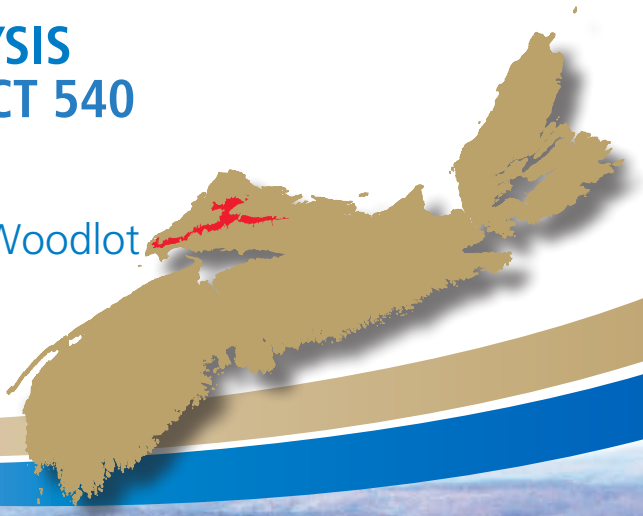
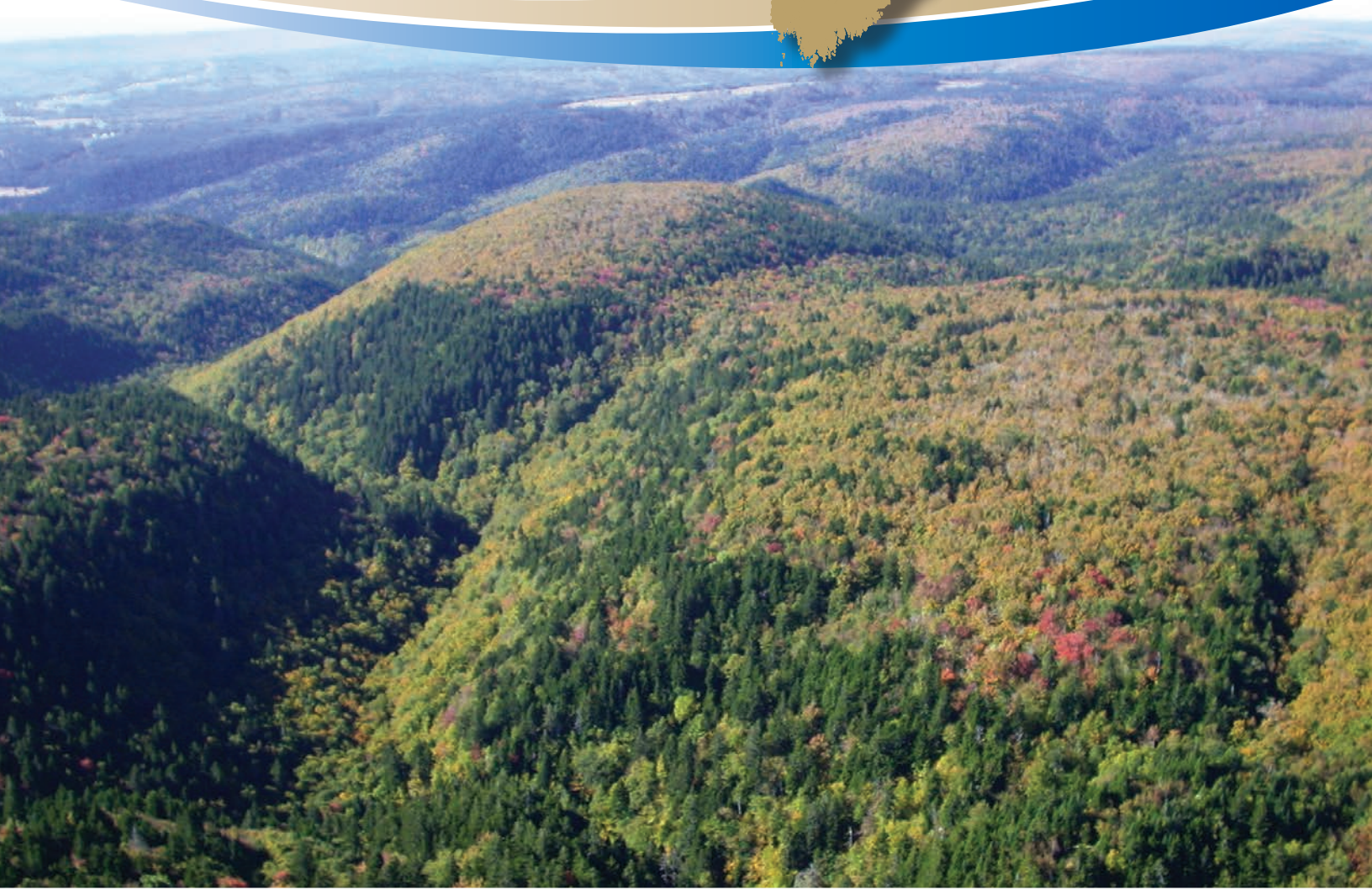
Department of Lands and Forestry

2019 Update

ECOLOGICAL LANDSCAPE ANALYSIS CUMBERLAND HILLS ECODISTRICT 540

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





ELA 2019-540

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 540: Cumberland Hills
2019 Update for Part 1 and 2

Prepared by the Nova Scotia Department of Lands and Forestry
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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 540: **Cumberland 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 Cumberland Hills Ecodistrict 540. 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.

Rounded hills, seldom exceeding 150 metres above sea level though sometimes slightly over 180 metres near Springhill and Leicester, help define the Cumberland Hills Ecodistrict.

Total area of the ecodistrict is 90,990 hectares. Eighty-five percent of Cumberland Hills is forested, considerably above the provincial average of 72%.

The lower Cumberland Hills in the foreground contrast to the higher elevations of the Cobequid Hills ecodistrict in the background. Cultivated wild blueberry fields and forest of red spruce cover the rolling landscape

Upland sites are a mixture of shade-tolerant softwood and hardwood stands, including red spruce, sugar maple, beech, and yellow birch Imperfectly drained sites are occupied by black spruce. Areas with coarse-textured soils are prone to moisture deficits in the summer and are susceptible to fire.

Agriculture is the main non-forest sector and the primary agricultural activity is blueberry production. The largest producer of frozen blueberries in the world is located in the ecodistrict.

The bedrock geology is generally sedimentary rocks, such as sandstone, shale, conglomerate, and coal. The Springhill coalfield, one of the province's most important past coal mining districts, still contains significant deposits of deep coal as well as smaller blocks of high quality coal accessible by surface mining.

Leicester Ridge divides two watersheds, with the Little River draining east to the River Philip and the Little Forks River flowing west to the Maccan River. Near Springhill, the Black River flows to the Maccan River.

These and other rivers provide valuable wildlife habitat. There are reports of wood turtle in the Black River system. Further surveys are required to confirm the reports. Several uncommon plants are associated with the rivers, including blue cohosh, small white leek, and Canada lily.

