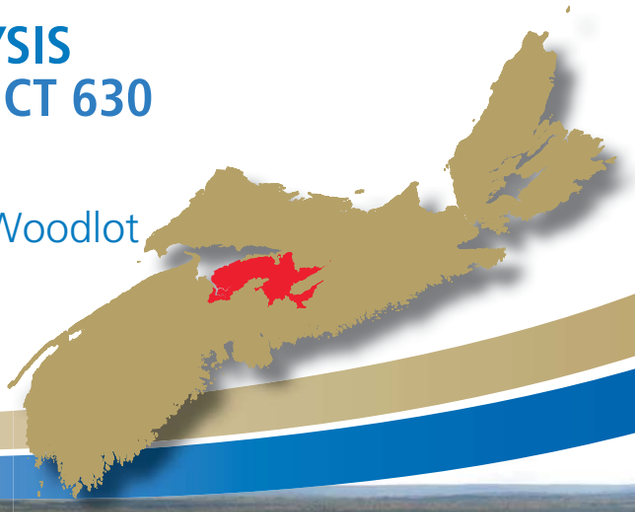
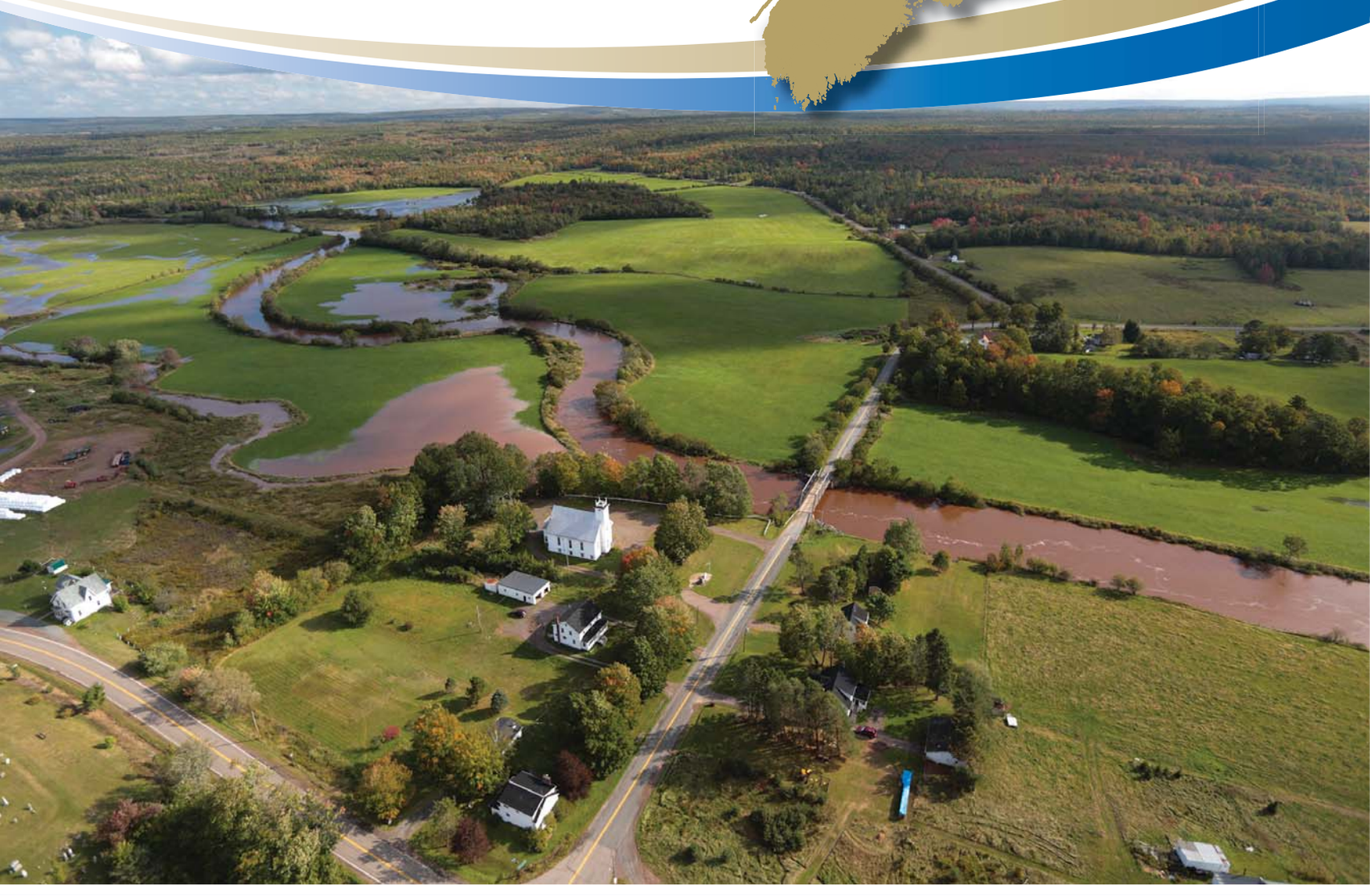
Department of Lands and Forestry

2019 Update

ECOLOGICAL LANDSCAPE ANALYSIS CENTRAL LOWLANDS ECODISTRICT 630

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





ELA 2019-630

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 630: Central Lowlands
2019 Update for Part 1 and 2

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

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

Information sources and statistics (benchmark dates) include:

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

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

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

Selected updated Tables and Figures

This document provides recalculated values for the following:

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

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

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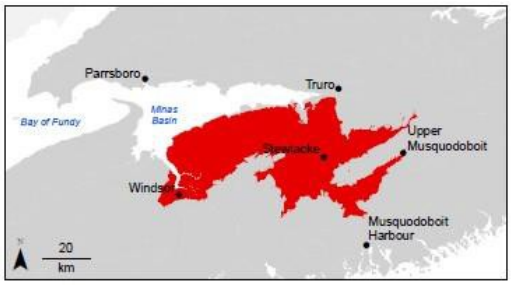
Tables

A NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES PUBLICATION



Ecodistrict Profile

Ecological Landscape Analysis Summary
Ecodistrict 630: **Central Lowlands**

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

This Ecological Landscape Analysis (ELA) provides detailed information on the forest and timber resources of the various landscape components of Central Lowlands Ecodistrict 630. The ELA also provides brief summaries of other land values, such as minerals, energy and geology, water resources, parks and protected areas, wildlife and wildlife habitat.

The Central Lowlands Ecodistrict encompasses parts of East and West Hants, Colchester, and Halifax counties. The ecodistrict covers an area of 270,258 hectares and is the largest ecodistrict in the Valley and Central Lowlands Ecoregion.

A significant feature of this ecodistrict is the several tidal rivers influenced by the Bay of Fundy, such as the Shubenacadie, Tennycape, Walton, Kennetcook, Cogmagun, Tomcod, and Meander. The only exception is the Musquodoboit River, which drains east to the Atlantic Ocean.

Most of the ecodistrict is fairly level with hummocky to undulating topography, with elevations seldom exceeding 90 metres above sea level.

Reddish-brown, fine-textured soils comprising loams, silts, and clays are common. The climate is conducive to farming and the area has been used extensively for dairy and beef production and the growing of forage, corn, and soybeans.

This ecodistrict is underlain by Carboniferous era shale, limestone, sandstone, and gypsum. Karst topography – sometimes indicated by the presence of sink holes – is found on areas underlain by gypsum. Glacial outwash deposits – some of which have been quarried for gravel and sand – are abundant, especially along the rivers.

A complex of red maple, aspen and black spruce forests along the Walton Woods Road, Hants County.

