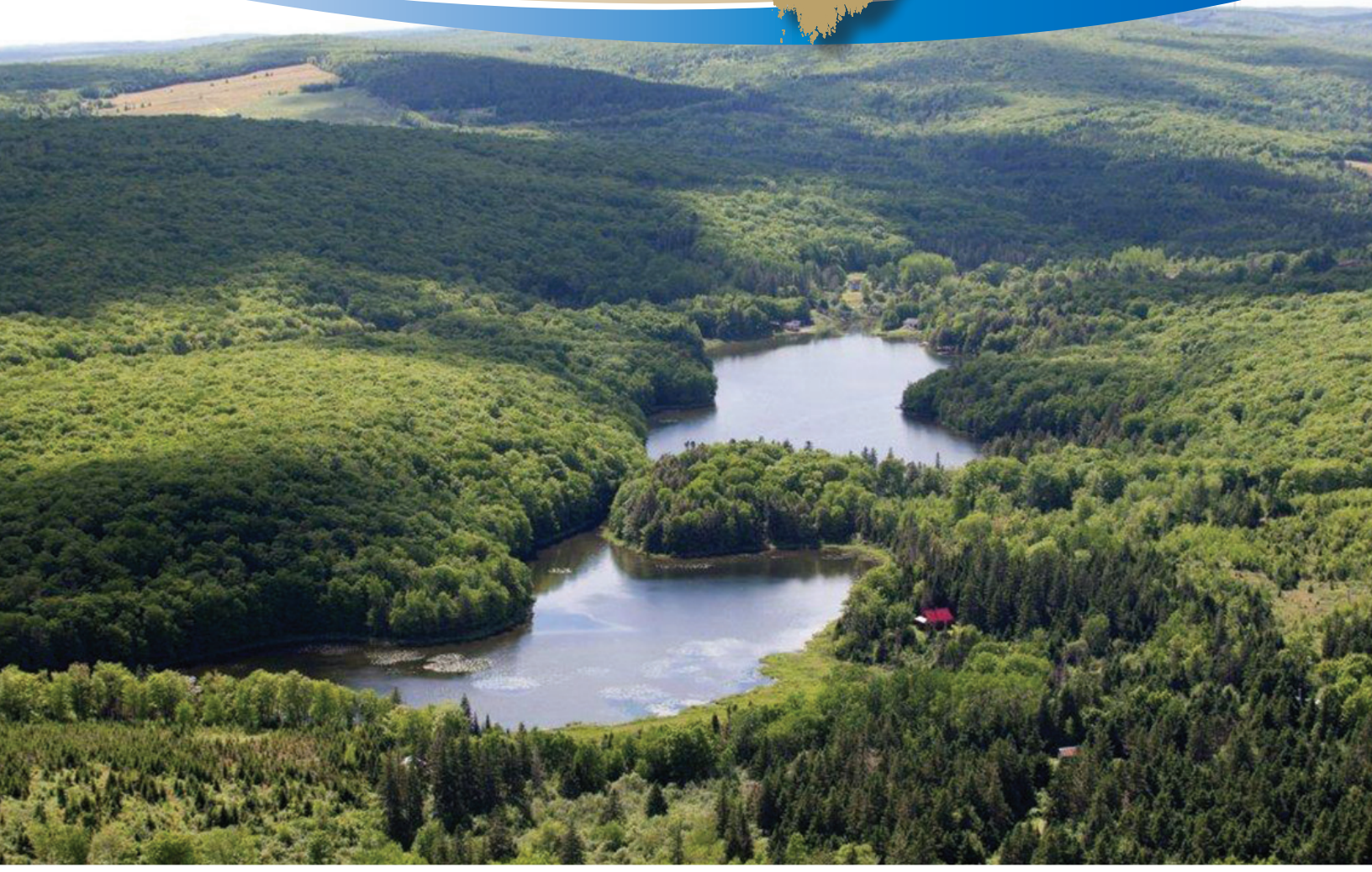
Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS COBEQUID HILLS ECODISTRICT 340

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



ELA 2015-340

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 340: Cobequid Hills

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This report, one of 38 for the province, provides descriptions, maps, analysis, photos, and resources of the Cobequid Hills Ecodistrict.

The Ecological Landscape Analyses (ELAs) were analyzed and written from 2005 – 2009. They provide baseline information for this period in a standardized format designed to support future data updates, forecasts and trends. The original documents are presented in three parts: Part 1 – *Learning About What Makes this Ecodistrict Distinctive* – and Part 2 – *How Woodland Owners Can Apply Landscape Concepts to Their Woodland.* Part 3 – *Landscape Analysis for Forest Planners* – will be available as a separate document.

Information sources and statistics (benchmark dates) include:

- Forest Inventory (1994) – stand volume, species composition
- Crown Lands Forest Model landbase classification (2006) – provides forest inventory update for harvesting and silviculture from satellite photography (2005), silviculture treatment records (2006) and forest age increment (2006)
- Roads and Utility network – Service Nova Scotia and Municipal Relations (2006)
- Significant Habitat and Species Database (2007)
- Atlantic Canada Data Conservation Centre (2013)

Conventions

Where major changes have occurred since the original ELA report was written, the new information will be provided in *italics,* so that the reader can see how some conditions have changed since the benchmark date of the ELA.

A glossary of definitions is provided for words that are underlined.

REPORT FOR ELA 2015-340

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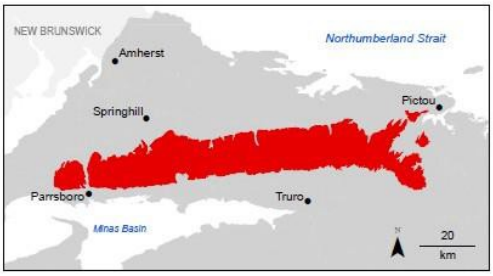


An objective of ecosystem-based management is to manage landscapes in as close to a natural state as possible. The intent of this approach is to promote biodiversity, sustain ecological processes, and support the long-term production of goods and services. Each of the province's 38 ecodistricts is an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

This Ecological Landscape Analysis (ELA) provides detailed information on the forest and timber resources of the various landscape components of Cobequid Hills Ecodistrict 340. 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.

Cobequid Hills is an uplands cigar-shaped ecodistrict that extends 150 kilometres across the northern part of Nova Scotia and forms a distinct and important large-scale geographic and ecological feature of the province.

Cobequid Hills supports one of the largest intact Acadian Forests of shade-tolerant hardwoods, such as sugar maple, yellow birch, and beech, on the mainland.