Private land ownership accounts for 84%, or 76,105 hectares, of the total area in the ecodistrict. Nearly 15%, or 13,353 hectares, is under provincial Crown control. A little bit more than 1% is considered Aboriginal lands or is federal land. The remaining lands are in transportation corridors and inland waters.

Plastic pipelines are used to transport the sap from sugar maple to the boilers. Maple syrup production is a common activity in the Cumberland Hills ecodistrict.

Landscapes are large areas that function as ecological systems and respond to a variety of influences. Landscapes are composed of smaller ecosystems, known as elements. These elements are described by their physical features – such as soil and landform – and ecological features – such as climax forest type. These characteristics help determine vegetation development.

Element descriptions promote an understanding of historical vegetation patterns and the effects of current disturbances. This landscape analysis identified and mapped eight key landscape elements – one dominant matrix element, and seven smaller patch elements – in Cumberland Hills.

Tolerant Mixedwood Hills, the matrix element representing slightly above half of the ecodistrict, has been altered from what was once a climax forest of shade-tolerant hardwoods – sugar maple, yellow birch, and beech (60%) – and tolerant softwoods – red spruce, hemlock, and white pine (40%) – to a forest with relatively equal areas in all covertypes.

In **Tolerant Mixedwood Hummocks**, much of the largest patch element has been converted to agricultural or other uses. Abandoned farmland has been reforested to white spruce or cultivated to grow wild blueberries. Other patch elements, in order of size, are **Spruce Pine Hummocks**, **Red Spruce Hummocks**, **Wetlands**, **Spruce Hemlock Pine Hummocks and Hills**, **Floodplain**, and **Spruce Pine Flats**.

Forest Ecosystem Management
For Cumberland 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 Cumberland Hills Ecodistrict 540. Resources and their components include the natural elements that make up the landscape and may affect functions like connectivity – how a landscape enables or impedes movement of resources, such as water and animals – as well as conditions of forest composition, road density, and land use intensity.

Only brief summaries are presented for other land values, including minerals, energy and geology, water resources, parks and protected areas, wildlife and wildlife habitat. These summaries are included in the document to present the range of land values that must be balanced during the design stage of the land management process and are not intended to be exhaustive treatments of the respective land values. Where possible, the reader will be referred to additional sources for detailed information.

Application

The data in this ELA represent inventory based off the Forest Inventory Database (FID) current as of the end of 2015 and the Crown Land Forest Model (CLFM) current as of 2017. The update provides a reference to compare to the baseline conditions provided in the ELA 2015, which in the case of the Cumberland 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 Cumberland 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 Cumberland Hills Ecodistrict is a long, narrow and hilly expanse of land stretching from Spicers Cove in Cumberland County to Warwick Mountain in Colchester County.

The ecodistrict is sandwiched between the Northumberland Lowlands 530 and Chignecto Ridges 560 ecodistricts to the north and the Cobequid Hills 340 and Parrsboro Shore 910 ecodistricts to the south.

Cumberland Hills rises above surrounding lowlands to elevations of 150 to 180 metres. Compared to the lowlands, the temperature is slightly cooler and the air slightly moister.

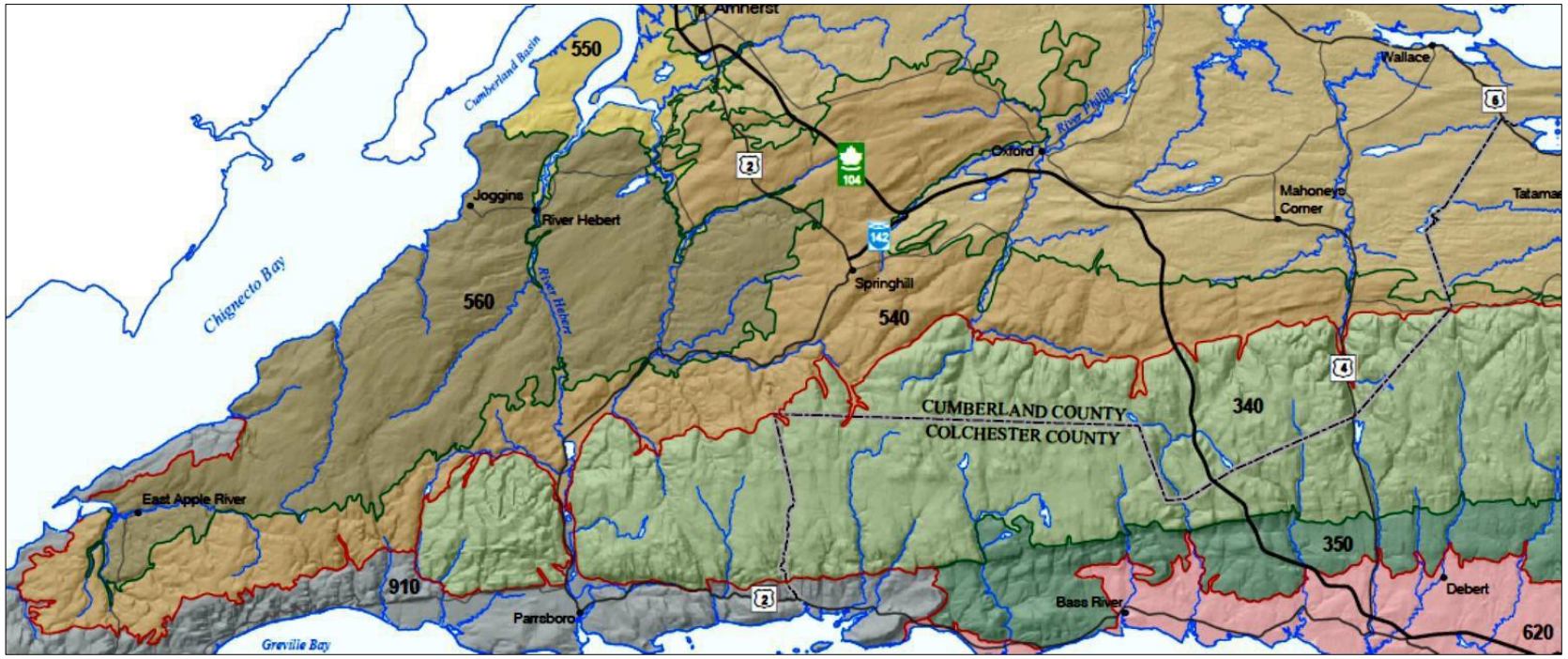
Improved soil drainage contributes to good growing conditions for forests, such as shade-tolerant softwoods and hardwoods. In this ecodistrict, two natural disturbance regimes dominate. In the softwood forests, frequent stand-initiating disturbances due to fire occur on about 50% of the landscape. In the other half, a gap disturbance regime is more common, notably on the hills and slopes. Here tolerant mixedwood and hardwood forests occur with occasional breaks in the canopy caused by wind, ice storms, and insect epidemics.

