidation of high concentrations of arsenopyrite in the slate can adversely affect the quality of drinking water by releasing arsenic into the water table.

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

The bedrock geology in Rawdon Wittenburg Hills is dominated by the metasedimentary rocks – sedimentary rocks apparently altered by metamorphism – of the Meguma Group, which are 480 to 540 million years old and cover 80% of the ecodistrict.

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

The Halifax Formation consists mostly of black and grey slates that locally contain abundant pyrite, pyrrhotite, and arsenopyrite. The Goldenville Formation comprises varying amounts of metasandstone and metasiltstones and is host to most of the gold deposits in Nova Scotia.

The remaining 20% of the ecodistrict consists of few igneous rocks and strips of early Carboniferous sediments found along the north and south sides of the ecodistrict. The majority of the plutonic rocks in the ecodistrict consist of granodiorites.

Most of the major faults in the ecodistrict run northwest to southeast parallel to the anticlines.

Parks and Recreation / Protected Areas

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

Wildlife and Wildlife Habitat

Wildlife in the Rawdon Wittenburg Hills 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 Rawdon Wittenburg Hills 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 Herbert and Meander rivers flow through the ecodistrict. Several species of rare riparian plants are known along these rivers. The rare woodland plant downy rattlesnake plantain has been found near the Little Meander River.

Wood turtles have been found in the ecodistrict.

Wood turtles, a species listed as threatened in 2013, have been found within the Herbert River and Little Nine Mile River. Wood turtles are known from the Musquodoboit, Shubenacadie, and Stewiacke watersheds so there is a possibility that some may use the lower reaches of the Wittenburg area tributary streams.

There are a small number of lakes in the ecodistrict, with Panuke being the largest, but only a portion is located in the district. Loons may be occasionally found in some of the lakes.

There are two known eagle nesting areas, one associated with the Herbert River and the other with Panuke Lake.

Karst topography is associated with the district in several locations. This unique, gypsum-based landform often has an assemblage of rare plants and is important for providing denning locations for many species of animals. One site near Upper Stewiacke has a cave that is known as a significant bat hibernation site.

Abandoned mines also provide the necessary habitat for overwintering bats, with one site known near Rawdon Gold Mines.

The little brown bat, once the most common bat in Nova Scotia, is now endangered by a disease known as white-nose-syndrome caused by a fungus. Estimates of a 90% percent decline in bat populations in Nova Scotia have taken place in three years since the disease was first recorded. There is no known cure for the disease which is lethal and affects all bat species that congregate in caves and abandoned mines used for hibernation. About 16 hibernation sites are known in Nova Scotia.

Bats have in the past hibernated in abandoned mines in the ecodistrict.

Most of the ecodistrict is within a deer management zone that supports a healthy and stable population of white-tailed deer that allows for a popular annual regulated fall deer hunt. Severe winter and spring weather is the primary limiting factor. Generally, the ecodistrict experiences a moderate winter climate with limited snow depths. However, occasionally severe conditions can be experienced and at such times deer tend to migrate toward lower elevations and gather in small groups.

With the ecodistrict being close to major population centres (e.g. Halifax, Dartmouth, Truro, and Windsor) many Nova Scotians enjoy the consumptive and non-consumptive uses and opportunities that the variety of flora and fauna of the ecodistrict provide.

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.

Natural disturbance agents in the ecodistrict are primarily associated with hurricanes and are of an infrequent nature so that old growth forests may develop with an uneven-age structure. Insect defoliation has not been a significant factor in forest disturbance. The beech bark canker, introduced in the 1890s, has reduced the beech to an understory species, although scattered disease-free individual trees are not uncommon.

An increase in average annual temperature due to global warming may have significant impact on forest composition, possibly reducing the abundance of black spruce and balsam fir. Soil moisture may not change since precipitation amounts are not expected to decrease with climate change. However, the frequency and extent of natural disturbances, such as fires caused by lightning and the blowdown of large forested tracts by hurricanes, may increase.

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.

Climatically, temperatures in Rawdon Wittenburg Hills are cooler, especially in winter, and considerably moister than the adjacent lowlands. These factors affect the climatic climax of vegetation types.

