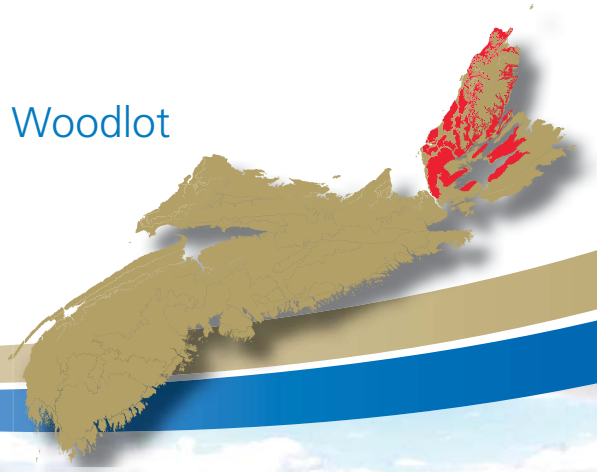
Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS
CAPE BRETON HILLS ECODISTRICT 310

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



ELA 2015-310

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 310: Cape Breton Hills

Prepared by the Nova Scotia Department of Natural Resources
Authors: Eastern Region DNRstaff

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This report, one of 38 for the province, provides descriptions, maps, analysis, photos and resources of the Cape Breton 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 (1997 to 1999) – 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 2015-310

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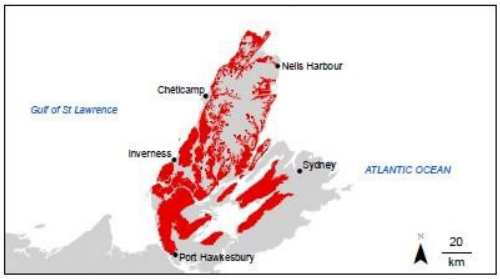


An objective of ecosystem-based management is to manage landscapes in as close to a natural state as possible. The intent of this approach is to promote biodiversity, sustain ecological processes, and support the long-term production of goods and services. Each of the province's 38 ecodistricts is an 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 Cape Breton Hills Ecodistrict 310. 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.

Most elevations in the Cape Breton Hills Ecodistrict range from 150 to 300 metres above sea level. The total area is 370,183 hectares.

Hardwood forested hills and steep slopes define this ecodistrict. When travelling along the Bras d'Or Lake, the hilly topography of Kellys Mountain, Boisdale Hills, Sporting Mountain, East Bay Hills, Whycocomagh, and Lewis Mountain is easily visible.

The steep slopes are also easily observed where they descend from the plateau to the valleys of major rivers and streams, such as the South West and North East Margaree, Aspy, North, and Chéticamp rivers.

The ecodistrict is influenced by the strong, cold winds of the Gulf of St. Lawrence. Temperatures are slow to warm in the spring, resulting in a short growing season.

Most of the rivers passing through the Inverness and Bras d'Or lowlands have their headwaters originating from wetlands and a few small lakes in the hills.

The Cape Breton Hills Ecodistrict provides important habitat to wildlife, including two species of mammals that are endangered in Nova Scotia: Canada lynx and American marten.

Fall colours on the tolerant hardwood forested slopes of Cape Mabou in the Cape Breton Hills.

Deer wintering yards are common on the sheltered south-facing slopes and numerous eagle nests are found along the ravines of major streams.

A distinctive landscape features of the ecodistrict is the community pastures and fields on top of hills in Mabou.

Shade-tolerant hardwood forests of yellow birch, sugar maple, and beech, along with red maple and scattered white spruce and balsam fir, are found throughout this ecodistrict on upper to lower slope, well-drained, sandy loam soils. Eastern hemlock, white pine and scattered red spruce are found on ravines with well-drained, medium-textured soils. Old field forests of white spruce are also common.

The Cape Breton Hills Ecodistrict includes 31,646 hectares of provincial wilderness areas, parks, protected areas, and other areas of legislated protection, along with 20,740 hectares of national parks.

Private land ownership accounts for 57% of the total area of the ecodistrict, with 35% under provincial Crown management and the remainder owned by others.

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 seven key landscape elements – one dominant matrix element, five smaller patch elements, and a corridor element– in Cape Breton Hills.

Tolerant Hardwood Hills is the matrix element, representing 85% of the ecodistrict. The element is dominated by tolerant hardwoods typical of the Acadian Forest, such as sugar maple, beech, and yellow birch, with white ash and ironwood on richer sites.