During periods of drought, losses due to fires initiating on the lowlands are likely unless hardwood stands act as fire breaks. The spruce budworm is also capable of creating stand-initiating disturbances in this ecodistrict, notably in mature stands of red spruce.

Ice damage in tolerant hardwood stands occurred in February 2003 with 110,000 hectares in Cumberland and Colchester counties being affected in this ecodistrict and the adjoining Chignecto Ridges and Cobequid Hills ecodistricts. Hardwood stands and softwood plantations were damaged by the ice with 33,000 hectares of the affected area receiving 11 to 30% crown damage.

Approximately 1,200 hectares, or 8% of the Crown lands within this ecodistrict, have been set aside as old growth under the Old Forest Policy.

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



Cumberland Hills 540 is a long, narrow ecodistrict that stretches from Chignecto Bay in the west across Cumberland County into Colchester County in the east.

Land Area

Cumberland Hills is rural and predominately under private ownership at 84% (Table 1). Only 15% is under the administration of provincial Crown.

Other land uses, such as rail and other transportation corridors, account for 1%.

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

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	13,353	14.7
Private	76,105	83.6
Federal	81	0.1
Aboriginal	366	0.4
Other (Includes inland water bodies and transportation corridors)	1,085	1.2
Total	**90,990**	**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	8,925	71.3
C2 – Multiple and Adaptive Use	3,201	25.6
C3 – Protected and Limited Use	236	1.9
Unclassified	150	1.2
Total	**12,512**	**100**

Less than 2% of Crown land in the ecodistrict is protected or set aside for limited use. Nearly 97% is for general resource use or multiple and adaptive use.

There is a sugar bush lease on 18 hectares of Crown land at East Leicester, Cumberland County. At the time of the report, the lease had been active for 28 years and had 4,500 taps.

Camps that produce maple syrup are found in the Cumberland Hills Ecodistrict.

There are several 0.4 hectare (1 acre) camp leases on Leamington Brook, south of Springhill. One of these is within the Economy River Wilderness Area.

Department of Lands and Forestry received a request from the Cumberland County Riders ATV Club to establish a network of ATV trails on Crown land at Little Forks, Cumberland County. In addition to the trails, the proposal involves a parking area, ATV training area, and closed courses for off-highway vehicles. Department of Lands and Forestry is working with the club to plan and build this trail network.

Forests

Within the Cumberland Hills Ecodistrict, with a total area of 90,990 hectares, 85%, or 77,747 hectares, is forested (Table 3). This is considerably above the provincial average of 72%.

Within the non-forested category, the largest sector is agriculture which accounts for 8% of the area, or 7,346 hectares. The main agricultural activity is blueberry production.

Oxford Frozen Foods, located in Oxford, is the largest producer of frozen blueberries in the world.

This ecodistrict is primarily rural. Only 1% is classed as urban. Approximately 3% of the area is in wetlands (2,973 ha).

The dominant covertype is softwood, representing 39% of the forest, followed by hardwood at 25% hardwood, mixedwood at 24% and 12% unclassified.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	77,747	85.4
Wetland	2,973	3.3
Agriculture	7,346	8.1
Barrens	47	0.05
Urban	1,236	1.4
Road, Trail, Utility	974	1.1
Other	668	0.7
Total	**90,990**	**100**

The most common forest community type is red and black spruce, accounting for 34% of the forest area within the ecodistrict. Red and black spruce forest are commonly found growing on imperfect to well-drained soils. Both species are in high demand by the forest industry and because of their value have been targeted for harvesting.

The hardwood stands dominated are by intolerant species consisting of red maple, poplar, and white birch. These species associations represent 43% of the forest area, or 38,000 hectares. Each of these three species is considered early successional species that quickly inhabit a site following disturbances.

Red spruce forests and blueberry fields dominate the Cumberland Hills landscape at Smith's Pond, Rodney.

The high percentage of early seral species is indicative of the amount of harvesting that has occurred over the past 20 years. Given the abundance of mid succession mixedwood in this ecodistrict, silviculture treatments that would hasten the development of late succession softwood in the understory should be utilized. This would include either a herbicide or pre-commercial thinning treatment.

Red and black spruce forests are the most common forest type in the ecodistrict.

Following harvest, many of these sites will convert naturally to intolerant hardwood-dominated sites unless silviculture treatments are applied. Other softwood community types (e.g. pine, hemlock and white spruce dominated sites) are less common. Combined, these stand types represent less than 5% of the forested area.

Tolerant hardwood (sugar maple, yellow birch, beech) stands account for 5% of the forest community. There is a lack of late succession tolerant hardwood in this ecodistrict. At Fenwick, an area of forest dominated by sugar maple has been designated a site of ecological significance.

Tolerant hardwood stands are commonly found on well-drained, fine-textured knolls. These knolls are a distinct feature of the landscape. In order to increase the percentage of late succession hardwood, these species (i.e. yellow birch and sugar maple), when present, should be favoured during pre-commercial thinning operations.

Two sawmills operate in this ecodistrict: Hoeg Brothers Lumber in Southampton and C.E. Harrison & Sons in Halfway River. One of the largest and most active landowners in this area is J.D. Irving. Also active in forest management is Athol Forest Co-op in Amherst. This landowner cooperative has been active in managing private land in this area for over 30 years.

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 4.9 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	2,196	2.9%
3	3,458	4.5%
4	10,871	14.1%
5	45,030	58.4%
6	13,247	17.2%
7 or more	2,256	2.9%
Total	**77,058**	**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

A characteristic of this ecodistrict is the scarcity of lakes. Only three lakes are larger than 10 hectares: Chase Lake, Newville Lake, and Welton Lake.

There are eight large rivers in this area, most generally flowing north. Located to the west of Highway 104 are the Hébert, Black, Little Forks, Maccan, Halfway, and Southampton rivers. On the east side of Highway 104 are River Philip and the Wallace River.

Geology, Minerals and Energy

The Cumberland Hills Ecodistrict lies on the southern part of the Cumberland Basin, flanking the northern margin of the Cobequid Mountains. The Cumberland Basin comprises a large subbasin that formed north of the Cobequid-Chedabucto Fault Zone and is part of the larger Maritime Basin. This subbasin comprises Carboniferous age sedimentary rocks (280 to 350 million years old) and contains significant mineral resources.

The sandstones and shales that underlie the younger Carboniferous rocks throughout much of the Maritime basin are targets for oil and gas exploration. In the Cumberland Hills these and other rocks have been the subject of extensive seismic exploration in 2003.

The deep coal deposits of the Springhill Coalfield currently are being assessed for coalbed methane production and the entire central area of the ecodistrict is under license for petroleum exploration.

Salt deposits of the Windsor Group occur in the area known as the Black River Diapir, a salt structure northeast of Springhill in the Salt Springs area, named for the natural salt springs in the area. Lakes in topographic depressions known as karst typify the land above the salt.