Rawdon Wittenburg Hills – Elements Defined

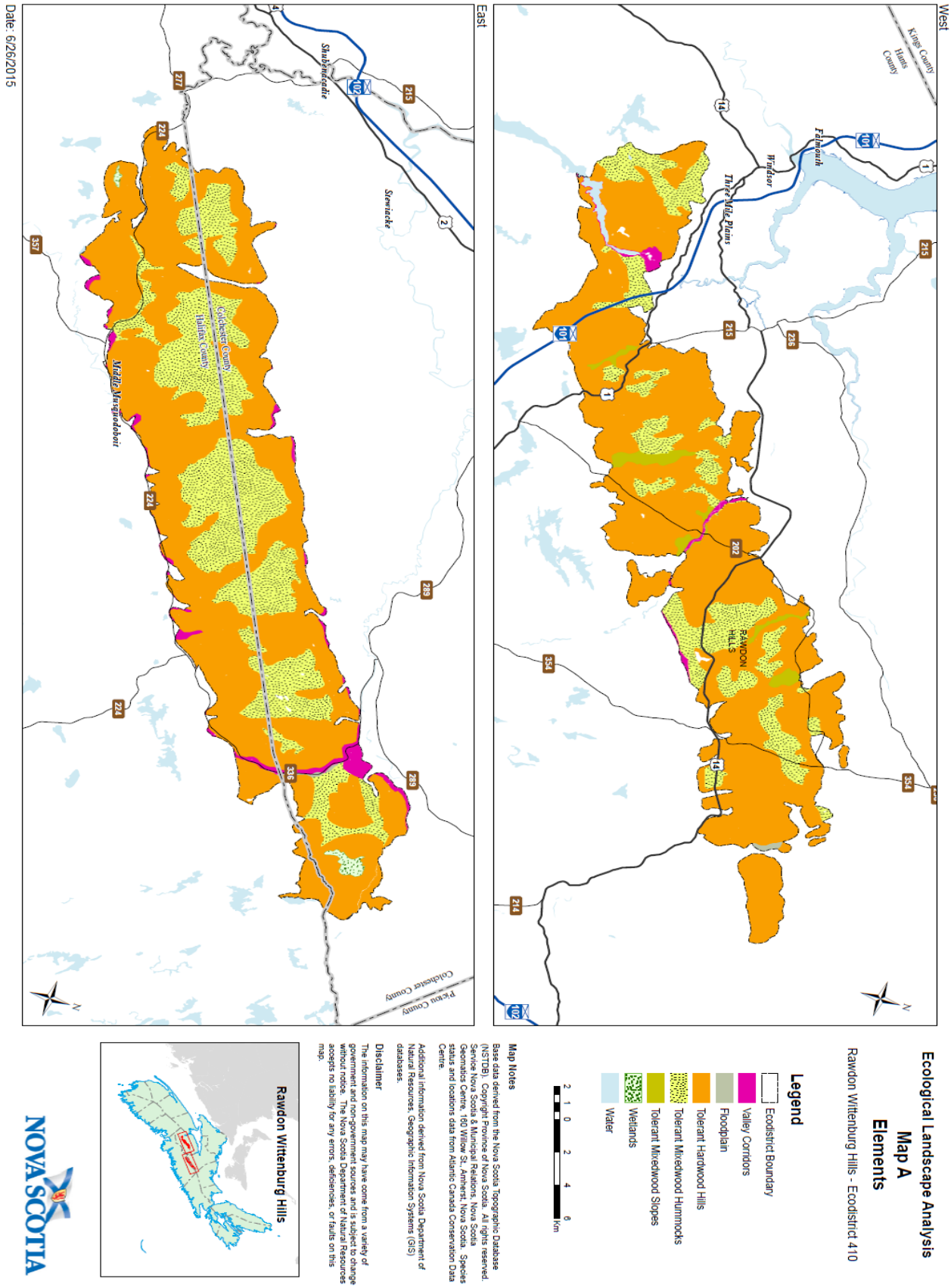
Landscapes are large areas that function as ecological systems and respond to a variety of influences. Landscapes are composed of smaller ecosystems, known as elements. These elements are described by their physical (e.g. soil, landform) and ecological features (e.g. climax forest type). These characteristics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

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

Tolerant Hardwood Hills is the matrix element, representing 72% of the area of the ecodistrict. The crests and upper slopes of the element support a forest of sugar maple and yellow birch with some beech and white ash. Lower slopes support a mixedwood forest of red spruce, hemlock, and yellow birch.