Spruce Pine Hummocks, representing 8% of the ecodistrict, is the largest patch element. The main tree species are black spruce, balsam fir, and scattered white pine with some tamarack and red maple. The other patch elements, in order of size, are **Spruce Fir Hills and Hummocks**, **Tolerant Mixedwood Hills**, **Wetlands**, and **Coastal Beach**.

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

Forest Ecosystem Management
For Cape Breton 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, and changes in land use and vegetation cover.

This ELA provides detailed information on the resources and descriptions of various components of the landscape for Cape Breton Hills Ecodistrict 310. 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 Cape Breton 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
(see 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 Cape Breton 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 Cape Breton Hills Ecodistrict comprises a total area of 3,702 square kilometres.

Hardwood forested slopes define the ecodistrict, such as those surrounding the Bras d'Or Lake area, including Kellys Mountain, Boisdale Hills, Sporting Mountain, East Bay Hills, Whycocomagh, and Lewis Mountain.

The higher steep-sloped hills are underlain with older resistant rocks and are covered with well-drained, moderately coarse-textured tills. In general, the lower more gradually sloping hills are underlain by coarse carboniferous sediments. The soils tend to be imperfectly drained, fine-textured tills. Seepage sites are common on the slopes providing some of the richer sites for tree and plant growth.

Fresh water accounts for less than 1% of the ecodistrict.

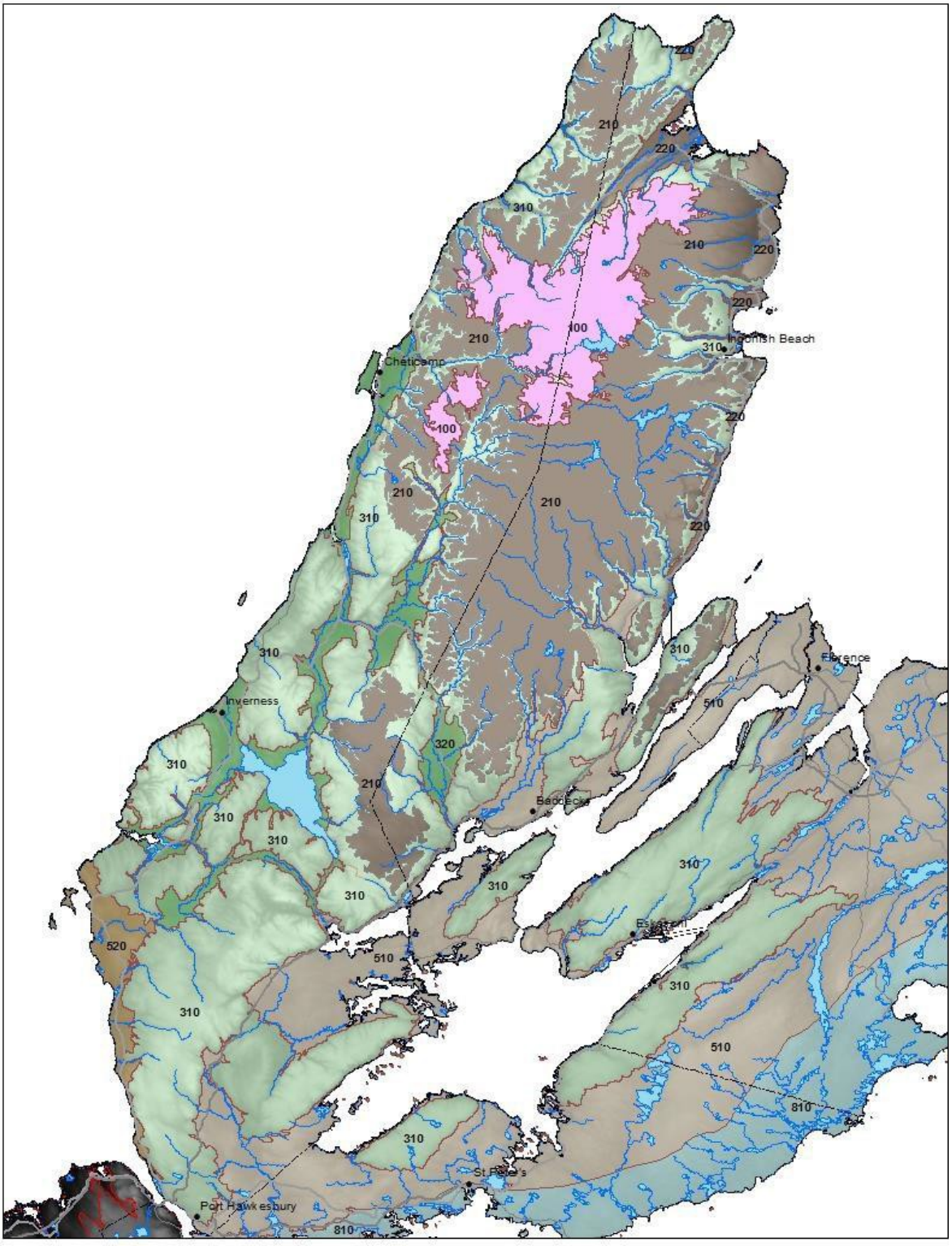
The mainly shade-tolerate hardwood forest exists on the side slopes of the hill complexes while black spruce and balsam fir are found on the imperfectly drained soils of the level and hummocky terrain located on the major hill tops.