The Springhill coalfield, one of the province's most important past coal mining districts, still contains significant deposits of deep coal within the Cumberland Group, as well as smaller blocks of high quality coal accessible by surface.

As recently as the 1990s, coal was also mined north of Springhill between Chignecto and Stanley, which comprises the eastern extremity of the Joggins-Chignecto coalfield. The town of Springhill and surrounding area is a designated geothermal area, which utilizes heat from groundwater that circulates within the defunct, deep underground coal mines.

There are only a few known anomalous concentrations of base metals in the rocks of this ecodistrict, including barite and galena (lead) associated with faults in the southern portion of the Springhill coalfield.

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 society's requirements for minerals and advances in scientific understanding and technological change.

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/.

Wentworth is the largest provincial park in the ecodistrict with an area of over 140 hect

Wildlife and Wildlife Habitat

Wildlife in the Cumberland 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 Cumberland 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 Cumberland Hills Ecodistrict consists of a diverse community of wildlife and wildlife habitat. The Cape Chignecto Provincial Park and Economy River Wilderness Area slightly overlap with this ecodistrict.

Designated species at risk found within Cumberland Hills – under the Nova Scotia Endangered Species Act (NSESA) or federal Species at Risk Act (SARA) – include Atlantic salmon, mainland moose, black ash, wood turtle, eastern waterfan lichen, brook floater mussel, and several bird species (common nighthawk, olive-sided flycatcher, eastern wood-pewee, bobolink, barn swallow, bank swallow, and Canada warbler).

The headwaters of several significant rivers are found in this ecodistrict. The small headwater streams are important spawning areas for Atlantic salmon, which benefit from the maintenance of special management zones along these streams for protection and to prevent siltation. Atlantic salmon is listed as an endangered species under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Some of the major rivers that flow through this ecodistrict include River Hébert and the Halfway, Southampton, Philip, Maccan, Little Forks, Wallace, Fox, and Black rivers, providing valuable wildlife habitat.

There are reports of wood turtle in River Philip and the Wallace River. Several uncommon plants are associated with the rivers, including blue cohosh, small white leek, and Canada lily. These intervale plants grow in the rich alluvial soils. In areas where fertile intervale land occurs, special management zones along the watercourses should be extended to include the whole intervale.

The Cumberland Hills Ecodistrict is an important area for mainland moose, especially around Shulie Lake. Moose have been reported in low numbers in the Leicester Ridge area. Mainland moose are listed as an endangered species under the Nova Scotia Endangered Species Act.

Fourteen deer wintering areas are partly or entirely within this ecodistrict. Management of these areas should conform to the special management practices for deer wintering areas. The wintering areas are usually found within the river valleys at lower elevations, away from the harsh climate and where there is a mixture of cover (softwoods in mid to late succession) and food (young hardwoods in early succession).

White-tailed deer are common in the ecodistrict, which includes 14 deer wintering areas.

Other notable species include bald eagle, fisher, beaver, and a great blue heron nesting colony near Chase Lake. Along Chignecto Bay in the Apple River area there is valuable salt marsh habitat where shorebirds congregate to feed during their migratory journey. Gaspereau can be found in the Welton Brook. Newville Lake has a diversity of wildlife species including wood turtles, gaspereau, freshwater mussels, and American eel.

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.

Natural disturbances within the ecodistrict were described in the early 1900s as including the heavy cull of forests, creation of farmland areas burnt by wildfire. Additional land settlement, agriculture and a long history of insect infestation and harvesting has changed the structure and function of this ecodistrict.

Numerous valley bottoms and slope systems follow the main river valleys and provide linkages to adjoining ecodistricts. The forests within some of these valley corridors, most notably River Hébert and around Newville Lake, Halfway River, Southampton River, Leamington Brook, Black River, River Philip, Wallace River and along Highway 204 from West Leicester to Mansfield, have been significantly altered by human land use, such as settlement, farming, urbanization, transportation systems, and forestry.

Natural Succession

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

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

Climatic climax – Vegetation types that are mainly a function of regional

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

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.

Cumberland 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.

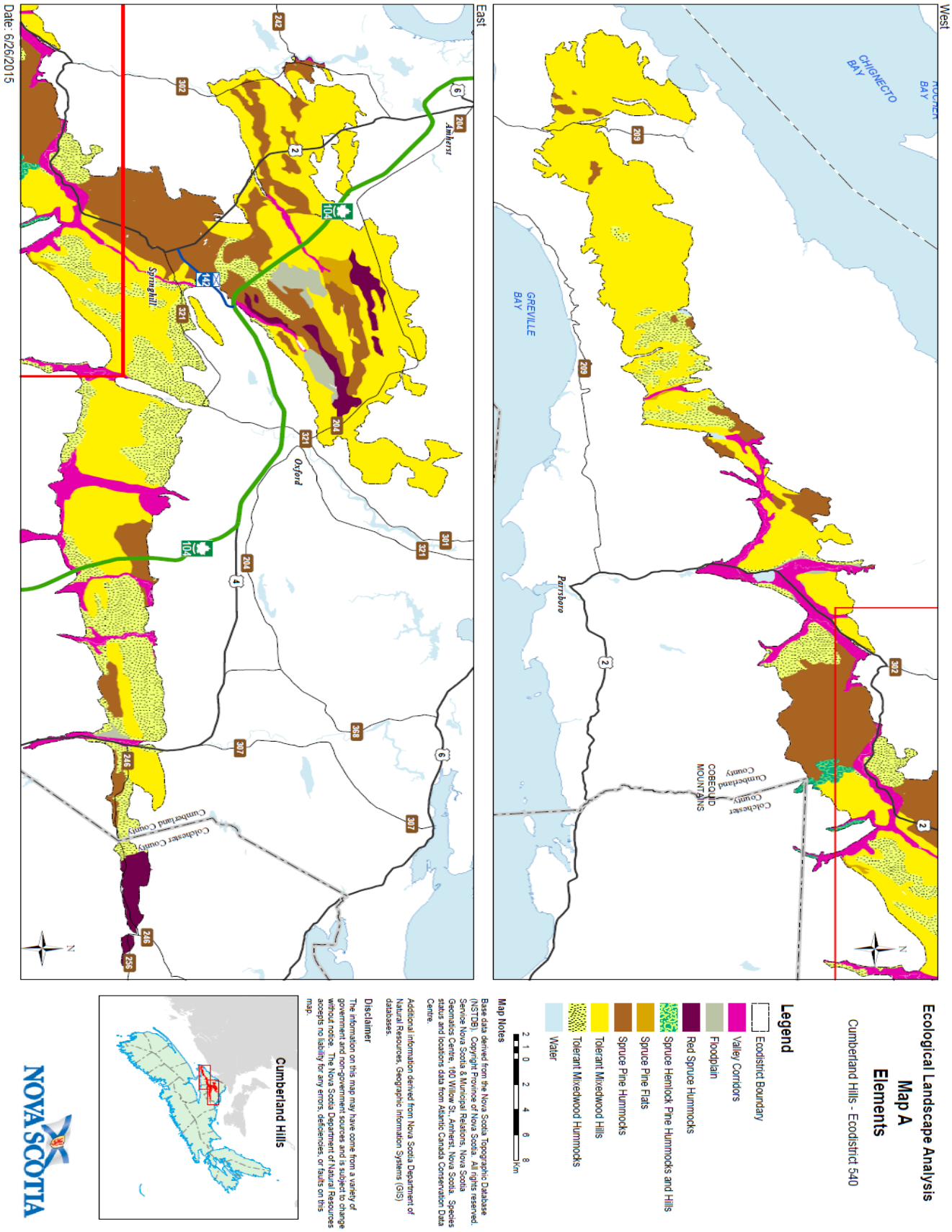
A landscape profile identified and mapped eight distinctive elements in the Cumberland Hills Ecodistrict – one matrix, and seven patches, (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types.