This ecodistrict extends across three counties – Cumberland, Colchester, and Pictou – from the Parrsboro area in the west to the Pictou area in the east. Cobequid Hills 340 separates two lowland ecodistricts, Minas Lowlands 620 to the south and Northumberland Lowlands 530 to the north.

The hills of the ecodistrict receive the greatest snowfall on the mainland with over 300 centimetres of snow in an average year. Yet within the Nova Scotia Upland Ecoregion, Cobequid Hills is the driest ecodistrict with annual precipitation of about 1,200 millimetres.

The highest points on the mainland are found in the Cobequid Hills at Nuttby Mountain and Dalhousie Mountain, which rise to 335 metres above sea level.

Rolling hills are one of the defining features of Cobequid Hills Ecodistrict 340.

The lakes are small and generally shallow, but Folly Lake, which resulted from glacial ice resting in the valley of an old river, choking both ends with gravel deposits from the melting ice, has depths of over 100 metres. The Cobequids provide a watershed for river and streams running north or south, which leave the mountains' ravines and gorges in a series of falls or cascades. There are 20 major river systems within Cobequid Hills, most emptying into the Minas Basin and Cobequid Bay.

Streams and rivers en route to the Minas Basin leave the Cobequid Hills through deep, steep-walled ravines and gorges in a series of falls or cascades.

Private land ownership accounts for 82% of the total Cobequid Hills Ecodistrict area of 190,295 hectares, with 17% under provincial Crown management.

The ecodistrict contains three wilderness protected areas, located in Economy River, Portapique, and Gully Lake.

Old iron mine workings in the Londonderry area have been used as wintering sites by bats. The size of the winter shelter for hibernating bats has the potential to be one of the largest in the province. *Bat populations in Nova Scotia have declined dramatically in recent years due to a fungal infection.*

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

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

Tolerant Hardwood Hills is the matrix element, representing more than 65% of the ecodistrict. This element naturally supports long-lived hardwood species that grow well in shade, such as sugar maple, yellow birch, and beech.

The two largest patch elements are close in size, each representing about 12% of the ecodistrict. **Tolerant Mixedwood Hummocks** is fragmented, with the largest areas occurring in Economy Lake and Lynn Mountain. **Red and Black Spruce Hummocks** is distributed throughout the ecodistrict. The two other patch elements are **Tolerant Mixed Slopes** at a little over 7% of the area and the tiny **Wetlands** element.

Valley Corridors is a linear element associated with the about 20 major watercourses in the ecodistrict.

Forest Ecosystem Management
For Cobequid 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 Cobequid Hills Ecodistrict 340. 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 does not represent current inventory, but instead provides baseline conditions for the time when the report was researched, which in the case of the Cobequid 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 the Department of Natural Resources (DNR), 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 Cobequid 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 Cobequid Hills Ecodistrict is 190,295 hectares in size and forms part of the Nova Scotia Uplands Ecoregion. The ecodistrict is cigar shaped and extends approximately 150 kilometres in a northwest to southeast orientation, west of Pictou to near Cape Chignecto.

The geological history of Cobequid Hills is complex with underlying fault blocks consisting of pre-Carboniferous metamorphic sediments, volcanic deposits, and granites dominating the landscape. The lower elevations comprise more easily eroded bedrock such as sandstones, shale, and limited deposits of limestone.

Many fault lines are expressed throughout the Cobequids, with the most prominent, the Cobequid Fault, extending along the south slope from Truro to Cape Chignecto. The soils of the Cobequids are dominated by coarse gravelly to stony loams derived from igneous and metamorphic rocks. In the hilly topography the soils are shallow to bedrock.

Less than 1% of the ecodistrict comprises freshwater lakes and streams. Cobequid Hills provides a watershed for streams running north and south that leave the mountains in deep steep-walled ravines as a series of falls or cascades.

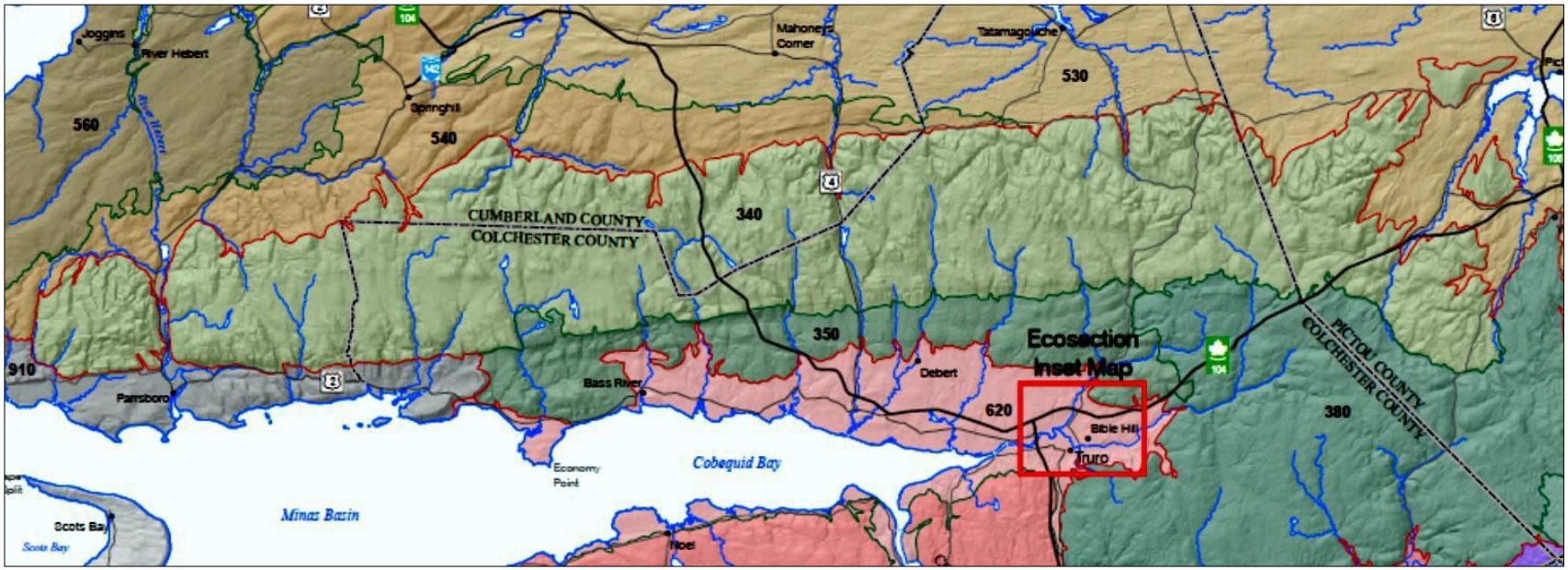
This ecodistrict is the chief hardwood region of mainland Nova Scotia and supports pure stands of long-lived tolerant hardwoods that extend from the crests to the lower slopes of the hills and large hummocks. These hardwood stands, on the upper elevations, are limited in growth potential because of damage caused by the exposure to wind, snow, and ice breakage that reduces height and stem quality.