In areas where soils and climate permitted agriculture by the early settlers, abandoned farmlands have reverted to balsam fir, white spruce, and mixedwood stands, in areas such as Creignish and Mabou.

The tolerant hardwood forest is shaped by gap dynamic disturbances, in which individual trees or small groups of trees die as opposed to the stand-level disturbances common in softwood forests.

There have also been species-specific disturbances in the hardwood forests resulting in significant mortality of entire species, such as the beech canker and yellow birch dieback.

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



Cape Breton Hills 310 is a large ecodistrict that covers parts of all four counties – Inverness, Victoria, Richmond, and Cape Breton – on Cape Breton Island.
(From Ecodistricts of Nova Scotia map 2007 *Revised*)

Land Area

In the Cape Breton Hills Ecodistrict, the majority of land is owned privately (57%), by the Crown (35%), federally (6%), or by Aboriginal communities (1%), with the remainder in other uses (Table 1).

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

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	130,592	35.3
Private	212,396	57.4
Federal	20,959	5.7
Aboriginal	3,486	0.9
Other (Includes inland water bodies and transportation corridors)	2,750	0.7
Total	**370,183**	**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 Cape Breton Hills, the largest category is C2 (58%), followed by C3 (24%), and C1 (18%).

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	22,981	17.6
C2 – Multiple and Adaptive Use	75,907	58.1
C3 – Protected and Limited Use	31,420	24.1
Unclassified	284	0.2
Total	**130,592**	**100**

Forests

Within the Cape Breton Hills Ecodistrict, 92% of the land is forested (Table 3). Agriculture represents 2% of the area, the same percentage as wetland, while small settlements (classified as urban) account for 1%.

This ecodistrict is predominantly a tolerant hardwood forest of yellow birch, sugar maple, beech, and red maple on well-drained soils.

Occasionally eastern hemlock and red spruce are found on the steep slopes of ravines along the major watercourses of the ecodistrict.

On top of the larger hill complexes with imperfectly drained soils, forests of black spruce and balsam fir are common.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	341,783	92.3
Wetland	5,853	1.6
Agriculture	6,310	1.7
Barrens	2,044	0.6
Urban	3,620	1.0
Road, Trail, Utility	2,306	0.6
Other	8,267	2.2
Total	**370,183**	**100**

Hardwood forests, shown in their autumn colours, dominate the Cape Breton Hills Ecodistrict.

Much of the early land grants on the upland sites were cleared for farming, but after they were abandoned in the early to mid-1900s, fields and pastures reverted to stands of white spruce.

The majority of the provincial Crown land base of 130,592 hectares is under a license and forest management agreement with NewPage Corp. (*now Port Hawkesbury Paper*) which operates a modern pulp and paper mill at Port Hawkesbury. Under this agreement, the mill operates as the province's forest management contractor for these Crown lands.

On the 57% of privately owned lands, the vast majority is considered forested. Forest harvesting on these lands is carried on by the individual landowners, numerous small private contractors, and two forestry cooperatives.

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 5 cubic metres per hectare per year (m^3/ha/yr), based on the ratings in Table 4. The average forest LC for the province is 4.9 m^3/ha/yr.

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

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	1,325	0.4
3	14,600	3.9
4	53,284	14.4
5	213,594	57.7
6	72,940	19.7
7 or more	14,440	3.9
Total	**370,183**	**100**

*Based on growth potential for softwood species.

Water Resources

Water resources in Cape Breton Hills represent consist mainly of small freshwater lakes and ponds.