Comparisons with current conditions determined that a large portion of the ecological structure has been altered within this ecodistrict. Most of the elements are under moderate to heavy land use pressures.

Tolerant Mixedwood Hills, the matrix element representing just slightly above half of the ecodistrict, has been altered from what was once a climax forest of shade-tolerant hardwoods – sugar maple, yellow birch, and beech (60%) – and tolerant softwoods – red spruce, hemlock, and white pine (40%) – to a forest with a relatively equal area in all covertypes.

In **Tolerant Mixedwood Hummocks**, much of the largest patch element has been converted to agricultural or other uses. Abandoned farmland has been reforested to white spruce or cultivated to grow wild blueberries. Other patch elements, in order of size, are **Spruce Pine Hummocks**, **Red Spruce Hummocks**, **Wetlands**, **Spruce Hemlock Pine Hummocks and Hills**, **Floodplain**, and **Spruce Pine Flats**.

Map of Elements in Ecodistrict



Forest Stands Within Elements

Each element contains a number of forest stands that can be classified by vegetation, soil, and ecosites. The Department of Lands and Forestry publication ***Forest Ecosystem Classification for Nova Scotia, Part I: Vegetation Types (2010)*** (http://novascotia.ca/natr/forestry/veg-types/veg-navigation.asp) is helpful in identifying forest plant communities.

Viewed online or available in print through Department of Lands and Forestry, woodland owners can learn about the characteristics of a particular forest community. Refer to Table 5a for descriptions of elements and Table 5b for forest vegetation types that are likely to be found within elements.

Table 5a – Elements Within Cumberland Hills		
Element	**Size (Hectares)**	**Element Description**
Tolerant Mixedwood Hills (Matrix)	46,285 51.1%	This matrix level element extends through the entire ecodistrict and supports a late successional forest dominated by the shade-tolerant species of the Acadian Forest. The element occurs on the slopes of rounded hills underlain predominantly by well-drained sandy loams. On the upper slopes and crests forests comprise sugar maple, yellow birch, and beech but at the middle and lower slope positions forests tend to comprise red spruce, balsam fir, and hemlock or mixed with yellow birch and maple. 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. Many of these hills have been cleared for agriculture and, when abandoned, reforest to white spruce or are converted to blueberry production.
Tolerant Mixedwood Hummocks (Patch)	18,386 20.3%	This element occurs throughout the ecodistrict and is usually associated with the hummocky terrain on the lower slopes of larger hills. The well-drained, gravelly and coarse-textured soils are moderately fertile and support a mixedwood climax forest of late successional species such as red spruce, sugar maple, and yellow birch with scattered occurrences of hemlock and white pine. 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 been cultivated to wild blueberries. Natural disturbances in tolerant mixedwood forests are primarily small gaps created in the stand canopy by individual tree mortality or small patch disturbances created by windthrow.
Spruce Pine Hummocks (Patch)	18,110 20.0%	This is a large patch element occurring on hummocky terrain throughout the ecodistrict. Drumlin-like landforms called flutes – long (hundreds of metres), narrow, linear glacial till deposits usually only several metres in height – occur in two large areas near River John. Jack pine forests are common with an extensive area near Chase Lake that established after a wildfire. With progressively poorer drainage, black spruce, tamarack, and red maple dominate the forest vegetation. Red spruce, hemlock, and the tolerant hardwoods are unlikely to be present in this element. Occasionally some forests, usually on slightly better-drained soils, will comprise the hybrid red-black spruce. In a few isolated areas, riparian floodplain forests of sugar maple, white ash, and black cherry will be found embedded in this element.
Red Spruce Hummocks (Patch)	2,264 2.5%	This patch level element occurs on gently undulating terrain. The soils are well-drained underlain by sandy loams and loams. The forests tend to comprise red spruce, white spruce, and balsam fir and where soils are imperfectly drained black spruce and the hybrid red-black spruce are more common. Early and mid-successional forests will have red maple, white birch, aspen, and grey birch with balsam fir. These forests are frequently disturbed by a variety of damaging agents including fire, insects, and wind.

Table 5a – Elements Within Cumberland Hills		
Element	**Size (Hectares)**	**Element Description**
Wetlands (Patch)	297 0.3%	The Wetlands element is a patch-level ecosystem and comprising freshwater bogs, fens, swamps, and poorly drained areas. The element may occur as a large wetland complex associated with rivers and lakes (e.g. Newville Lake), as narrow linear communities associated with flow accumulations and small streams, as a community of water-loving vegetation (sedges, sphagnum moss, false holly and winterberry) associated with level terrain where drainage is impeded (e.g. Thompson Reid Meadow), 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.
Spruce Hemlock Pine Hummocks and Hills (Patch)	1,004 1.1%	Spruce Hemlock Pine Hummocks and Hills is a small patch element occurring primarily on steeper slopes of ravines aligned in a north-south direction near Mapleton and Leamington Brook. The well to rapidly drained soils of coarse texture supports a forest of red spruce and white pine with hemlock on the soils with higher moisture and nutrient content which are usually associated with lower slope positions. Upper slopes will have tolerant hardwood forests of sugar maple and yellow birch. Stands can develop old forest characteristics.
Floodplain (Patch)	3,433 3.8%	A complex of floodplain and wetland forest types occurs along the largest rivers and streams of this ecodistrict including the Halfway and Hébert Rivers. This patch element is usually underlain with imperfectly drained, sandy loams or loams derived from alluvial deposits. Often adjacent to the floodplain are glacial fluvial deposits of coarse sands and gravels. Two large wetland complexes underlain by peat and poorly drained tills are found in the upper reaches of the Black River and Chase Lake.
Spruce Pine Flats (Patch)	834 0.9%	This small patch element occurs on two different substrates. Along the River Philip it occurs on imperfectly drained coarse-textured gravelly soils derived from glacial fluvial deposits. At the headwaters of the Little Forks River the element is underlain by imperfectly drained fine-textured soils on level terrain derived from glacial tills. Overall, the element comprises black spruce and pine with red spruce and yellow birch becoming more abundant as drainage improves.
Total	**90,646***	*Area is not the same as in Table 1 because water has not been included and rounding of numbers.