Tolerant Mixedwood Hummocks, the largest patch element, supports a climax forest of red spruce and includes a variety of hardwood species. Much of the element has been converted to other uses and abandoned farmland has been reforested to white spruce or white pine or been cultivated into wild blueberry fields. The other patch elements, in order of size, are **Tolerant Mixedwood Slopes**, **Wetlands**, and **Floodplain**.

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 Rawdon Wittenburg Hills		
Element	**Size (Hectares)**	**Element Description**
Tolerant Hardwood Hills (Matrix)	43,767 71.8%	The slopes of the hills create the conditions for this shade-tolerant hardwood matrix element. The soils on the upper to middle slopes of this upland terrain are well-drained gravelly sandy loams and loams derived from slates and siltstones (shales). The crests and upper slopes support a forest of sugar maple and yellow birch with scattered beech and white ash. On the lower slopes moderately well-drained to imperfectly drained gravelly sandy loams and loams support a mixedwood forest of red spruce, hemlock, and yellow birch. Where steep slopes follow the larger streams and rivers a ravine-like forest of hemlock occurs (e.g. Herbert River near South Rawdon). Much of the element on the well-drained upper slopes has been converted to other land uses, primarily agriculture and settlement. When fields are abandoned white spruce and white pine are quick to reforest the sites. Many of these abandoned farmlands have been converted to high-yielding wild blueberry fields. A long history of forest harvesting has also increased the abundance of earlier successional species such as red maple, white birch, and balsam fir. Natural disturbances in this element would be mostly due to wind and insects/disease creating small gaps and patches in the canopy and opportunity for uneven-aged forests. Stands can develop old forest characteristics.
Tolerant Mixedwood Hummocks (Patch)	15,951 26.2%	This element occurs throughout the ecodistrict and is usually associated with the hummocky terrain on the upper slopes of the Rawdon and Wittenburg hills. For the most part soils are gravelly sandy loams to loams that are moderately well to imperfectly drained and supporting a climax forest of red spruce. In many areas soils are shallow to the slate bedrock and with the gentle terrain drainage is impeded. Where soils are deeper and better-drained, mixedwood forests of shade-tolerant species such as red spruce, yellow birch, and sugar maple occur with pure hardwood forests on the best of the sites. Early and mid-successional forests will have red maple, white birch, aspen, and balsam fir. Much of the element has been converted to other uses and abandoned farmland has either reforested to white spruce or white pine and/or been cultivated into wild blueberries. Natural disturbances in tolerant mixedwood and hardwood forests are primarily small gaps created in the stand canopy by individual tree mortality or small patch disturbances created by windthrow. Red spruce forests on moist soils are more susceptible to stand-level disturbances, especially windthrow, but the infrequency of natural stand disturbances such as insects or windthrow allow stands to develop uneven-aged and old forest characteristics.