On the sheltered, rich, lower slopes the growth potential and stem quality improves. Between the hills, there are extensive flats of imperfectly drained course soils supporting red and black spruce.

Another prominent characteristic of this ecodistrict are the steep-sided ravines with well-drained coarse to medium-textured soils that support tolerant species of white pine, hemlock, red spruce, white ash, sugar maple, yellow birch, and ironwood.

The abandoned farmland of the early settlers support stands of white spruce that once supported tolerant hardwood forests. Some of the old fields have been converted to blueberry production.

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



The Cobequid Hills Ecodistrict 340 is a long, narrow band in Central Nova Scotia that passes through Cumberland, Colchester, and Pictou counties.

Land Area

The Cobequid Hills Ecodistrict is rural and mainly under private ownership (82%), with only 17% under the administration of provincial Crown (Table 1).

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

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	32,467	17.1
Private	155,115	81.5
Federal	0	0
Aboriginal	0	0
Other (Includes inland water bodies and transportation corridors)	2,713	1.4
Total	**190,295**	**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	11,181	34.4
C2 – Multiple and Adaptive Use	13,984	43.1
C3 – Protected and Limited Use	7,086	21.8
Unclassified	216	0.7
Total	**32,467**	**100**

In Cobequid Hills, Crown lands are designated as C1 (34%), C2 (43%), and C3 (22%).

This ecodistrict has several small lakes suitable for recreation and therefore has a relatively large number of camps (see also section on Parks and Recreation / Protected Areas).

There are 38 camps found on Crown land within this ecodistrict administered through the DNR. About half of these are found on or near Economy Lake or Hart Lake.

Three of these camps are located within the Economy River Wilderness Area or the Portapique River Wilderness Area and are therefore administered by Nova Scotia Environment. In addition, the Girl Guides of Canada have a 10-year recreational lease on one hectare of land on the shores of Hart Lake.

The Snowmobilers Association of Nova Scotia (SANS) has a license to construct, manage, and maintain a snowmobile trail that runs east to west through many Crown parcels in this ecodistrict. This license is automatically renewed annually, but does not allow exclusive use of the trail.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	171,091	89.9
Wetland	2,930	1.5
Agriculture	9,056	4.8
Barrens	0	0
Urban	754	.4
Road, Trail, Utility	2,280	1.2
Other	4,184	2.2
Total	**190,295**	**100**

Maple syrup production is a common commercial activity in this area which supports a number of sugar camps.

A company has plans to construct a wind farm on private land near Nuttby. There are also plans to build 12 wind turbines on Crown land on Nuttby Mountain. Companies in the wind energy business have expressed interest in Crown land throughout this ecodistrict, and specifically in New Britain, Wentworth Valley, and McCallum Settlement.

Wind turbines are a common sight on Nuttby Mountain and elsewhere in the Cobequid Hills Ecodistrict.

Agriculture, which also includes cultivation of wild blueberries, accounts for 5% of land use in the ecodistrict, second only to forested land.

Forests

Within this ecodistrict, 171,091 hectares, or 90% of the total area, is forested (Table 3). The remaining 10% comprises agriculture, wetlands, urban use, corridors, and other lands.

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 5.6 cubic metres per hectare per year (m^3/ha/yr), based on the ratings in Table 4. The average forest LC for the province is 4.9 m^3/ha/yr.

Some areas are not suitable for trees.

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	905	.5
3	1,441	.8
4	9,129	5.4
5	59,618	34.8
6	83,879	49.0
7 or more	16,119	9.5
Total	**171,091**	**100**

*Based on growth potential for softwood species.

The most common community type is tolerant hardwoods and accounts for approximately 39% of the current forest area within the ecodistrict. Sugar maple, yellow birch, and beech are the most common species and also have the greatest growth potential on the well-drained, rich, sheltered lower slopes. These species are in high demand for value added products such as flooring and furniture.

The red and black spruce community type occupies 28,397 hectares, or approximately 18% of the forested area.

The tolerant hardwood mixedwoods occupy the third largest area within the ecodistrict. This community type is generally sugar maple, yellow birch, beech, red and black spruce along with scattered balsam fir.

Hardwoods are the most common covertype in the ecodistrict.

Water Resources

Like Chignecto Ridges, a distinct feature of this ecodistrict is the small number and lack of size of freshwater lakes. The larger lakes are located in the western to central parts of the ecodistrict and are Simpson, Economy, Folly and Sutherland. A number of smaller lakes are scattered between the Debert River and the West Branch North River. Some of these smaller lakes are Guyon, Frog, Farm, and Shatter.

Wetlands account for 1.5%, or 2,930 hectares, of the ecodistrict. Though most of these lakes are small and shallow, Folly Lake, which appears to have been formed by glacial ice, is 80 hectares in size and 100 metres deep.

The Cobequid Hills provide a watershed for streams running north or south which leave the mountains in deep, steep-walled ravines as a series of falls or cascades.

There are 20 major river systems within the Cobequid Hills, most emptying into the Minas Basin and Cobequid Bay. These major river systems are Fox, Farrells, West Branch Moose, East Branch Moose, Harrington, Bass (of Five Islands), East, Economy, Murphy Brook, Silica Lake/Bass, Portapique, Great Village, Folly, Chiganois, Debert, North, Salmon, Six Mile Brook, Four Mile Brook, and West.

There are no designated water supply areas in the Cobequid Hills Ecodistrict.

Lakes are generally small in the ecodistrict.

Minerals, Energy and Geology

The Cobequid Hills Ecodistrict lies on and to the north of the Cobequid-Chedabucto Fault System and to the south of the Cumberland Basin. The Cobequid-Chedabucto Fault System comprises several faults generally running east-west, creating a large change in topography between the highlands of the Cobequid Mountains and the lowlands to the south. Because of this fault system and the variety of geology in the ecodistrict, there are numerous mineral deposits and a wide range of rocks that contain significant mineral resources.

The Cobequid Hills bedrock geology consists of rocks from the Precambrian and Carboniferous periods, from 300 million to more than 544 million years ago. There is a wide variety of rocks in the ecodistrict comprising igneous, metamorphic, and sedimentary rocks. These rocks are a mixture of granitic, gabbroic, gneissic, and plutonic rocks, along with the volcanic, siltstone, argillite, sandstone, and agglomerate stratified rocks. There are also diabase dykes and sills and some mylonite rocks in the ecodistrict.