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

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Floodplain	FP4, FP5, FP6	13	FP3	22	**FP1**	49
Spruce Pine Hummocks	IH1, IH4, IH6, OW2, OW4, SP1, SP2, SP10	15	SP3, SP4, SP6, SP8	26	**SP5**, SP7	45
Red Spruce Hummocks	IH1, IH3, IH4, IH5, IH6	28	MW2, MW4, MW5, SH5, SH6, SH7, SH8, SH10	29	**SH1**, SH2, **SH3**, SH4	27
Spruce Pine Flats	IH4, IH6, OW2, OW4, SP1, SP2, SP10	9	SP6, SP8	21	SP5, **SP7**	53
Spruce Hemlock Pine Hummocks and Hills	IH3, IH4, IH5, IH6	8	MW2, MW4, MW5, SH5, SH6, SH7, SH8, SH10	19	MW1, MW3, **SH1**, SH2, **SH3**, SH4	56
Tolerant Mixedwood Hills	IH3, IH5, IH6	23	IH7, MW2, MW4, MW5, SH5, SH6, SH8, SH10, TH7	33	**MW1, MW3**, SH1, SH2, SH3, TH1, TH2, TH3, TH4, TH8	32
Tolerant Mixedwood Hummocks	IH3, IH5, IH6	23	IH7, MW2, MW4, MW5, SH5, SH6, SH8, SH10, TH7	27	**MW1, MW3**, SH1, SH2, SH3, TH1, TH2, TH3, TH4, TH8	32
Wetlands	WC1, WC2, WC3, WC4, WC5, WC6, WC7, WD1, WD2, WD3, WD5, WD6, WD7, WD8					

View forest groups and vegetation types at
http://novascotia.ca/natr/forestry/veg-types/veg-navigation.asp
To help with identification of vegetation types, the 14 forest groups in Nova Scotia designated by Department of Lands and Forestry are: Cedar (CE), Coastal (CO), Flood Plain (FP), Highland (HL), Intolerant Hardwood (IH), Karst (KA), Mixedwood (MW), Old Field (OF), Open Woodland (OW), Spruce Hemlock (SH), Spruce Pine (SP), Tolerant Hardwood (TH), Wet Coniferous (WC), Wet Deciduous (WD)
Bolded vegetation types indicate typical late successional community
[1] Forest Ecosystem Classification for Nova Scotia (2010)
*Percentage of element in each successional stage. Percentages may not total 100 due to unclassified lands (such as clearcuts and regenerating stands) not being included.

Photos Illustrating Vegetation Types in Elements

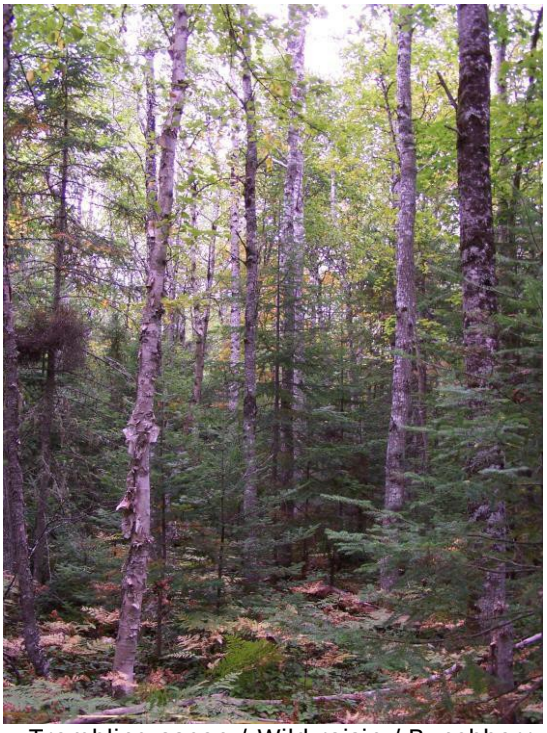
The following photos show some of the vegetation types expected to be found within their respective elements.

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

Red Spruce – Balsam fir / Schrebner's moss (SH5) is a mid-successional vegetation type found in Tolerant Mixedwood Hummocks, the largest patch element in the Cumberland Hills Ecodistrict.

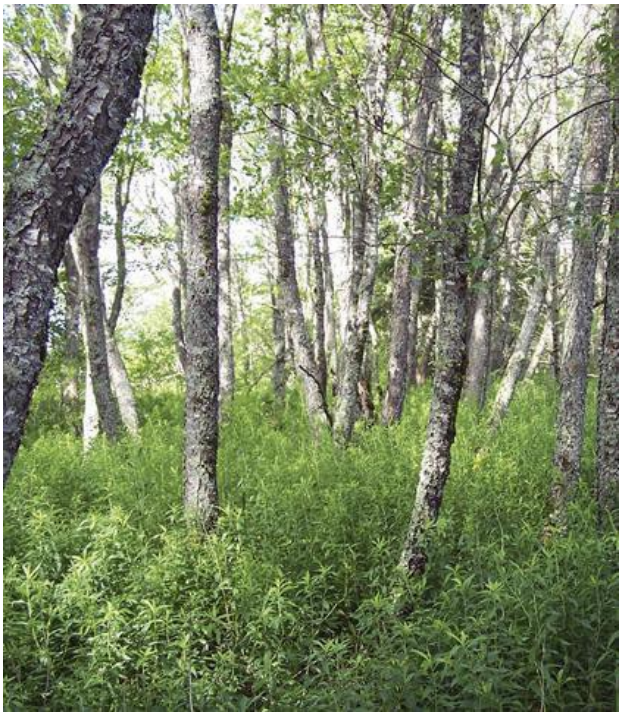
White birch – Red maple / Sarsaparilla – Bracken (IH6) is an early successional vegetation type found in the Spruce Pine Flats element.

Balsam fir / Wood fern / Schrebner's moss (SH8) is a mid-successional vegetation type found in the Red Spruce Hummocks element.



Trembling aspen / Wild raisin / Bunchberry (IH4) is an early successional vegetation type found in the Spruce Hemlock Pine Hummocks and Hills element.

Black spruce / Lambkill— Labrador tea / Sphagnum (WC2) is a nutrient poor vegetation type found in the Wetlands element.



Black cherry – Red maple / Rough goldenrod – Jack-in-the-pulpit (FP5) is relatively uncommon deciduous forest early successional vegetation found in the Floodplain element.

Black spruce / False holly / Ladies' tresses sphagnum (SP7) is a late 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.

In the Cumberland Hills Ecodistrict, two natural disturbance regimes predominate. In the softwood dominated forests, frequent stand-initiating disturbances due to fire occur on 50% of the landscape. The other half is mainly gap disturbed, most notably on the hills and slopes. Here tolerant mixedwood and hardwood forests occur with occasional breaks in the canopy caused by wind, ice storm, and insect epidemics.