Table 5a – Elements Within Rawdon Wittenburg Hills		
Element	**Size (Hectares)**	**Element Description**
Tolerant Mixedwood Slopes (Patch)	725 1.2%	Tolerant Mixedwood Slopes is a linear patch element associated with steep-sided slopes and ravines along major watercourses leaving the Rawdon Hills. The most notable are along the upper Meander and Herbert rivers and the Thumb Hill Creek and Glen Brook. Soils are well to rapidly drained with moister and richer soils at lower and toe slope positions as water and nutrients move downslope to reach the watercourse and/or the level terrain associated with riparian zones. Soils are derived from glacial tills and are primarily gravelly sandy loams and loams although coarse-textured soils are common on excessively steep slopes. Mixedwood forest of tolerant tree species such as sugar maple, yellow birch, red spruce, hemlock, and white pine are typical. However, depending on slope and soil conditions, forests of pure hardwood or softwood may prevail. Stands can develop old forest characteristics.
Wetlands (Patch)	199 0.3%	This is a relatively small patch type element comprising freshwater bogs, fens, swamps, and poorly drained areas. In this ecodistrict, this element occurs primarily as a wetland complex on poorly drained level to hummocky terrain on the upper levels of the Rawdon and Wittenburg hills. The element is often a small patch embedded in other larger elements such the Tolerant Mixedwood Hummocks. Plants such as sedges, sphagnum moss, false holly, and winterberry are indicators of the poor drainage conditions. Wetlands are generally treeless or sparsely forested woodlands of black spruce, tamarack, and red maple. This element plays a critical role in water collection, filtering, and groundwater recharge.
Floodplain (Patch)	230 0.4%	This element occurs on smooth topography in the riparian areas along rivers and larger streams. This linear, patch element is usually underlain with imperfectly drained, sandy loams or loams derived from alluvial deposits. Often these soils are gravelly or underlain by gravel deposits. In some locations and adjacent to the floodplain, glaciofluvial deposits of coarse sands and gravels are found. This element on well to moderately well-drained soils produces the typical climax forest of sugar maple, white ash, and elm. Where soils are no longer enriched regularly with alluvium from flooding, late successional forests with hemlock, red spruce, white pine, yellow birch, and sugar maple develop. Earlier successional species such as black cherry, white spruce, aspen, and red maple are common.
Total	**60,919***	*Area is not the same as in Table 1 because water has not been included.

Table 5b – Forest Vegetation Types[1] Within Elements in Rawdon / Wittenburg Hills

Element	Seral Stage					
	Early	% *	Middle	%	Lat	%
Tolerant Hardwood Hills	OF1, OF2, OF3, OF4, IH3, IH4, IH5, IH6	30.1	IH7, TH7, TH8	22.4	**TH1, TH2**, TH3, TH4	19.9
Tolerant Mixedwood Hummocks	OF1, OF2, OF3, OF4, IH3, IH4, IH5, IH6, MW5	27.6	IH7, MW4, SH5, SH6, SH7, SH8, SH9, SH10, SP4, SP6, SP7	23.8	**MW1, MW2, MW3,** SH1, **SH3,** SP5	21.2
Tolerant Mixedwood Slopes	IH4, IH6, MW5	34.8	IH7, MW4, SH5	16.4	MW1, MW2, **MW3, SH1, SH2,** SH3, SH4	41.3
Floodplain	FP6	14.4	FP3	13.7	**FP1**	13.4
Wetlands	WC1, WC2, WC5, WC6, WC7, WD1, WD2, WD3, 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.

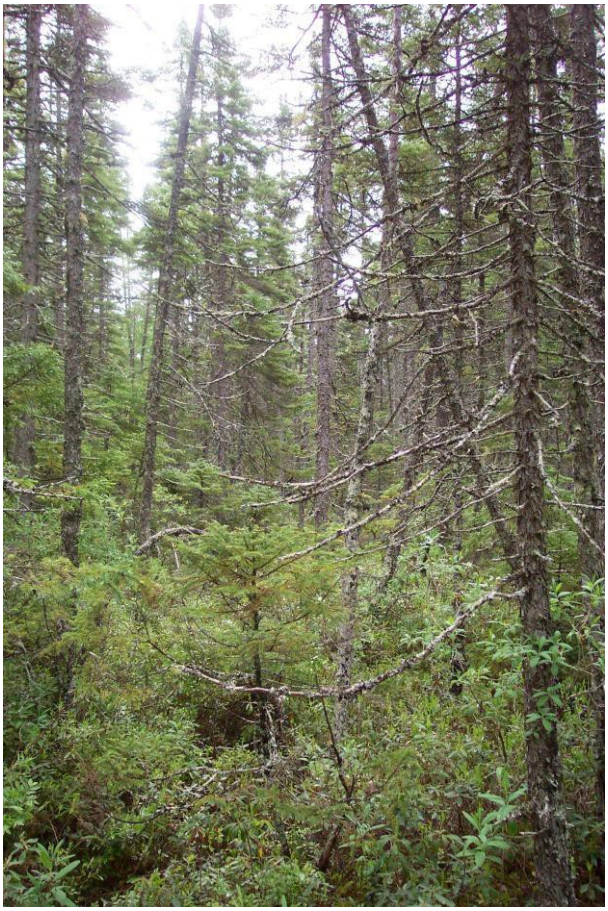
Photos Illustrating Vegetation Types in Elements

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

Sugar maple / New York fern – Northern beech fern (TH2) is a late successional vegetation type found in the Tolerant Harwood Hills matrix element.