Rivers in the ecodistrict are important for populations of anadromous fish – that migrate up river from the sea to spawn – such as gaspereau, shad, and eels, as well for nesting and overwintering bald eagles. Wood turtles have been found within the Shubenacadie, Walton, Kennetcook, and Herbert watersheds.

The tidally influenced Shubenacadie River near Stewiacke showing the dyke used to keep salt water off the farmlands.

Wildlife can be viewed at the Shubenacadie Provincial Wildlife Park. The soils and climate of the ecodistrict support coniferous forests of black and red spruce, white pine and hemlock, and earlier successional species of white birch, red maple, and aspen. On the better-drained hills, climax forests of mixed Acadian Forest species of yellow birch, red spruce, hemlock, beech, and sugar maple will occur.

Private land ownership accounts for 78% of the total Central Lowlands Ecodistrict area. Nineteen percent is under provincial Crown management. Less than 1% is considered aboriginal lands. The remaining lands are in transportation corridors and inland waters.

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 nine key landscape elements – one dominant matrix element, and eight smaller patch elements – in Central Lowlands.

Red and Black Spruce Hummocks is the matrix element, representing 42% of the ecodistrict. Red and black spruce are the main species. White and red pine form a significant component, indicating a history of disturbances by fire.

Tolerant Hardwood Hills, representing 29% of the ecodistrict, is the largest patch element. This element supports shade-tolerant species of the Acadian Forest, such as sugar maple, yellow birch, beech, red spruce, and hemlock.

The other patch elements, in order of size, are **Tolerant Mixedwood Hummocks**, **Spruce Pine Flats**, **Floodplain**, **Wetlands**, **Marshes and Grasslands**, **Salt Marsh**, and **Tolerant Hardwood Drumlins and Hummocks**.

Forest Ecosystem Management
For Central Lowlands Ecodistrict

The primary ecological goals of ecosystem-based management are to maintain and conserve ecosystem biodiversity, productivity, and resilience. Integration of economic, ecological, and social values within a single planning process provides opportunities for creative solutions to meet the challenges of sustainable resource management. By maintaining their integrity, ecosystems can better adapt to environmental stressors such as extended cycles of climate change, atmospheric pollution, changes in land use and vegetation cover.

This ELA provides detailed information on the resources and descriptions of various components of the landscape for Central Lowlands Ecodistrict 630. 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 Central Lowlands Ecodistrict was up to 2006. These baseline measurements can be used to assess trends through comparison with present and future inventories.

The ELA supports an approach to maintaining healthy ecosystems by mimicking natural conditions. The report describes the inherent natural structure and condition of landscapes based on enduring physical features, such as elements. It goes on to show how this structure may influence ecosystem functions, such as wildlife movement and connectivity. The ELA summarizes conditions of ecosystems such as forest composition, land use intensity, and road density at the time the report was written.

Finally, the relationship between inherent structure and existing conditions is used to guide future direction. The ELA is part of an ecosystem approach that will expand to encompass other initiatives of the 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 Central Lowlands – *Learning About What Makes This Ecodistrict Distinctive*

This first part of the report provides an overview of the ecodistrict for a broad readership. By reviewing several key topics, the reader will have a better understanding of the features that help give the area its character and set it apart as a distinct and unique ecodistrict.

Ecodistrict Characteristics

In Central Nova Scotia lies significant lowland encompassing parts of East and West Hants, Colchester, and Halifax counties.

A significant feature of this central basin is the extent to which it is drained by several large rivers, nearly all of which – the Musquodoboit River that flows to the Atlantic Ocean is the exception – are affected by the tidal movements of the Bay of Fundy.

Reddish-brown, fine-textured soils characteristic of the ecodistrict have been derived from the underlying Carboniferous rock. The drainage has been restricted on most of these soils due to glacial compaction. An area of sandier soils is found near Upper Kennetcook.

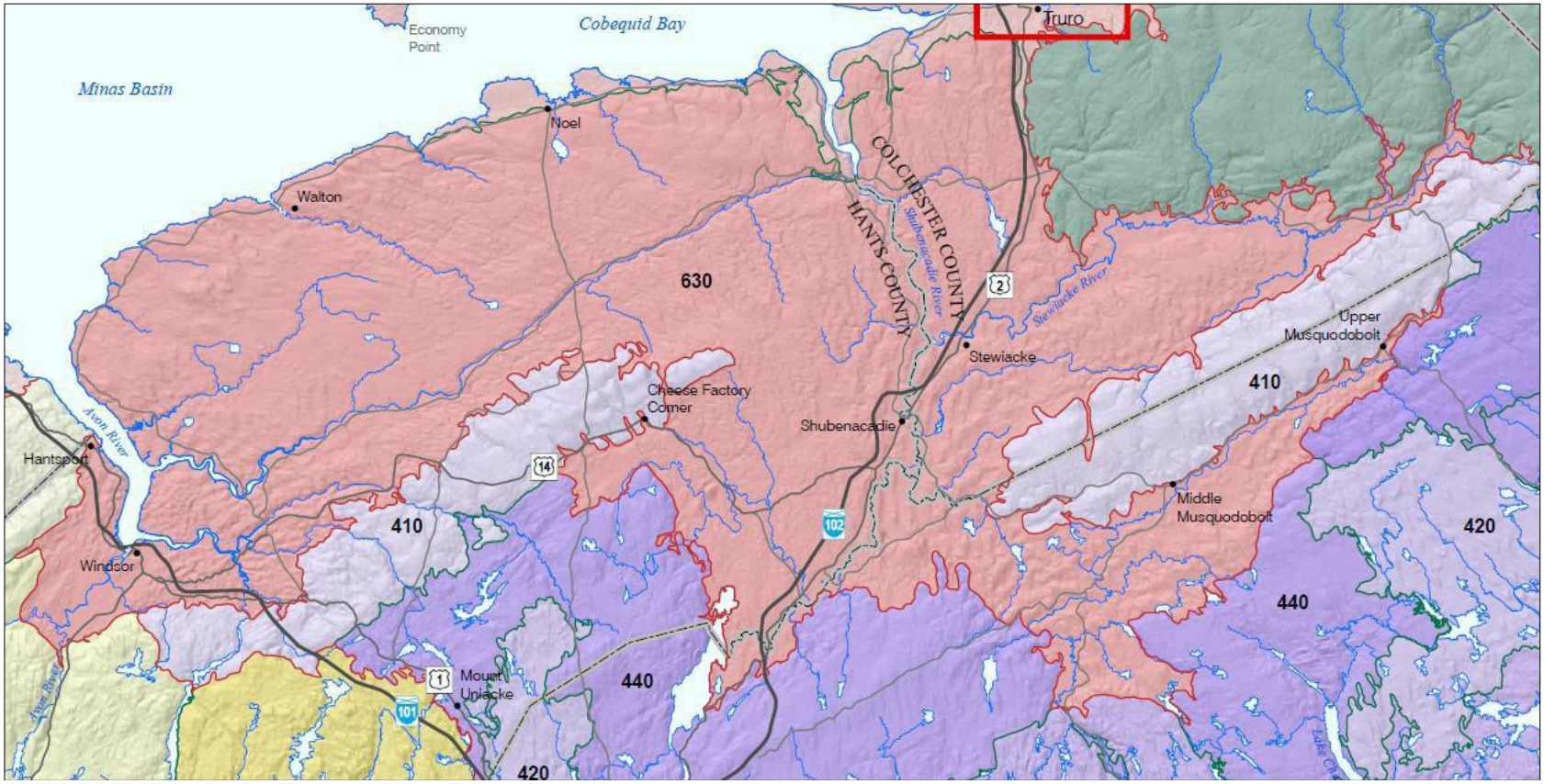
A conspicuous feature of the ecodistrict is the abundance of large peat lands and adjacent areas of imperfect to poorly drained forests over impermeable clay loam till on level terrain near the Cogmagun and Tomcod rivers.