During periods of drought, losses due to fires initiating on the lowlands will occur unless hardwood stands act as fire breaks. The spruce budworm is also capable of creating stand-initiating disturbances in this ecodistrict, most notably in mature stands of red spruce.

Ice damage in tolerant hardwood stands occurred in February 2003 with 110,000 hectares in Cumberland and Colchester counties being affected throughout this ecodistrict and the adjoining Chignecto Ridges and Cobequid Hills ecodistricts. Both hardwood stands and softwood plantations were damaged with 33,000 hectares of the affected area receiving 11 to 30% crown

damage. Potential old growth forests of sugar maple, yellow birch, and beech are possible on the hill ecosections.

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.

Natural disturbance shapes the diversity of the forest ecosystem. In the Cumberland Hills, gap replacement is the predominant natural disturbance. In these areas there is an absence of stand-initiating disturbances which supports the development of a dominant overstory that is sustainable through dynamic processes of canopy gap formation, understory development, and overstory recruitment.

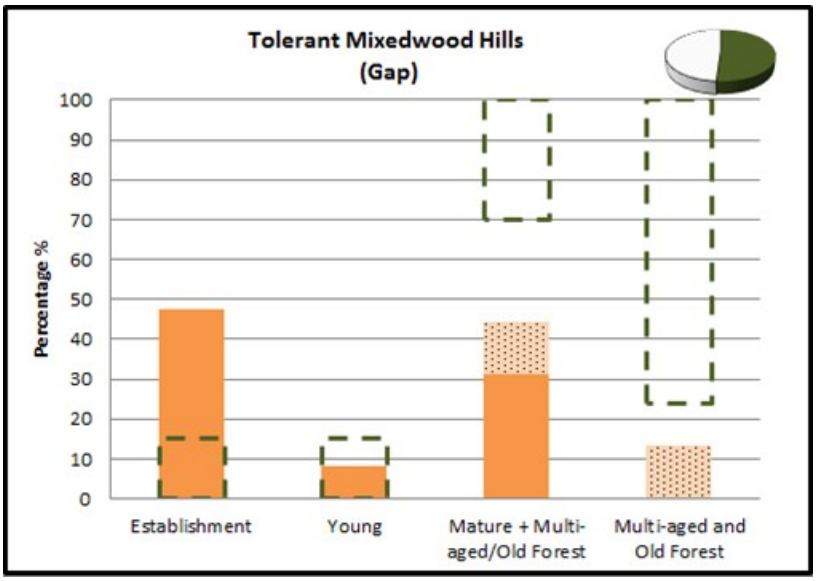
These formations range from individual tree mortality to periodic gap forming events that are rarely of a stand-initiating intensity. In these disturbances it is desirable to have most of the forest in a mature late seral stage (see Table 6 for details).

Development Class Targets by Element

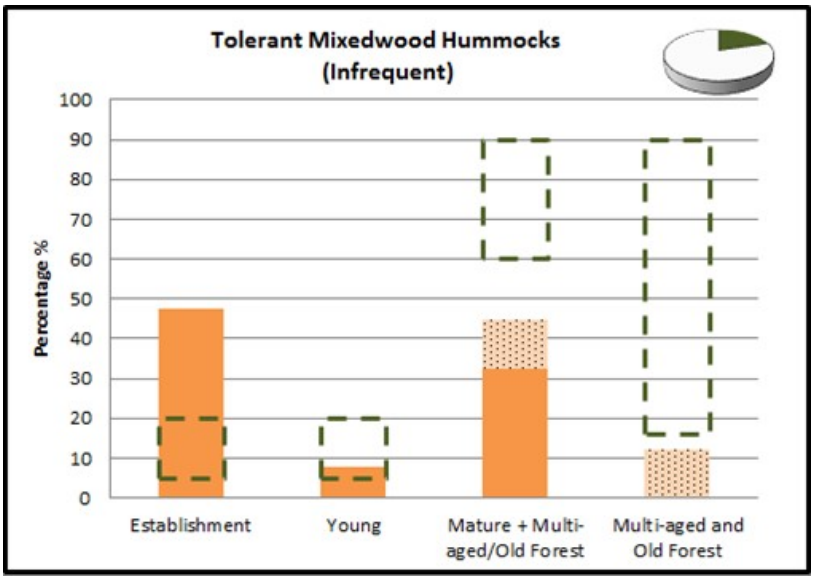
The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime. The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage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

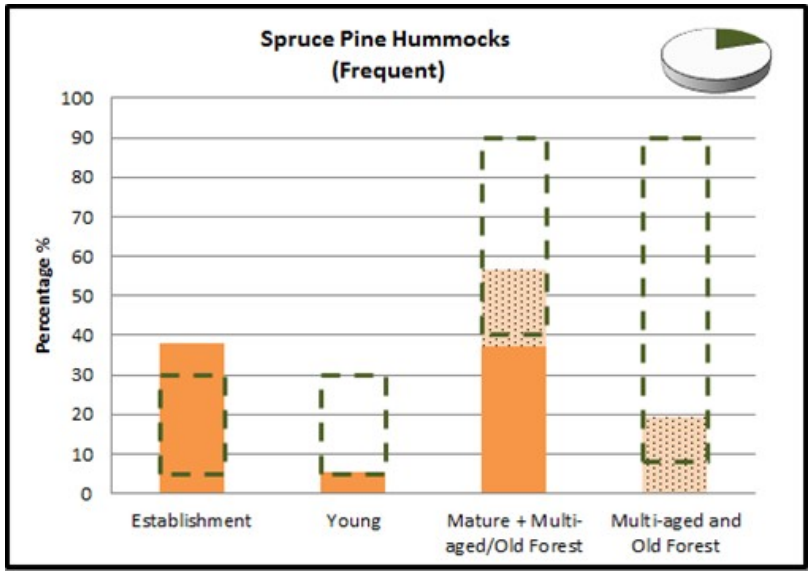
The **Tolerant Mixedwood Hills** matrix element has excessive establishment stage forest and is below desired levels of mature and multi-aged habitat. Partial harvests to favour climax species and retain large old trees will promote multi-aged forest and maintain mature conditions. Tending immature stands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