Black spruce / False holly / Ladies' tresses sphagnum (SP7) is a mid-successional vegetation type found in the Tolerant Mixedwood Hummocks patch element.

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



Blackspruce / Lambkill – Labrador tea / Sphagnum (WC2) is a vegetation type found in the Wetlands element.

Red maple / Sensitive fern – Rough goldenrod (FP3) is a mid-successional vegetation type found in the Floodplain 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.

In Rawdon Wittenburg Hills, gap and infrequent disturbances are the predominant natural disturbance regimes that shape the diversity of the forest ecodistrict. The most common disturbance agent associated with the Rawdon Wittenburg Hills is wind.

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 (Forest Management Guide for Great Lakes St. Lawrence Landscapes 2010).

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%

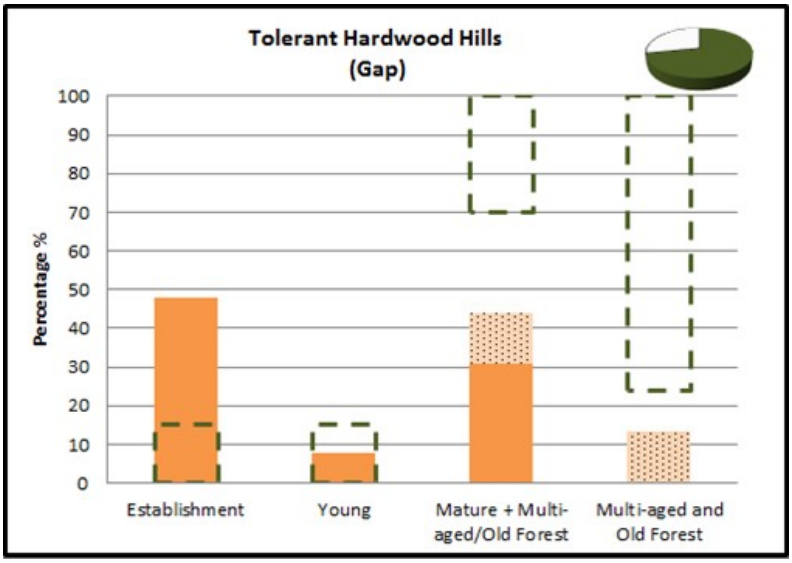
Table 6 indicates that for frequent stand initiating disturbances, both establishment and young development class forests would typically comprise between 5 and 30% of area, while mature forest – which includes multi-aged and old forest – would cover more than 40%. Mature forest should consist of a relatively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

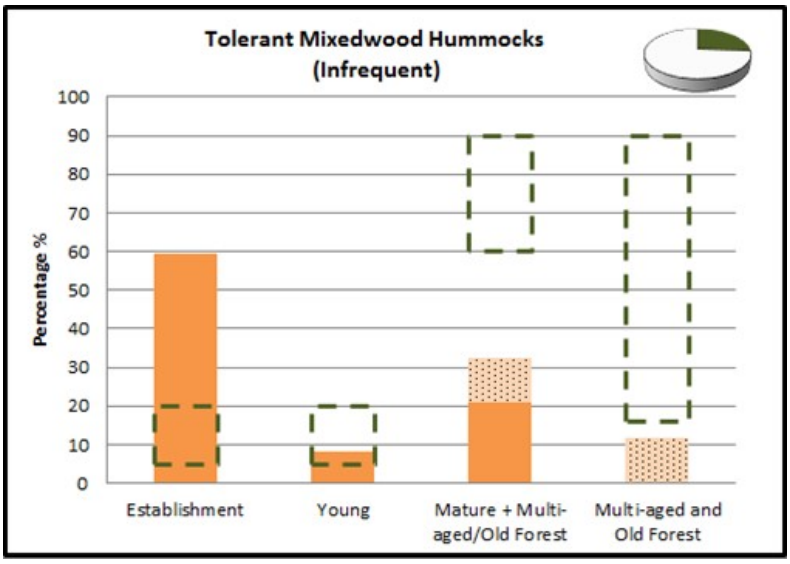
The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime. The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage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