The structural geology is complex with numerous faults and folding throughout the Cobequid Hills. Some of the larger faults are the Cobequid Fault, the Londonderry Fault, and the Rockland Brook Fault along the southern half of the ecodistrict, while the Spicers Brook Fault and the Waughs River Fault are to the north.

Overlying the bedrock in many parts of Cobequid Hills are recent sediments. Most of the Cobequids are covered with a thin layer of till with bedrock exposed in many places, which contribute to the development of soils. The glacial fluvial sands and gravel deposits that are located along the ridges and valleys are an important source of aggregate, as are the plutonic rocks throughout the hills.

There has been recent exploration for conventional oil and gas in the Cobequid Hills. The Carboniferous rocks of Nova Scotia have been explored by seismic surveys exploration as recently as 2003 and with high energy prices there is more potential for future exploration.

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. They are also important in areas of structural traps or where overlain by Windsor Group salt and gypsum, providing a geological reservoir.

Iron ore was mined near Londonderry and at East Folly Mountain up until the early 1900s. A small amount of arsenic was mined at Williamsdale, Cumberland County. Barite and graphite were mined in the hills near Five Islands area in Colchester County. Coal was mined in the Delaney and McCallum Settlement, Colchester County, with past copper mining in New Lairg and Six Mile Brook in Pictou County. A small amount of gold was mined in Lower Mount Thom, North Earltown, and Warwick Mountain.

Aside from these activities, there is no active underground mining currently in the Cobequid Hills Ecodistrict.

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

The Cobequid Hills Ecodistrict has less than 15 hectares of provincial parks and park reserves. However, the ecodistrict includes approximately 10,700 hectares designated as wilderness protected areas. This ecodistrict bisects the *Bay of Fundy and Northumberland Shore Beaches Regions* identified in the Provincial Parks Concept Plan.

The ecodistrict is generally characterized by topography with “upper crests of upland ridges” as described in the concept plan. Consequently, outdoor recreational opportunities are primarily land-based and closely linked to backcountry experiences such as hiking, snowmobiling, skiing, and scenic viewing opportunities.

The highest points on the mainland are found at Nuttby and Dalhousie mountains at 335 metres, which provide excellent viewscapes extending over the Cobequids and beyond. Green Hill Provincial Park offers a magnificent panoramic view of Pictou County.

Three wilderness protected areas occur in this ecodistrict, in Economy River, Portapique, and Gully Lake.

The Gully Lake Wilderness Area is part of the Cobequid Hills Ecodistrict.

Freshwater lakes are few, small and generally shallow. Angling and boating are popular on Folly Lake and other lakes, including Economy, Simpson, Hart, Trout, and Sutherlands.

Private camps are plentiful and used by anglers and for hunting deer, bear, ruffed grouse, and other upland game in fall and early winter. Trapping for furbearers occurs in all accessible areas.

Organized snowmobiling is a popular winter time activity and hundreds of kilometres of marked and groomed trails traverse the ecodistrict. Trails are operated and maintained by several organized snowmobile clubs. These trails form part of the provincial network of licensed and

unlicensed trials established under the auspices of SANS. ATV riding is also common, with many riders belonging to organized clubs.

Many steep-walled canyons occur along the western Cobequids and several of these have spectacular waterfalls, some cascading 20 metres or more. Hiking trails have been developed to reach Ward Falls on the Diligent River, Economy Falls and others. The challenging Kenomee Canyon and Simpson Lake trails provide return hiking trail and camping experiences into the Economy River Wilderness Area. A network of hiking trails occurs in the Gully Lake Wilderness Area. The Rogart Mountain Trail is also in the area. These trails are used by cross-country skiing and snowshoeing enthusiasts during the winter.

Ski Wentworth offers downhill skiing on both natural and machine-made snow from early December to early April. Cross-country skiing is popular at Wentworth and on a variety of other trails throughout the ecodistrict.

The most current and up-to-date information for parks and protected areas in this ecodistrict can be found at: http://novascotia.ca/parksandprotectedareas/plan/interactive-map/.

Wildlife and Wildlife Habitat

Wildlife in the Cobequid 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 Cobequid 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 DNR staff. Information on important sites is documented by DNR 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 headwaters for many major watercourses are found in the Cobequid Hills, including Portapique, Folly, Economy, and Chiganois rivers. Waterfalls and steep-sided gorges can be found in association with these rivers and their tributaries. These habitats are prominent on the Minas Basin side of the hills. Notable rivers include Economy, Moose, Bass, and Portapique.

The wet rock faces associated with waterfalls provide habitat for some rare vascular plants, including fragrant fern and adder's-mouth. The river riparian zones are important habitat for intervale plants which grow in the rich alluvial soils. Several rare plants are associated with the rivers, including blue cohosh, small white leek, and Canada lily.

Isolated stands of black ash have been found along two rivers within the Cobequid Hills. Many of the rivers and brooks in this ecodistrict are chiseled through bare exposed basalt or other bedrock

with the slopes often being characterized by talus, a mass of rocks at the base of a cliff or slope. Talus slopes and their waters are home to rare mammals, such as the long-tailed shrew and water shrew. Rivers and their associated habitat also provide travel corridors between lowland and upland areas, key habitats for many species, such as fisher and otter.

Atlantic salmon can be found in most rivers that drain to the north. The rivers that drain to the south in the Bay of Fundy no longer support a healthy salmon population. These Bay of Fundy salmon stocks are now listed as endangered under federal legislation. The headwater streams of the rivers are important spawning areas; therefore it is extremely important to maintain ecological integrity of these habitats through special management zones and other means to prevent siltation and other threats to salmon.

Brook trout is the predominant fish species found in the many small headwater streams and riparian zone management efforts that maintain water quality are important for this and other aquatic species.

The few lakes in the ecodistrict are usually small and shallow with the exception of Folly Lake. The scarcity of lakes is a sharp contrast to the large number of watercourses in this ecodistrict. Most brooks and rivers are recharged by large bogs and swamps in the river headwaters instead of by lakes, as is the case in most of the province. Sutherland Lake, a cool spring-fed lake and the headwaters of the Portapique River, is important habitat for prototype quillwort, a rare perennial aquatic plant.

Several deer wintering areas fall within this ecodistrict. Deer tend to migrate off the Cobequid Hills in winters when there is heavy snow accumulation to lower, south-facing slopes. During the spring, deer will return to the higher elevations of the mature hardwood forest to feed on new plant growth.