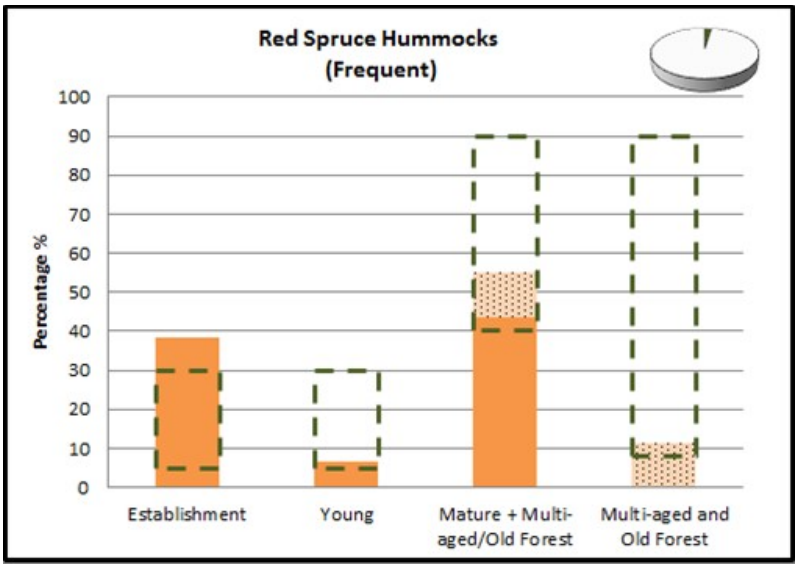
In the **Tolerant Mixedwood Hummocks** patch element multi-aged and old forest are significantly below target, while establishment levels are excessive. Mature forests with a mix of climax species should be encouraged through extended rotations, natural regeneration, promotion of climax species, and uneven-aged practices appropriate for infrequent natural disturbances. This is the only occurrence of this element in the larger ecoregion.



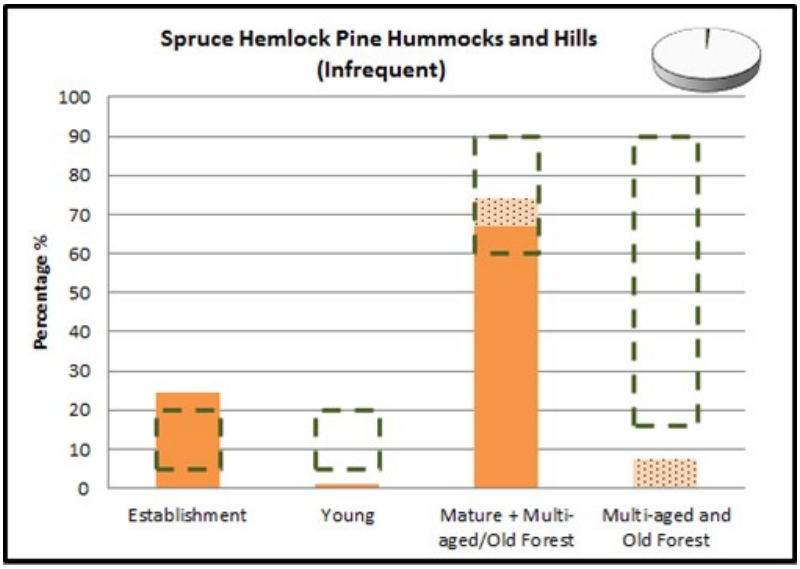
The **Spruce Pine Hummocks** patch element has a desirable range of development classes, except establishment class which exceeds the range. These frequent natural disturbance regime forests support periodic stand-initiation events that favour establishment of an even-aged cohort, often with scattered surviving mature pine that provide large seed trees and super canopy structure. Fire-dependent species red pine and jack pine should be favoured.



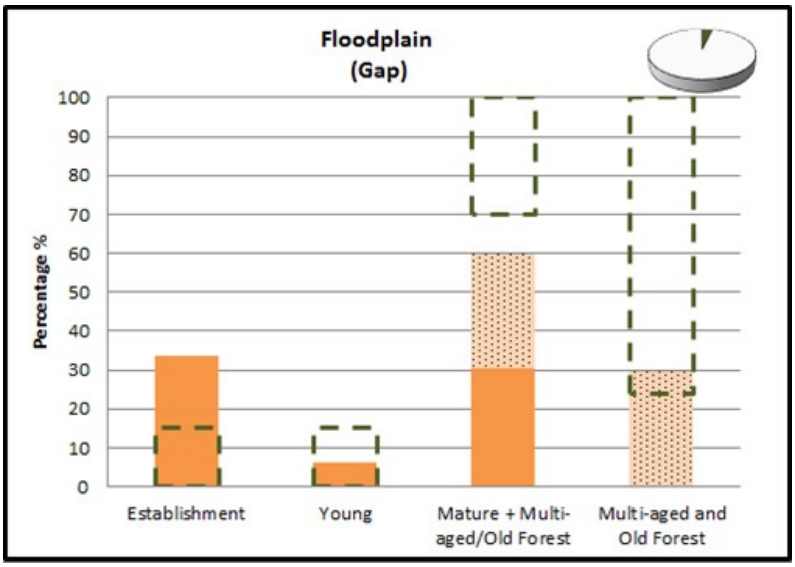
The **Red Spruce Hummocks** patch element has a desirable range of development classes, except for establishment which exceeds the expected range. The more fertile red spruce sites should provide opportunities to maintain and restore mature forest with extended rotations and uneven-aged practices and restoration techniques to favour climax species. Pre-commercial thinning can improve species composition and diameter growth rates.



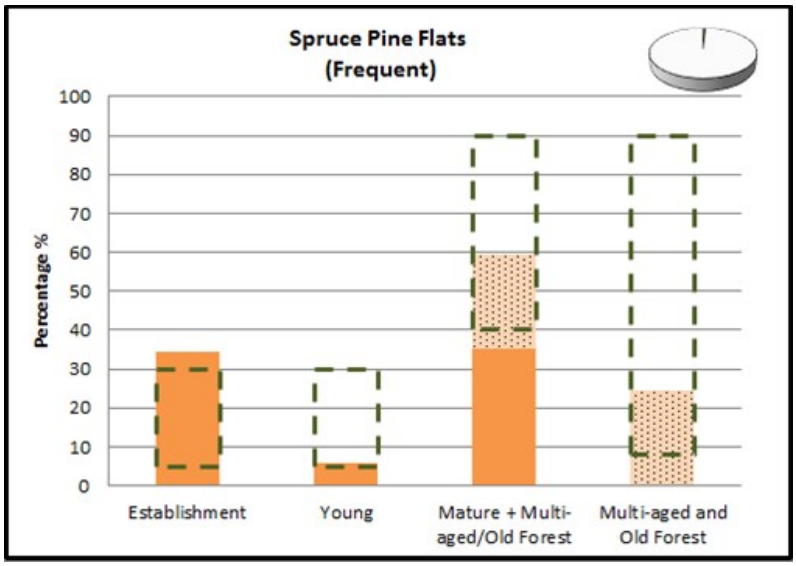
The very small **Spruce Hemlock Pine Hummocks and Hills** patch element, occurs primarily along steep sheltered ravines often in association with the corridor element. The element is dominated by mature climax forests, which will support multi-aged and old growth forest development. This element is uncommon in the ecodistricts and ecoregion.



The very small **Floodplain** patch element is often associated with the wetlands elements 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.



Spruce Pine Flats currently supports abundant mature forest conditions. The element's small size and frequent natural disturbance regime favours rapid composition shifts. This element is uncommon in both the ecodistrict and ecoregion.



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).