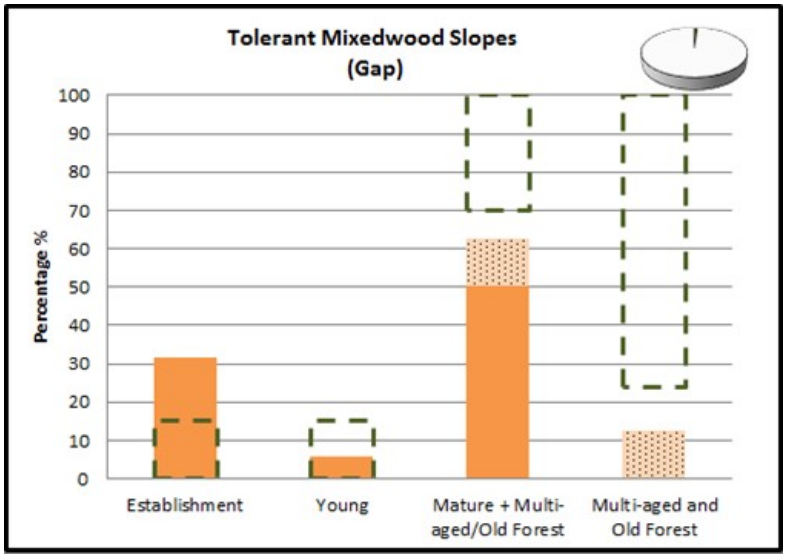
In the matrix element **Tolerant Hardwood Hills,** mature and old forest has been significantly reduced below target levels and replaced with younger establishing forests. Continuing harvest of mature forests can use partial harvesting techniques consistent with gap disturbance ecology to maintain mature forest conditions and promote multi-aged forests. With over twice as much establishment class as desired, forestry prescriptions that increase late successional species in immature forests should be used.



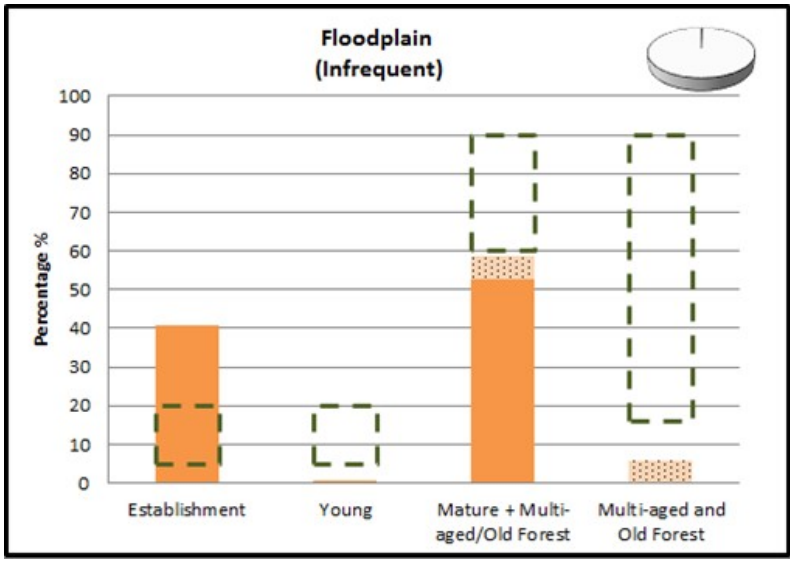
Tolerant Mixedwood Hummocks, the largest patch element, has development classes that are similar to the matrix element. Mature forests cover can be maintained using partial harvesting techniques on suitable sites and stands. Extended rotations, natural regeneration, promotion of late seral species, and uneven-aged practices are most appropriate for infrequently disturbed forests.



In **Tolerant Mixedwood Slopes**, the establishment class currently exceeds target levels for gap disturbed ecosystems. Mature forest and multi-aged and old forest are below targets. Where opportunities for management exist, partial harvesting in mature forests to maintain canopy and promote mixed ages is appropriate. Pre-commercial thinning in young stands can favour climax species.



The very small **Floodplain** patch element is often associated with the wetland element and provides a habitat interface with the hydrological system. The small size and limited distribution of this element make its composition sensitive to local level disturbance.



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).