Some of the soils experience a moisture deficit in the summer which creates opportunity for fires to create ecosystems of black spruce, red pine, and white pine. On sites where soils are derived from the glacial outwash till, white pine will occupy the coarser soils. An unusual association is the occurrence of red pine with black spruce on the imperfectly and poorly drained clay soil that is prominent on the smooth topography of the watersheds of the Tomcod and Cogmagun rivers.

Pure stands of tolerant hardwood species are uncommon. The fine-textured interval soils of the major rivers have been used extensively for farming and natural forests of American elm, white and black ash, and sugar maple are now rare. Several examples of these interval forests can be found along the Meander, Herbert, and Kennetcook rivers. Rare and uncommon plants such as showy lady slipper, blue cohosh, and bloodroot are also common in these scattered remnants.

Much of the ecodistrict is underlain by calcareous materials (limestone, gypsum, and anhydrite) of the Windsor Group. On these sites forests of hemlock, white pine, red oak, and tolerant hardwood species will be common. These sites will also have rare and uncommon plants such as ram's head lady'slipper, yellow lady's slipper, bladder fern, leatherwood, and shepherdia.

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



The Central Uplands Ecodistrict 630, covering much of Hants County, southern Colchester County and northwestern Halifax County, is the largest ecodistrict in the Valley and Central Lowlands Ecoregion.
(From Ecodistricts of Nova Scotia map 2007)

Land Area

The Central Lowlands Ecodistrict is rural and predominately under private ownership, at 78%, with only 19% under the administration of provincial Crown (Table 1).

Aboriginal lands account for less than 1% and other uses represent the remaining 3%.

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

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	51,357	19.0
Private	210,474	77.9
Federal	0	0
Aboriginal	1,398	0.5
Other (Includes inland water bodies and transportation corridors)	7,028	2.6
Total	**270,258**	**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).

In Central Lowlands, the largest Crown land use category is C1 (85%), followed by C2 (12%).

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	37,699	85.4
C2 – Multiple and Adaptive Use	5,480	12.4
C3 – Protected and Limited Use	346	0.8
Unclassified	623	1.4
Total	**44,148**	**100**

This ecodistrict has a relatively small number of leases, but several of these are large and rather unique. There was an airfield on Crown land north of Stanley, and in 1978 this area was leased to the Dartmouth Experimental Aircraft Association and later to the Stanley Sport Aviation Association. The lease area is 252 ha.

To the east of Stanley, Sun Gro Horticulture Canada Ltd. leases an area of 661 hectares for peat production. The lease term is ten years, with a ten-year renewal option. The company is required to pay royalties on peat bales and must remove a minimum weight every year to maintain the lease. Upon termination of the lease, the company must restore the site to the satisfaction of provincial government officials. Currently the lease is inactive.

Two other leases in this ecodistrict include St. Mary's Archery Club, which leases ten hectares on the Irwin Lake Road in Hilden for an archery range and clubhouse. Immediately to the west of the Archery Club lease, the Cobequid Christmas Tree Growers Association lease has three hectares for growing trees to demonstrate and research Christmas tree growth and development.

Ducks Unlimited Canada leases less than one hectare of land within the Shubenacadie Provincial Wildlife Park for construction of the Greenwing Legacy Interpretative Centre. The lease term is 20 years, with a renewal option.

LaFarge Canada has an option to buy or lease approximately 300 hectares of Crown land north of Antrim. This area has a rich gypsum deposit and could be developed.

Forests

Within the 270,258 hectares of land in this ecodistrict, 200,693, or 74%, is forested (Table 3).

Agriculture plays a major role, accounting for 34,267 hectares, or 13% of the ecodistrict.

The other categories, in order of size, are wetland (6%), urban (3%), other (2%), road, trail and utility use (1%), and barrens (less than 1%).

The current forests comprise 40% softwood, 28% mixedwood, 15% hardwood and 16% unclassified.

Red and black spruce community types make up 42% of the forested area.

This ecodistrict has been heavily disturbed by harvesting. As a result, early successional species such as white birch, red maple, and aspen are abundant. This community type accounts for 16% of the forested area.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	200,693	74.3
Wetland	16,679	6.2
Agriculture	35,267	13.0
Barrens	131	0.05
Urban	8,337	3.1
Road, Trail, Utility	3,884	1.4
Other	5,267	1.9
Total	**270,258**	**100**

On the better-drained hills, late successional climax species such as yellow birch, hemlock, sugar maple, and beech are found.

Occurrences of red pine growing with black spruce are common on the watersheds of the Tomcod and Cogmagun rivers.

There are very few sawmills in this ecodistrict.

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	7,358	3.8
3	10,658	5.5
4	29,579	15.2
5	85,869	44.1
6	58,082	29.8
7 or more	3,281	1.6
Total	**194,825**	**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.

Agriculture plays a prominent role in the ecodistrict, accounting for 13% of land use.

The two largest patch elements in the ecodistrict, Tolerant Mixedwood Hills and Tolerant Mixedwood Hummocks, include many hardwood species that provide spectacular fall colours.

Central Lowlands reflects the two largest land uses of forests and farms.

Water Resources

The major rivers of this area include the Shubenacadie Tennycape, Walton, Kennetcook, Cogmagun, Tomcod, Meander, and Musquodoboit.

The Shubenacadie River is one of the major waterways in the Central Lowlands Ecodistrict.

This ecodistrict is noted for its small number of lakes. Most of the lakes in this ecodistrict are located in West Hants, north of the Kennetcook River. The larger lakes include Anthony, Shields, and Woodward Sanford. Some of the smaller lakes are Wade and Smith.

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

Central Lowlands comprises mostly Carboniferous-age sedimentary rocks, up to 365 million years old, in the Windsor, Shubenacadie, and Musquodoboit basins, which contain significant mineral resources resulting in several development activities.

Starting in the west, Fundy Gypsum operates two gypsum mines in the Windsor area at Miller Creek and Wentworth. At the Walton mine there was past production of barite, lead, zinc, copper, and silver. Peat has been harvested in an area known as McDonald Bog. There has been exploration drilling for the titanium sands in the Shubenacadie River. The Gays River lead zinc mine has been operated off and on over the past thirty years.

At East Milford, National Gypsum operates one of the largest open-pit gypsum mines in the world.

National Gypsum operates one of the largest gypsum mines in the world at East Milford.

Lafarge Canada Inc. operates a large limestone quarry west of Brookfield. Shaw Resources produces silica sand near West Indian Road, west of Shubenacadie. Gallant Aggregate is a large aggregate producer located at West St. Andrews.

Alton Natural Gas Storage LP plans the construction of an underground gas storage facility by dissolving salt, forming a cavern near Alton.

Companies such as Triangle Petroleum Corporation and Forent Energy Limited are actively exploring for hydrocarbons in the ecodistrict, which may have the most mineral and petroleum potential in the province.

Hayes Cave is a well-known gypsum deposit with karst topography, which occurs when groundwater dissolves sedimentary rock – such as limestone or gypsum – creating a landscape characterized by caves, sink holes, fissures, and underground streams. Karst topography also occurs at Sweets Corner, Noel Road, and Scotch Village.

The structural geology is influenced mainly by the sedimentary basins that comprise most of the ecodistrict. Most faulting is located in the centre of the ecodistrict, running southwest and northeast. At the western end there are several faults running northwest and southeast.

Overlying most of the bedrock in many parts of Central Lowlands are mostly late glaciation, ground morraine, streamlined drift, and glacial fluvial deposits. These contribute to the development of soils, and have been used as a source of aggregate.