Moose are found in the Cobequid Hills, which makes up the majority of the northern mainland moose population. Mainland moose populations have been in decline and in 2003 were declared endangered under provincial legislation. Early successional vegetation is a main source of moose forage and an important habitat element.

Bats have used old mine workings in the Londonderry area as wintering sites.

Londonderry, historically an iron mining town, is now the home of some important abandoned mines. There are more than 100 mine openings that spread from east to west over 15 kilometres. These old mine workings are used as wintering sites by bats. The

size of the bat hibernacula is not known for certain, but has the potential to be one of the largest in the province. *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 large expansive tolerant hardwood forests on the Cobequid Hills provide excellent habitat for primary and secondary cavity users. Many species of warbler and other insectivore birds are present here in the summer.

Nesting birds include red-tailed hawk, great horned owl, tree swallow, common loon, American woodcock, northern flicker, American robin, red-breasted nuthatch, and American kestrel. During the winter months, common raven, pileated woodpecker, ruffed grouse, grey jay, and chickadees are common inhabitants.

In the late 1990s a new portion of the Trans-Canada Highway was constructed through this area, which has had an impact on various wildlife species.

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 DNR 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.

In this ecodistrict natural disturbances appear to occur infrequently creating small patches or individual tree mortality as would occur with winds and winter storm damage, insects, and natural old age. Many of the tolerant hardwood and softwoods develop into old growth with gap dynamics providing breaks in the canopy and allowing the development of uneven-aged stands.

Hurricanes and winter storm damage may be the most significant of the disturbance agents. Tolerant hardwood stands are generally not subject to large stand-initiating events. In the softwood forests around Moose River, Economy Lake or Farm Lake, areas with large forest opening sizes are more likely due to blowdown. Based on 40 years of fire records between 1959 and 1999, the occurrence of lightning-caused fires in the Cobequid Hills is one of the lowest in Nova Scotia.

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.

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

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.

Cobequid Hills – Elements Defined

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

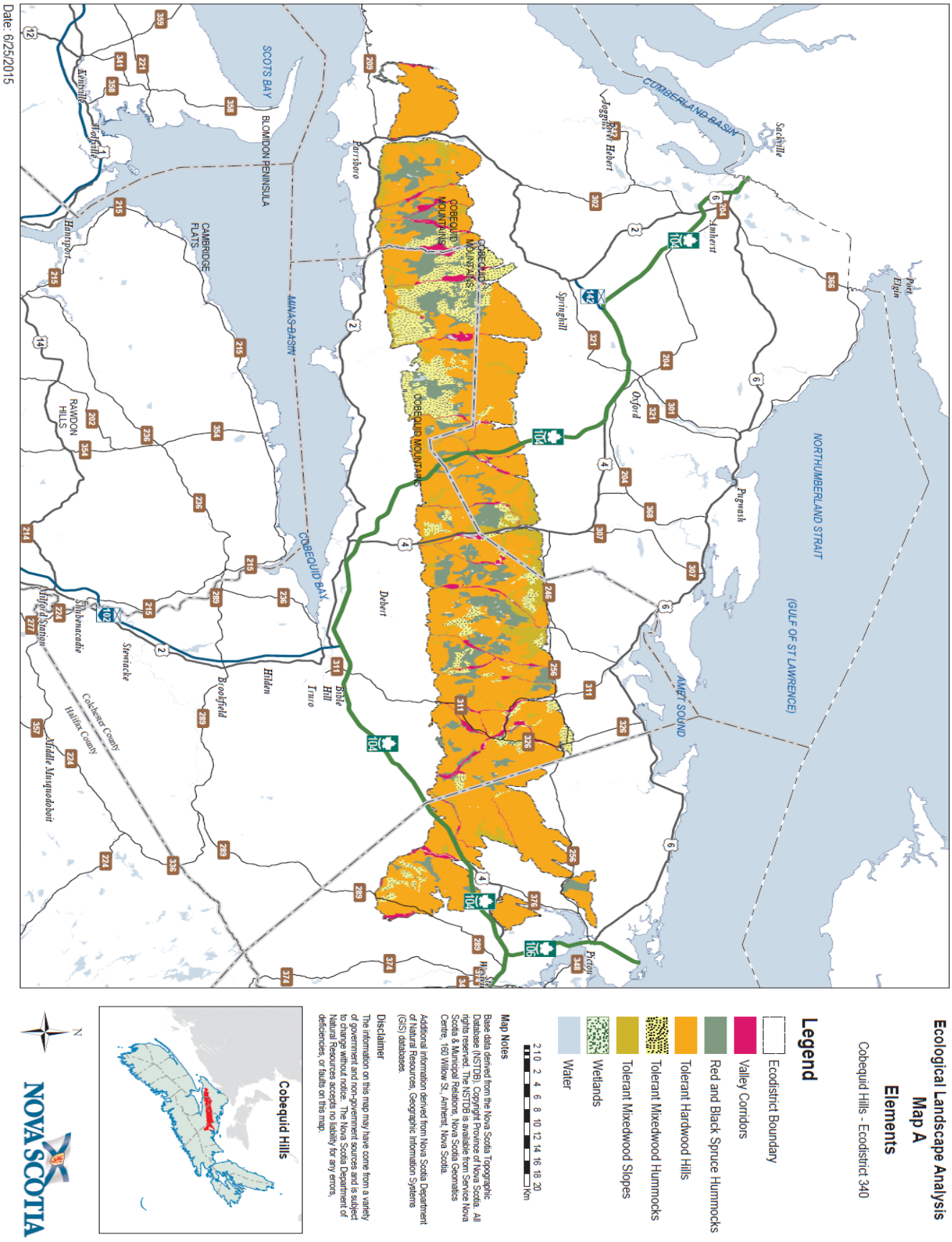
A landscape profile identified and mapped six distinctive elements in the Cobequid Hills Ecodistrict – one matrix, four patches, and a corridor (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types. Corridors are natural linear communities, such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

Tolerant Hardwood Hills is the matrix element, representing more than 65% of the ecodistrict. This element naturally supports long-lived hardwood species that grow well in shade, such as sugar maple, yellow birch, and beech.

The two largest patch elements are close in size, each representing about 12% of the ecodistrict. **Tolerant Mixedwood Hummocks** is very fragmented, with the largest areas occurring in Economy Lake and Lynn Mountain. **Red and Black Spruce Hummocks** is distributed throughout the ecodistrict. The two other patch elements are **Tolerant Mixed Slopes** at a little over 7% of the area and the tiny **Wetlands** element.

Valley Corridors is a linear element associated with the about 20 major watercourses in the ecodistrict.

Map of Elements in Ecodistrict



Forest Stands Within Elements

Each element contains a number of forest stands that can be classified by vegetation, soil, and ecosites. The DNR 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 DNR, 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 Cobequid Hills		
Element	**Size (Hectares)**	**Element Description**
Tolerant Hardwood Hills (Matrix)	123,589 65.2%	This element defines the Cobequid Hills Ecodistrict and forms the matrix forest. It represents mid to late successional shade-tolerant hardwood forests typical of the Acadian Forest. Representative species include sugar maple, beech, yellow birch, white ash, and ironwood on the richer sites. Natural stand-level disturbances are rare and stands will usually maintain themselves through gap replacement leading to an uneven-aged climax forests. Stands can develop old forest characteristics. Natural disturbance agents include hurricanes, ice storms, disease, and insects. In the Cobequids, this element occurs primarily on hilly topography and slopes. Soils are well-drained loams and sandy loams and generally of medium to rich fertility. Vernal pools (ephemeral water collection areas) and seepage areas are important biodiversity features commonly found in tolerant hardwood forest. Under these closed canopy forests, the shrub layer consists of regenerating trees and shrubs such as hobblebush, fly honeysuckle, and beaked hazelnut. These forests also have an abundant cover to ferns and club mosses.
Tolerant Mixedwood Hummocks (Patch)	23,091 12.2%	A mixture of shade-tolerant hardwood and softwood forests form large landscape-level patches on the hummocky upland terrain on top of the Cobequids. Stands comprising tolerant mixedwood species are most likely associated with moister, lower slope positions. This element represents mid to late successional forests typical of the Acadian Forest. Representative species include sugar maple, beech, yellow birch, and red spruce, with hemlock resigned to a few steep slopes associated with streams and rivers. Natural stand-level disturbances are infrequent with hurricanes, fire, and insects the most probable agents. Stands can experience small gap disturbances as the time between stand-level disturbance events increases. Mature forests will most likely have advanced regeneration in the understory of similar species.
Red and Black Spruce Hummocks (Patch)	22,378 11.8%	Red and black spruce occurring on imperfectly drained soils creates a mid-sized landscape-level patch element on hummocky terrain on the plateau-like top of the ecodistrict. The occurrence of the two spruce species is dictated by soil drainage and the red spruce will occur on the well to moderately well-drained soils. Black spruce will be found on the imperfectly to poorly drained soils. The hybridized red-black spruce will occur wherever soils are not quite fertile enough to support red spruce. This element represents mid to late successional forests with red spruce stands more typical of the Acadian Forest. Natural stand-level disturbances are frequent with hurricanes, fire, and insects the most probable agents. Soils are primarily coarse-textured sandy loams and generally of poor to medium fertility. With progressively poorer drainage, black spruce and red maple dominate with false holly and winterberry in the shrub layer. Clearcut harvesting will increase pioneer species competition levels with species such as raspberry and pin cherry. Early successional forests will have increasing amounts of red maple and balsam fir.

Table 5a – Elements Within Cobequid Hills		
Element	**Size (Hectares)**	**Element Description**
Tolerant Mixedwood Slopes (Patch)	13,380 7%	The steep slopes of ravines and gorges in the Cobequids support a mixedwood forest of tolerant species such as red spruce, hemlock, yellow birch, beech, and sugar maple. This linear patch-level element occurs throughout the ecodistrict following the rivers and their major tributaries. Natural stand-level disturbances are infrequent and forests develop an uneven-age structure and old growth characteristics. Natural disturbance agents include hurricanes, ice storms, disease, and insects. Soils are rapid to well-drained loams and sandy loams and generally of medium fertility. Moister and richer soils occur at lower and toe slope positions as water and nutrients move downslope to reach the watercourse and/or level terrain associated with riparian zones. Often there are seepage sites along the slope where soils are wetter and richer with plants indicating this improved condition. Earlier and mid-successional stages can be dominated by intolerant hardwood species such as red maple and white birch while balsam fir can be abundant in young softwood forests. These slope forests and the watercourses they follow are important wildlife corridors within the ecodistrict as well as among other adjacent ecodistricts.
Wetlands (Patch)	47 <0.1%	The wetlands element is a patch-level ecosystem and comprises freshwater bogs, fens, swamps and poorly drained areas. The element may occur as a large wetland complex associated with rivers and lakes, as narrow linear communities associated with flow accumulations and small streams, as a community of hydrophytic vegetation (sedges, sphagnum moss, false holly, and winterberry) associated with level terrain where drainage is impeded, or as a depression in the landscape where water remains in excess year round. Smaller disjoint wetlands are often embedded within other elements, especially the Red and Black Spruce Hummocks element. Wetlands are generally treeless or sparsely forested woodlands of black spruce, tamarack, and red maple. For the most part, sites are underlain by poorly drained mineral soils derived from sandstone tills or organic soils derived from peat (sphagnum mosses) or sedges. On the higher ground with better-drained soils softwood forests of red and black spruce will occur. This element plays a critical role in water collection, filtering, and groundwater recharge.
Valley Corridors (Corridor)	7,210 3.8%	This element type is the strong linear river corridors that dissect the Cobequid Hills in various locations. Twenty such corridors were noted. Most of these linear features are associated with late successional species such as hemlock, red and black spruce, sugar maple, yellow birch, and beech. These species still dominate the current forest but balsam fir, white spruce, and spruce fir-dominated stands now account for 18% of the forest. Seventy-four percent of the forest is in the mature and multi-aged development class.
Total	**189,695***	*Area is not the same as in Table 1 because water has not been included.

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

Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Tolerant Hardwood Hills	IH6, IH7, MW4, MW5	14	TH7, TH8	17	**TH1, TH2,** TH3, TH4, TH5	53
Tolerant Mixedwood Hummocks	IH6, MW4, MW5	9	MW2, SH5, SH6, SH8	17	MW1, MW3, SH1, **TH1, TH2, SH3**	64
Tolerant Mixedwood Slopes	IH6, MW4, MW5	9	MW2, SH5, SH8	14	**MW1, MW3,** SH1	70
Red and Black Spruce Hummocks	MW4, MW5, IH6	13	MW2, SH5, SH6, SH8	22	**SH3,** SP7	44
Wetlands	FP3, WC1, WC2, WC5, WC6, WC7, WD1, WD2, WD3, WD6, WD7, WD8, SP7					

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 DNR are: Cedar (CE), Coastal (CO), Flood Plain (FP), Highland (HL), Intolerant Hardwood (IH), Karst (KA), Mixedwood (MW), Old Field (OF), Open Woodland (OW), Spruce Hemlock (SH), Spruce Pine (SP), Tolerant Hardwood (TH), Wet Coniferous (WC), Wet Deciduous (WD)
Bolded vegetation types indicate typical late successional community
[1] Forest Ecosystem Classification for Nova Scotia (2010)
*Percentage of element in each successional stage. Percentages may not total 100 due to unclassified lands (such as clearcuts and regenerating stands) not being included.