Exploration and development drilling for conventional oil and gas is currently ongoing in the Carboniferous rocks. The Carboniferous rocks of the Central lowlands have been explored by seismic surveys exploration and drilling.

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

There are approximately 22 kilometres of lateral pipeline running southwest to northeast through the eastern end of the ecodistrict.

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/.

Rafting the world's highest tides is popular on the Shubenacadie River, with many outfitters offering river rafting adventure packages.

The Shubenacadie Provincial Wildlife Park (above) and the Oakfield Provincial Park (below) are both located in the Central Lowlands Ecodistrict.

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Wildlife and Wildlife Habitat

Wildlife in the Central Lowlands Ecodistrict includes relatively common species of plants, animals, and other organisms, along with some species that are rare and/or at risk in Nova Scotia.

Wildlife information for Central Lowlands and other ecodistricts comes from a number of sources, including surveys, harvest statistics, hunter and trapper reports (abundance rankings), biological collections from harvested and road killed animals, and observations and reports from the public and Department of Lands and Forestry staff. Information on important sites is documented by Department of Lands and Forestry in the Significant Habitats Database and by the Atlantic Canada Conservation Data Centre in Sackville,N.B.

Old forests are recognized as providing important wildlife habitat. The provincial goal is to have a minimum 8% for old forests on provincial Crown land. Shade-tolerant hardwoods and softwoods may provide important wildlife structural components, such as cavity trees, and are encouraged across the landscape through appropriate silviculture systems.

The current old forest tally for the Central Lowlands is slightly below 8%. However, it should be noted that only 19% of the ecodistrict is under Crown management.

The Central Lowlands Ecodistrict is a fairly flat landscape with hummocky to undulating topography with elevations seldom exceeding 90 metres. Ecodistricts to the west, south, and east rise in elevation and provide the headwaters of many of the large rivers for which this ecodistrict is noted.

To the north lies the Minas Basin and Cobequid Bay, which have a major effect on the local climate and coastal topography with the powerful tidal waters eroding the Carboniferous rocks, resulting in irregular shaped, low cliffs and wide intertidal mud and sand flats with salt marshes in the many estuaries.

Landscape management for wildlife strives to create and maintain representation of all succession stages and covertypes within the ecodistrict by species, species association, and area size.

Extensive wildlife inventories have not been completed. However, based on ecological landscape analysis and limited Department of Lands and Forestry wildlife surveys, inventory plots, hunter and trapper reports, annual bird counts, forest management plan reviews and naturalist`s reports, there is evidence that the ecodistrict supports a broad diversity of healthy populations, somewhat favouring species that prefer younger forests composed of smaller patch sizes.

The Shubenacadie River, emptying into Cobequid Bay at Maitland, drains much of this ecodistrict along with such tributary rivers as Stewiacke, Five Mile, St. Andrews, Gays, and Nine Mile. To the west the Walton, Kennetcook, Cogmagun, Herbert, Meander, St. Croix, and Avon rivers empty into the Minas Basin.

These rivers are important for populations of anadromous fish, such as gaspereau, shad, and eels as well as nesting and overwintering bald eagles. Wood turtles have been found within the Shubenacadie, Walton, Kennetcook, and Herbert watersheds.

The Fundy tides have a significant effect on many of these river systems in that the tide can reach inland long distances; in the case of the Shubenacadie, 64 kilometres to the village of Milford.

Bald eagles overwinter and nest in the ecodistrict.

Several species at risk depend upon the habitat of the Shubenacadie River. Striped bass spawn at the confluence of the Stewiacke and Shubenacadie rivers, one of the last best spawning locations along the Atlantic seaboard. Sturgeon and Atlantic salmon, although rare, still use this waterway.

In the winter, the lower 30 kilometres of the Shubenacadie is a significant natural overwintering area for bald eagles where they feed on flocks of waterfowl and fish such as tomcod along with anthropogenic food sources such as offal from local farm operations.

To the southeast, the Musquodoboit River drains the Musquodoboit Valley and flows southward out of the ecodistrict to the Atlantic Ocean at Musquodoboit Harbour. The river maintains a salmon and sea trout run, in addition to gaspereau and eels, which are food for nesting bald eagles.

The watershed has a significant population of wood turtles, especially within the Little River tributary, where they rely on wide intact riparian zones as a necessary part of their habitat.

Many of the rivers have associated fertile riparian zones which support uncommon interval plants, such as black cherry. The Meander River interval has 11 species of conservation concern, such as blue cohosh, Canada lily, yellow lady slipper, and black ash. Round-leaved liverleaf is found along the Gays River.

Lakes are not abundant within the ecodistrict and are generally small and shallow. Loons have been reported on several lakes, including Noel and Crosskill.

Wetlands, an important habitat component of any ecodistrict, are scattered across this landscape but particularly noteworthy are the large bog and fen systems in the Stanley area, such as McDonald, Cox, Colin, Yellow, and Petite bogs.

In addition to their many ecological functions, wetlands also provide species-specific habitat. For example, the Petite Bog is home to peatland insects such as jutta arctic, elfin skimmer, northern bluet, and sphagnum sprite. Rivers such as the Tomcod, Walton, and Cogmagun have their headwaters within these wetland complexes.

The coastal zone of the Central Lowlands extends westward form Noel to the Avon River estuary, where extensive mud flats, the result of the Bay of Fundy tides, are used as feeding grounds by hundreds of thousands of migrating shore birds. The significance has been recognized in that a portion of the area is part of the 26,800-hectares Ramsar Site, a designated wetland of

international importance.
In addition to shorebirds, large numbers of black ducks and Canada geese use the remaining salt marsh and associated wetlands during the spring and fall.

Large sections of the Central Lowlands are underlain by gypsums which have some of the best karst topography within Nova Scotia, notably the Milford, Avondale, Brooklyn, St. Croix, and South Maitland areas.

Associated with the gypsums are a number of cave systems, many of which support overwintering bat populations which, it is speculated, come from all over the Maritimes.

One of the most widely known caves in the ecodistrict is the Hayes Caves in Hants County, 4.5 kilometres southwest of South Maitland which is also the only known large hibernaculum in Nova Scotia for the little brown bat. In winter, the caves are occupied by between 3,800 and 8,000 bats. *In 2013, Nova Scotia added three species of bats to its endangered species list due to a fungal infection called white-nose syndrome that has killed more than 90% of the province's bat population*

The calcareous soils are also important for several rare plant species such as leatherwood, yellow lady's slipper, and ram's head lady's slipper.

During severe winters, white-tailed deer will move from higher elevations taking advantage of the reduced snow depths of the Central Lowlands, in particular seeking shelter in mature forests associated with the many river valleys.

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.

Central Lowlands is used by white-tailed deer in the winter to escape high snow depths in higher elevations

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 fire. The large area of poorly drained soils in the ecodistrict is due in part to a compacted till and the gentle lay of the land.

During the summer months, these soils dry quickly and forests are more susceptible to fire. Later in the fall, the soils become saturated and forests are subjected to blowdown due to the shallow rooting of the softwood species. The suppression of fire in this ecodistrict may lead to a reduction of red pine forests in the future.

Insect defoliation has not been a significant factor in forest disturbance, although the spruce budworm was present in the early 1970s, creating patchy defoliation throughout the eastern portion of the county. The balsam wooly adelgid is damaging and causing mortality throughout the ecodistrict. Only colder winter temperatures (-30 degrees C) will reduce its impact on the forests. The beech bark canker, introduced in the 1890s, has reduced the beech to an understory species although scattered disease-free individuals are not uncommon.

An increase in average annual temperature due to global warming may have significant impact on forest composition, especially 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:

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.