Photos Illustrating Vegetation Types in Elements

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

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

Red spruce – Balsam fir / Stair-step moss – Sphagnum (SH6) is a mid-sucessional vegetation type found in the Tolerant Mixedwood Hummocks patch element.

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

White birch – Balsam fir / Starflower (MW5) is an early successional vegetation type found in the Tolerant Mixedwood Slopes element.

Red maple / Sensitive fern – Lady fern / Sphagnum (WD3) is a wet red maple forest found in the Wetlands 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 DNR is employing to try and realize this objective. DNR 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 Cobequid Hills Ecodistrict, gap disturbances are the predominant natural disturbance shaping the diversity of forest ecosystems. In these areas there is a dominant overstory that is sustained through the dynamic process of understory development and overstory recruitment. The disturbance agents on Cobequid Hills associated with gap disturbance mortality are winds, winter storm damage, or insects, allowing the development of uneven-aged stands. These forests usually comprise shade-tolerant species of sugar maple, yellow birch, and beech on the well-drained hills and upper 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 DNR 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 DNR website (http://novascotia.ca/natr/library/forestry/reports/NDRreport3.pdf).

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

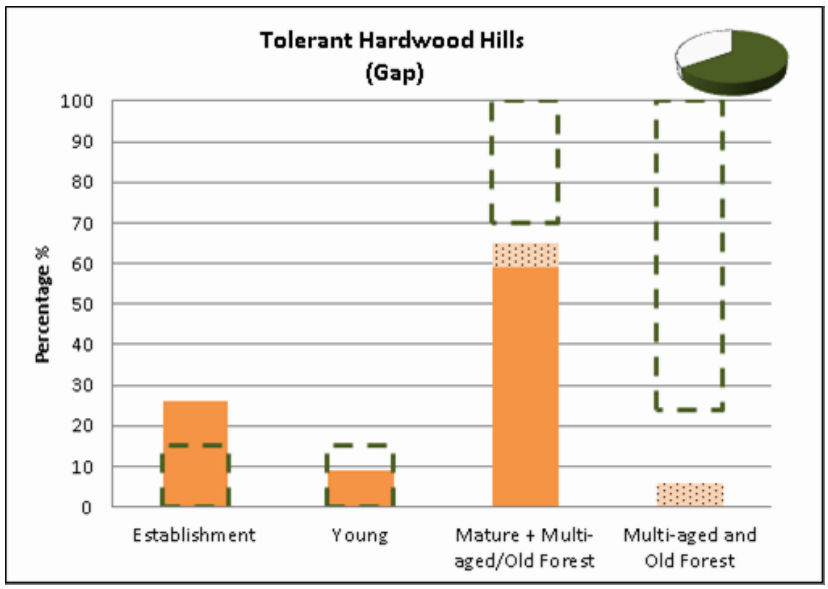
Natural Disturbance Regime	Development Class			
	Forest Establishment	Young Competing Forest	Mature Forest (including multi-aged and old forest)	Multi-aged and Old Forest
Frequent Stand Initiating	5 - 30%	5 - 30%	>40% early, mid, and late seral representation	>8%
Infrequent Stand Initiating	5 - 20%	5 - 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.

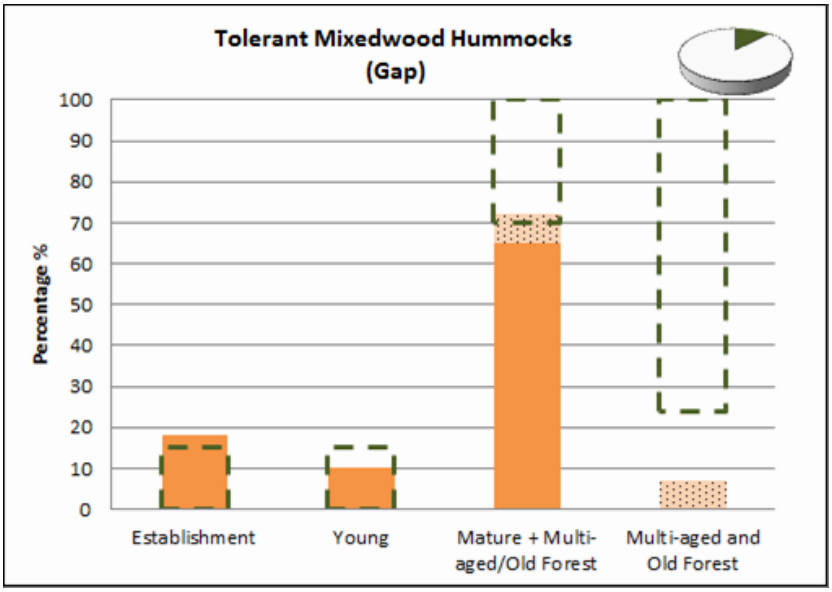
Development Class Targets by Element

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.

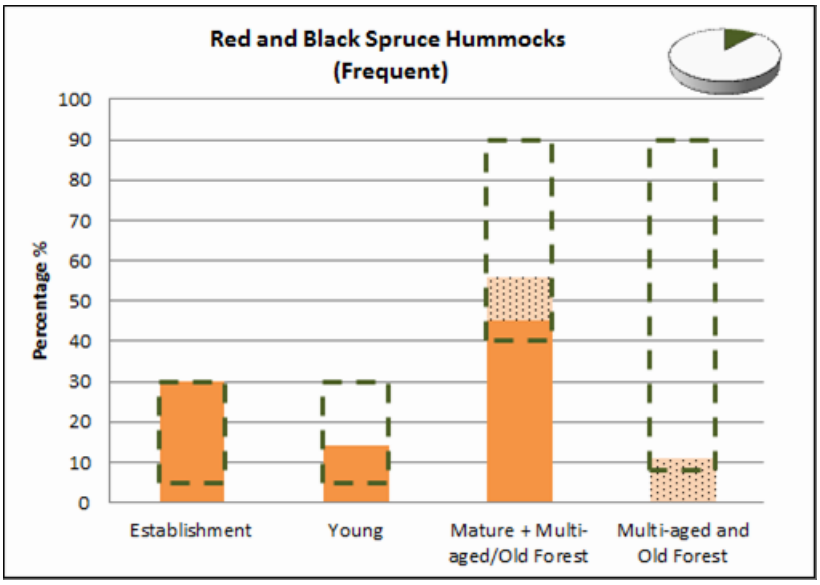
In the **Tolerant Hardwood Hills** element, both the mature and multi-aged and old forest classes are below their target ranges. Partial harvests consistent with gap disturbance, including retention of old trees, will promote multi-aged forest development, particularly in tolerant hardwood stands. Favouring climax species in establishment and young forests will provide future mature forest opportunities.