Central Lowlands – Elements Defined

Landscapes are large areas that function as ecological systems and respond to a variety of influences. Landscapes are composed of smaller ecosystems, known as elements.

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

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.

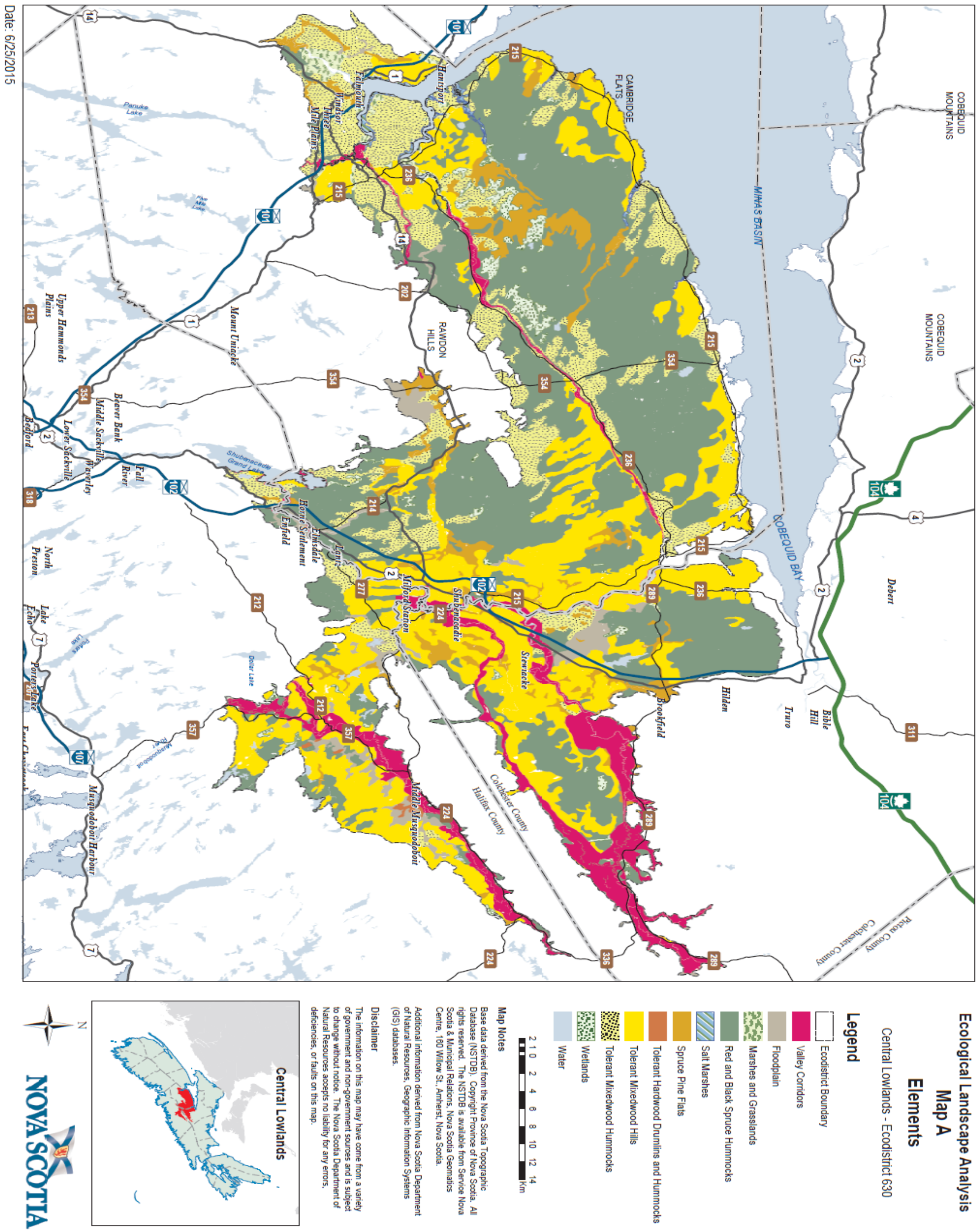
A landscape profile identified and mapped nine distinctive elements in the Central Lowlands Ecodistrict – one matrix, and eight patches (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types.

Red and Black Spruce Hummocks is the matrix element, representing 42% of the ecodistrict. Red and black spruce are the main species. White and red pine form a significant component, indicating a history of disturbances by fire.

Tolerant Hardwood Hills, representing 28% of the ecodistrict, is the largest patch element. This element supports shade-tolerant species of the Acadian Forest, such as sugar maple, yellow birch, beech, red spruce, and hemlock.

The other patch elements, in order of size, are **Tolerant Mixedwood Hummocks**, **Spruce Pine Flats**, **Floodplain**, **Wetlands**, **Marshes and Grasslands**, **Salt Marsh**, and **Tolerant Hardwood Drumlins and Hummocks**.

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 Central Lowlands		
Element	**Size (Hectares)**	**Element Description**
Red and Black Spruce Hummocks (Matrix)	110,883 41.6%	The matrix-level element occurs primarily on imperfectly drained hummocky and ridged terrain throughout the ecodistrict. East of the Shubenacadie River, red spruce dominates with black spruce relegated to wetter lower slopes and level terrain. Elsewhere in the ecodistrict, and most prominently in Hants County, black spruce dominates most slope positions on the hummocky and ridge-like topography. Here the soils are less fertile, often with a 10-30 centimetre layer of sandy loam to loamy sand over a compacted impermeable clay layer. White and red pines are also a significant component of the forest, indicating a fire history. Ericaceous shrubs create an extensive understory in forests on these poorer sites. Stand-level disturbances caused by windthrow of the shallow rooting red and black spruce are frequent and forests seldom achieve old growth.
Tolerant Mixedwood Hills (Patch)	75,029 28.2%	This is a large patch level element that captures the rolling hills of the Shubenacadie and Stewiacke valleys. The soils are primarily deep and fine-textured glacial tills with strong water holding capabilities but with the slope provide good growing conditions for forests and agricultural crops. The element supports a late successional mixedwood forest dominated by the shade-tolerant species of the Acadian Forest, such as sugar maple, yellow birch and beech, red spruce, balsam fir, and hemlock. The crests and upper slope positions are preferred by the hardwood species with the softwood becoming more dominant in the middle to lower slope positions. Often there are seepage sites along the slope where soils are wetter and richer with plants and trees such as white ash, indicating an improved condition.
Tolerant Mixedwood Hummocks (Patch)	38,323 14.4%	This smaller patch element is similar to the larger element that occurs on hillier topography in the ecodistrict but occurs on hummocky more gently sloping terrain. The soils are primarily deep and fine-textured glacial tills with strong water-holding capabilities, but with the slope provide good growing conditions for forests and agricultural crops. The element supports a late successional mixedwood forest dominated by the tolerant species of the Acadian Forest, such as sugar maple, yellow birch and beech, red spruce, balsam fir, and hemlock. On the moister lower slopes, red and black spruce are dominant. On the level or depressional terrain between hummocks, wet forests of red maple, fir, black spruce, and tamarack dominate.
Spruce Pine Flats (Patch)	18,327 6.9%	This patch element supports a forest of black spruce and pine and is scattered throughout the ecodistrict. Where it occurs on gravelly, coarse-textured soils associated with glacial fluvial deposits alongside large streams and rivers, white pine and black spruce are dominant. However, on the extensive imperfect to poorly drained flats associated with the Stewiacke and Musquodoboit rivers, the forest is primarily black spruce with only scattered white pine. Occasionally, stands of jack pine and red pine can occur on drier, sandier soils. On a few sites – scattered well-drained areas with annual or periodic flooding – a floodplain forest of sugar maple, white ash and maybe elm is possible. Wherever soil drainage gets progressively poorer, wet forests of red maple, black spruce, tamarack, alders, false holly, winterberry, and other woody shrubs are common.