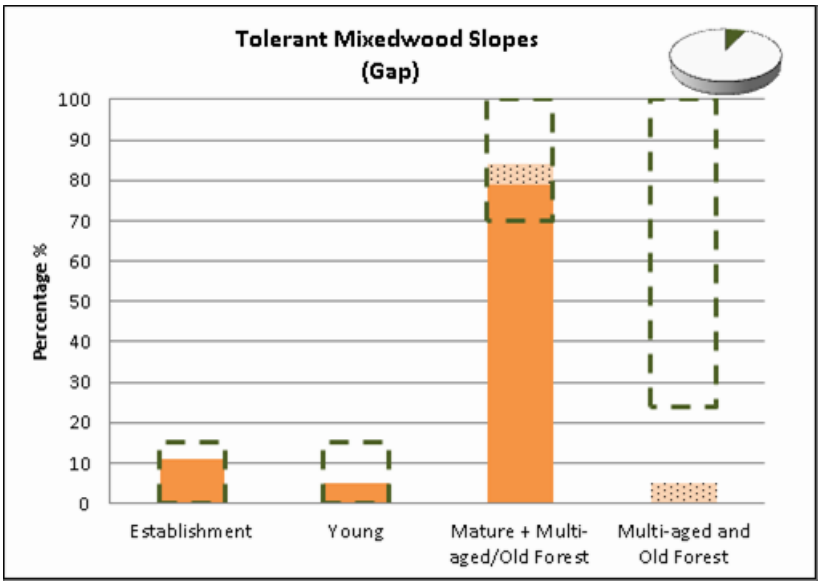
In the **Tolerant Mixedwood Hummocks** element, stand-level natural disturbances are unusual, so a larger percentage of older forests is expected on the landscape. To enhance multi-aged and old forest conditions in hardwood and softwood stands, extending harvest rotations and using uneven-aged management practices can help achieve this result. Currently, the desired range for multi-aged and old forest is below target.



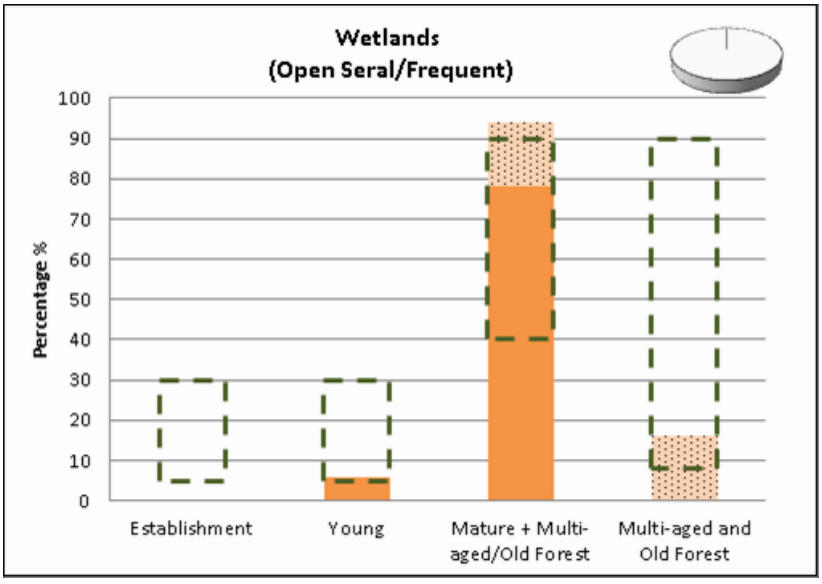
The **Red and Black Spruce Hummocks** element meets the desired target levels for all development classes. Red spruce sites should provide opportunities to maintain and restore mature forest with extended rotations and uneven-aged practices to favour climax species. Thinning in establishment and young forests can enhance late successional species' composition.



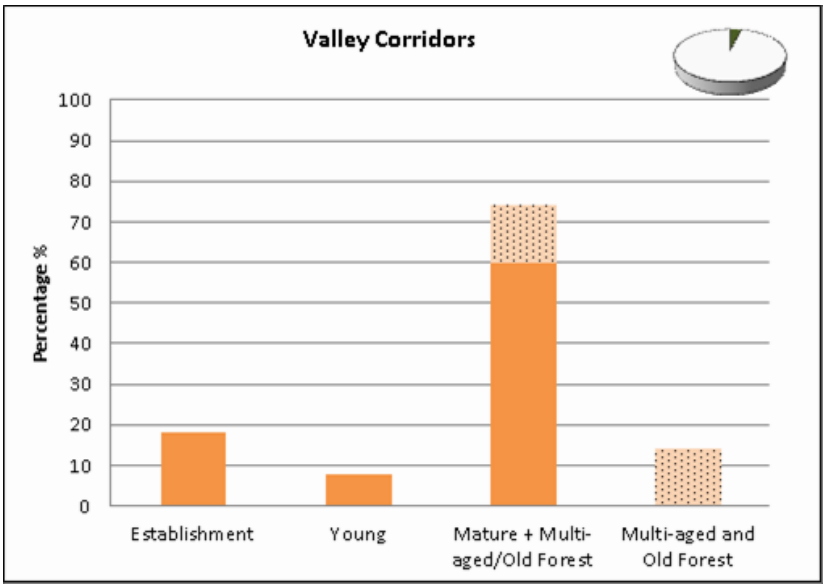
In **Tolerant Mixedwood Slopes**, mature conditions are consistent with the desired composition for gap disturbed ecosystems. This condition enhances slope stability and provides mature habitat continuity. The establishment and young forest classes provide diversity of habitat and species. The multi-aged and old forest class is under-represented but recruitment from the mature class can be expected.



The forested component of the **Wetlands** element is predominately mature and multi-aged, with a lack of establishment class habitat. This patch element is variably composed of mature forest interspersed with woodlands and open wetlands. Disturbances are often patchy, reflecting the diverse structure.



The **Valley Corridors** element includes parts of several elements and does not have a specific disturbance regime or composition target. The current dominance of mature conditions should enhance forest cohesion and support connectivity functions along this linear element feature.



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 DNR 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).