Table 5a – Elements Within Central Lowlands		
Element	**Size (Hectares)**	**Element Description**
Floodplain (Patch)	10,928 4.1%	This element is a linear patch primarily associated with the larger rivers of the ecodistrict, including the Stewiacke, Shubenacadie, Nine Mile, Gays, and Musquodoboit. Where soils are better-drained, typical floodplain forests occur, dominated by white ash, sugar maple and at one time elm. Early successional forests can include black cherry, chokecherry, red maple and willow. Where soils are wetter, forests are usually black spruce with scattered white pine. Interspersed are coarse-textured gravelly soils from glacial fluvial outwash deposits which support black spruce and white pine.
Wetlands (Patch)	7,226 2.7%	The wetlands element comprises bogs, fens, swamps, and poorly drained areas. This element may occur as a large wetland complex associated with rivers and lakes, as narrow linear communities associated with flow accumulations and small streams, as a community of hydrophytic vegetation associated with level terrain where drainage is impeded, or as a depression in the landscape where water remains in excess year round.
Marshes and Grasslands (Patch)	3,991 1.5%	A history of reclamation first started by the 17th century Acadians using dykes and wooden sluices has resulted in a large area of land being reclaimed from salt marshes through drainage and protection from daily salt water flooding. They have become some of the most fertile agricultural areas in the province. Most of the salt marshes along the Shubenacadie and Stewiacke Rivers have been reclaimed and are being used for agriculture.
Salt Marsh (Patch)	1,034 0.4%	The twice daily tidal actions of the Bay of Fundy created extensive areas of salt marsh along the floodplains of the Stewaicke, Shubenacadie, Kennetcook, Herbert, Cheverie, Tennycape, Cogmagun, St. Croix, Avon, and Walton rivers and their tributaries. These salt marshes also occurred along the tidal flats of the Minas Basin. Reclamation for agriculture use has resulted in most of these marshes being drained and protected from daily saltwater flooding.
Tolerant Hardwood Drumlins and Hummocks (Patch)	468 0.2%	This very small patch element occurs on drumlin-like terrain near Elderbank and Middle Musquodoboit. The element supports a late successional hardwood forest dominated by the tolerant species of the Acadian Forest, such as sugar maple, yellow birch, and beech on the crests and upper slopes with red spruce becoming more dominant on the lower slopes.
Total	**266,293***	*Area is not the same as in Table 1 because water has not been included.

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

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Red and Black Spruce Hummocks	IH1, IH2, IH4, IH6, MW5, OF1, OF2, OF4, OF5	27.1	MW4, SH5, SH6, SH8, SP4, SP6, SP8	23.4	SH1, SH2, **SH3, SH4, SH5,** SH7	20.6
Spruce Pine Flats --- Floodplain ecosite	IH1, IH4, IH6, OW1, OW2, OW4, SP1, SP2, SP10 --- FP4, FP5, FP6	16.4	MW4, SP3, SP4, SP6, SP8 --- FP2, FP3	15.4	**SP5,** SP7, SP9 --- **FP1**	21.7
Tolerant Mixedwood Hills	IH3, IH5, IH6, OF1, OF2, OF3, OF4, OF5	34.2	MW2, MW4, SH5, SH6, SH8	18.9	**MW1, MW3,** SH1, SH3	10.4
Tolerant Mixedwood Hummocks	IH3, IH5, IH6, OF1, OF2, OF3, OF4, OF5	30.1	MW2, MW4, SH5, SH6, SH8	18.5	**MW1, MW3,** SH1, SH3	10.9
Tolerant Hardwood Drumlins and Hummocks	IH3, IH4, IH5, IH6	29.4	IH7, TH8	20.5	TH1, **TH2, TH3,** TH4	5.0
Floodplain --- Spruce Pine ecosite	OF1, OF2, OF4, OF5, FP4, FP5, FP6 --- IH1, IH4, IH6, SP1, SP2, SP10	19.3	FP2, FP3 --- MW4, SP3, SP4, SP6, SP8	12.4	**FP1** --- **SP5,** SP7	10.2
Salt Marsh	Grasslands of *Spartina spp.*					
Marshes and Grasslands	Cultivated Fields and Freshwater Wetlands (cattails, willows, alders, WC, WD)					
Wetlands	WC1, WC2, WC3, WC4, WC5, WC6, WC7, WD1, WD2, WD3, WD5, WD6, WD7, WD8					

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

Photos Illustrating Vegetation Types in Elements

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

Red oak – Red maple / Witch-hazel (IH2) is an early to mid-successional vegetation type found in the Red and Black Spruce Hummocks matrix element.

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

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

Red maple / Sensitive fern – Rough goldenrod (FP3) is a mid-successional vegetation type found in the floodplain ecosite of the Spruce Pine Flats element.

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

Tamarack – Black spruce / Lambkill / Sphagnum (WC7) is a vegetation type found in the Wetlands element.

White birch – Red maple / Sarsaparilla – Bracken (IH6) is an early successional vegetation type found in the Tolerant Hardwood Drumlins and Hummocks element.

Landscape Composition and Objectives

Landscapes contribute to the maintenance and conservation of native biodiversity. Managing landscapes for biodiversity requires a variety of planning approaches and tools. Sustaining forest composition diversity by reflecting natural patterns of disturbance and succession is one approach that Department of Lands and Forestry is employing to try and realize this objective. Department of Lands and Forestry is developing a number of additional approaches and planning tools which will be integrated with objectives defined in the ELA protocol.

Human activities, such as forest harvesting, can have a significant impact on the structure and composition of the forested landscape. Well-planned harvesting can provide a tool to achieve landscape composition goals.

Natural Disturbance Regimes

Three natural disturbance regimes dominate natural forests:

Frequent Stand Initiating – Disturbances usually occur more frequently than the average life span of the dominant species and are of sufficient intensity to kill most of the existing mature trees, thereby promoting the establishment of a new forest within a relatively short period. Some unharmed trees often survive the disturbance in pockets and/or as scattered individuals.

Infrequent Stand Initiating – The time between stand-initiating disturbances is usually longer than the average longevity of dominant species, thereby supporting processes of canopy gap formation and understory development in mature forests.

Gap Replacement – An absence of stand-initiating disturbances supports the development of a dominant overstory that is sustained through dynamic processes of canopy gap formation, understory development and overstory recruitment. Gap formation ranges from individual tree mortality to the replacement of a small group of trees.

On the Central Lowlands, infrequent stand-initiating disturbances are the main natural disturbance shaping the diversity of forest ecosystems, though frequent disturbances is a feature of black spruce and pine elements.

The time between infrequent 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. The disturbance agents on the Central Lowlands associated with infrequent disturbances include wind and fire. The forest ecosystems that arise from this disturbance type are spruce, spruce-hemlock-yellow birch and sugar maple-yellow birch-red spruce.

In areas of the ecodistrict where there is a dominant overstory that is sustained through dynamic processes, such as gap replacement, understory development and overstory recruitment is evident. These forests usually comprise the tolerant species of sugar maple, yellow birch and beech on the well-drained hills and upper slopes and red spruce, hemlock, and pine on the mid-slopes.

Forest Composition

Forest disturbances lead to forest renewal and the development of young forest habitats with characteristic successional patterns. Management of landscapes to conserve biodiversity requires sustaining ecologically adequate representation of natural habitat diversity, among a number of other measures and planning approaches.

At a landscape planning scale, the variety of habitats can be broadly described in terms of the composition of development classes, seral stages, and covertypes.

Development Classes describe changes in structure and process as forests age and trees grow larger. For landscape management purposes, four development classes are recognized:

- forest establishment (0 to 6 m height)
- young competing forest (7 to 11 m height)
- mature forest (> 11 m height; including multi-aged and old forest)
- multi-aged / old forest (multiple layered)

Within this simplified description there is considerable variation in the processes and structures that evolve in particular stands. When the current forest inventory is used to classify development classes, the height criterion is used. When forecasting future conditions using the Forest Model, the age criterion is preferred.

Harvesting and silviculture activities, such as planting and thinning, have been ongoing on Crown land since the 1940s.

Seral Stages describe changes in species composition of forest communities as succession progresses from domination of early seral "pioneer" species following disturbance, toward late seral communities dominated by long-lived, shade-tolerant "climax" species. Seral stage is dependent on the composition of tree species of a forest, irrespective of age. For landscape management purposes, three seral stages are recognized:

- early
- mid
- late

Early successional species are those that do well in direct sunlight and include white and grey birch, aspen, poplar, white spruce, tamarack, pin cherry, jack pine, and red pine. These species grow quickly, but are usually short-lived.

They are replaced by mid-successional species that can tolerate moderate amounts of shade, such as white ash and red oak.

Late successional species generally have a high shade tolerance and include hemlock, red spruce, sugar maple, and beech, as well as yellow birch and white pine. The species often develop slowly in shaded understories and can be long-lived and form old growth.

Covertypes descriptions further refine landscape composition by distinguishing forests of different community conditions. Management generally recognizes three forest covertypes:

- softwood (overstory cover of softwood species is 75% or more)
- hardwood (overstory cover of hardwood species is 75% or more)
- mixedwood (overstory cover of either softwood or hardwood is between 25% and 75%)

Forest Composition Objectives

Within ecodistricts, the forest composition should contain a range of conditions that sustain the inherent forest communities and dominant natural disturbance regimes. Table 6 provides target ranges for development class and seral stage composition appropriate for different disturbance regimes. These ranges have been derived from the professional judgment of Department of Lands and Forestry forest ecologists to guide composition objectives for large landscape areas.

Woodland owners can use this guidance to assess how their holdings contribute to the overall ecodistrict structure by referring to the landscape element bar charts that illustrate where deficiencies exist. For example, landowners who have a large amount of mature forest in an element where this is in short supply can recognize the contribution of their holdings to the overall health of the landscape.

Four hundred years of European settlement in the Acadian region has left insufficient natural landscape structure to confirm these ranges. Facing similar challenges, a comprehensive modeling approach was used by the Ontario Ministry of Natural Resources to support "range of variation" targets for natural disturbance regimes in the Great Lakes St. Lawrence region (http://www.ontario.ca/document/forest-management-great-lakes-and-st-lawrence-landscapes). A full description of definitions and mapping of Nova Scotia's disturbance regimes is contained in the report "Mapping Nova Scotia's Natural Disturbance Regimes" available from the Department of Lands and Forestry website (http://novascotia.ca/natr/library/forestry/reports/NDRreport3.pdf).

Table 6 - Landscape Composition Target Ranges (by Development Class / Disturbance Regime)

Natural Disturbance Regime	Development Class			
	Forest Establishment	Young Competing Forest	Mature Forest (including multi-aged and old forest)	Multi-aged and Old Forest
Frequent Stand Initiating	5 - 30%	5 - 30%	>40% early, mid, and late seral representation	>8%
Infrequent Stand Initiating	5 - 20%	5 - 20%	>60% most in mid and late seral stages	>16%
Gap Replacement	0 - 15%	0 - 15%	>70% most in late seral stage	>24%

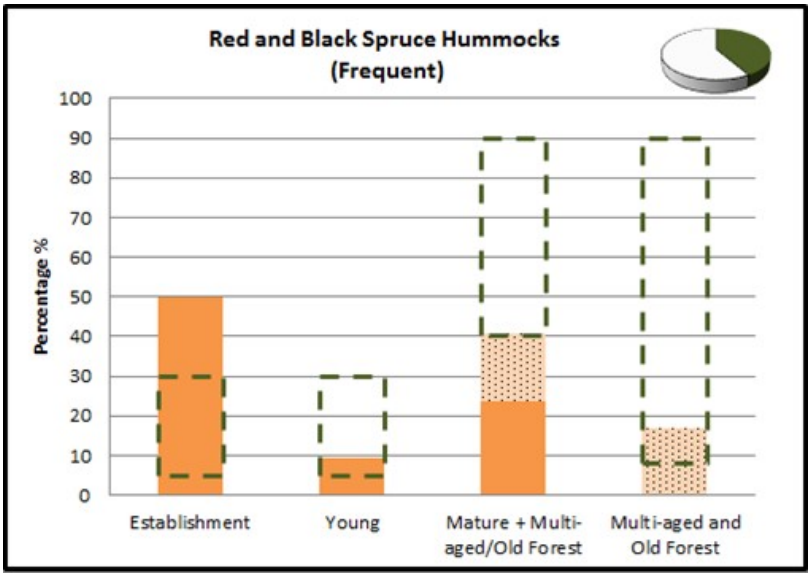
Table 6 indicates that for frequent stand-initiating disturbances, both establishment and young development class forests would typically comprise between 5 and 30% of area, while mature forest – which includes multi-aged and old forest – would cover more than 40%. Mature forest should consist of a relatively even balance of early, mid, and late successional stands. At least 8% of the mature forest should be in the multi-aged and old forest class. The targets for the other disturbance regimes are shown in Table 6. Forest planning should strive to maintain composition within these targets and identify corrective and mitigating measures when outside these ranges.

Development Class Targets by Element

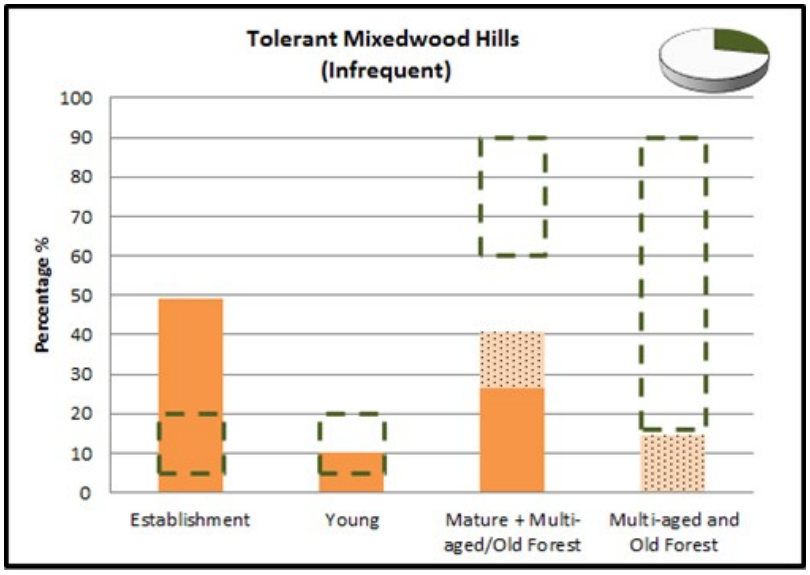
The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime. The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage of each development class at the time the original data was gathered. The dotted area in the mature class shows the amount of multi-aged and old forest area included. The coloured portion of the small pie chart in the corner of the graphic shows the relative size of the element within the ecodistrict.

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

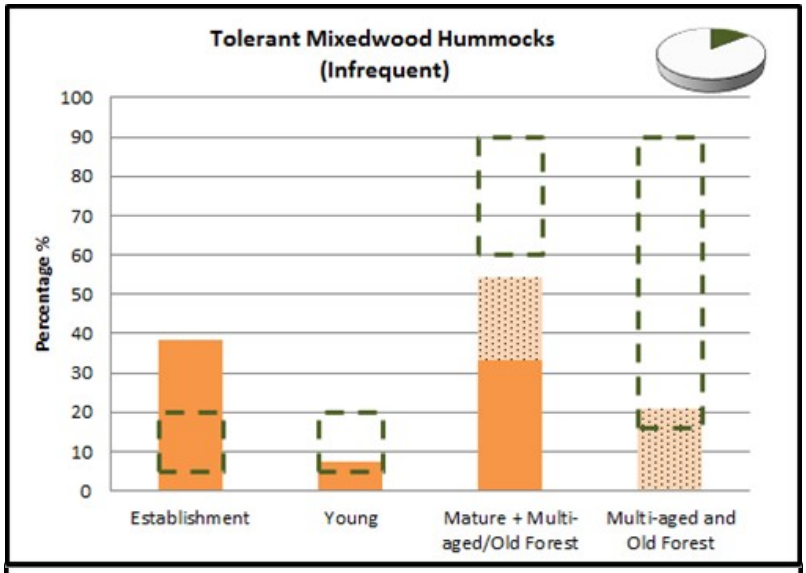
In the **Red and Black Spruce Hummocks** matrix element, the target area for forest in the establishment development class is exceeded. Thinning and uneven-aged practices can be used to maintain mature cover on red spruce sites. Where black spruce dominate, partial harvesting is usually inappropriate. However, using commercial thinning in young black spruce forests can enhance mature forest characteristics.



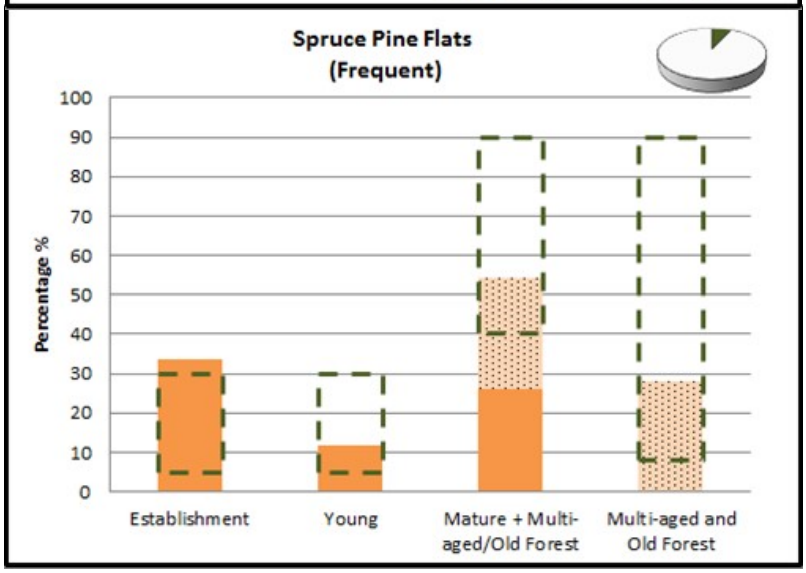
The **Tolerant Mixedwood Hills** patch element has excessive establishment stage forest and is below desired levels of mature and multi-aged habitat. Partial harvests can be used to favour climax species and retain large old trees to promote multi-aged forest and maintain mature conditions. Thinning can be used in young stands to favour climax species and enhance mature forest conditions.



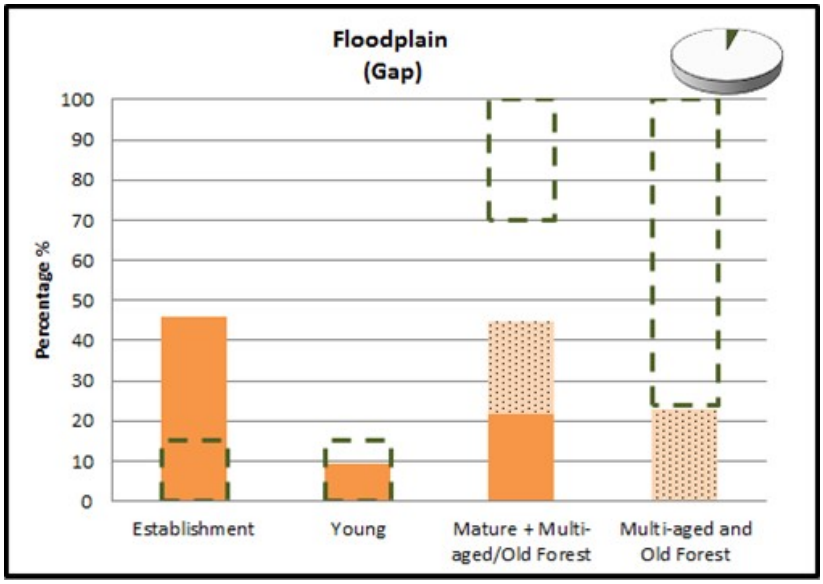
Tolerant Mixedwood Hummocks is similar to Tolerant Mixedwood Hills with the establishment development class significantly above the desired target. Mature forests with a good representation of climax species should be encouraged to support connectivity functions. Extended rotations, natural regeneration, promotion of late seral species, thinning, and uneven-aged practices are most appropriate.



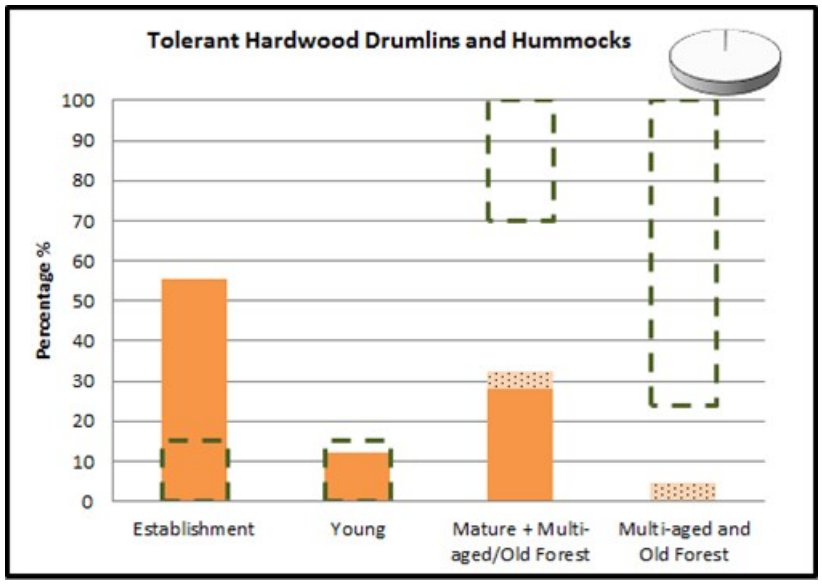
In the **Spruce Pine Flats** patch element, all the classes are within target ranges except the establishment which exceeds. Frequent natural disturbance regime forests support stand-initiation events that favour establishment of a dominant, even-aged cohort of mixed seral species. Disturbances typically retain mature survivors – particularly pine – that provide seed trees and mature structure in developing stands.



The **Floodplain** patch element is associated with the wetlands element and provides a habitat interface with the hydrological system. The remaining forest area is small and fragmented and the mature and multi-aged forest classes are below targets. Forestry in the remaining mature forest should employ uneven-aged management techniques.



Tolerant Hardwood Drumlins and Hummocks is a very small, localized patch element, heavily impacted by non-forest uses. The remaining forest area is small and fragmented. Management options in young and establishment forests that enhance late successional species should be favoured. Forestry in the remaining mature forest should employ uneven-aged management techniques.



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).