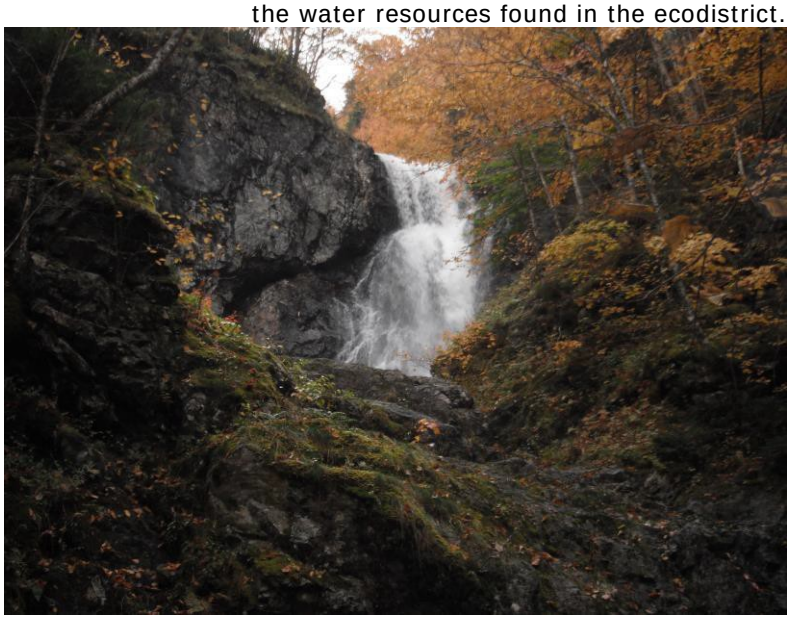
The majority of these small lakes are located along the eastern and southwestern portions of the ecodistrict. Examples include MacMullins and Loon lakes located on the East Bay Hills in Cape Breton County, Beaver Lake on North Mountain, Inverness County, and Hill Lake and Pringle Lake on South Mountain, Richmond County. Fresh water accounts for less than 1% of the ecodistrict.

The ecodistrict itself, apart from the water resource, is an important upland water catchment area for neighbouring ecodistricts. There are more than 1,000 hectares of identified domestic water supply within the Crown land holdings.

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.



McDonald Lake, above, and Uisge Ban Falls, below, are among the water resources found in the ecodistrict.

Minerals, Energy and Geology

The Cape Breton Hills Ecodistrict is an assemblage of isolated blocks scattered across central and southwestern Cape Breton. The ecodistrict includes portions of the Aspy, Bras d'Or, and Mira (Avalon) terranes.

These elevated blocks tend to be elongated in a northeast-southwest direction and stand out in bold relief against the lowlands that have been eroded away around them. Although the bedrock and structural geology of Cape Breton Hills is variable, the ecodistrict can be grouped into the following three general areas: central Cape Breton, southwestern Cape Breton, and the Mabou

highlands. Many of the boundaries with adjacent ecodistricts follow faults, geological contacts, stream valleys or are transitional areas between lowland and highland ecodistricts.

The surficial geology of the Cape Breton Hills is variable. Approximately half the ecodistrict is covered by a stony or silty till 2 to 30 metres thick. The remainder of the ecodistrict has areas of rolling to rugged rock with a discontinuous veneer of glacial till. These areas are dominated by weathered bedrock and colluvial deposits on steep slopes, including valley walls.

Intrusive rocks, particularly those close to tidewater, are potential sources of aggregate materials for local and export markets (e.g. Kellys Mountain pluton). Several bedrock quarries in the Sydney, Port Hastings, Whycocomagh, and Baddeck areas are currently operating to serve local markets.

Glacial and alluvial deposits contain several sand and gravel deposits. Unconsolidated granular aggregate resources have been extracted from these deposits at a number of locations, particularly in the Port Hastings area, to supply the requirements of the local construction industry. An existing sand pit near MacLeod Settlement is currently being expanded to supply the local concrete industry. A deposit of Cretaceous age white silica sand, northwest of Melford, was worked in the 1920s. Surficial deposits make a major contribution to soil development and may be a source of aggregate.

Scattered across the ecodistrict are several small peat deposits.

Gypsum mining in the Melford area was worked in the 1920s.

The variety of rock types, ages, and tectonic history of the Cape Breton Hills Ecodistrict present many possible environments for the formation of economic mineral deposits.

The ecodistrict contains over 150 metallic and industrial mineral occurrences (copper, zinc, molybdenum, iron, uranium, gold, silver, marble, dolomite, limestone, silica, corundum, graphite, salt, potash, gypsum, anhydrite, celestite, fluorite, pyrophyllite, talc, and barite) in the provincial database.

Late Precambrian metamorphic rocks contain the majority of these mineral occurrences. Mineral exploration dates back to the late 1800s, and shafts and adits – horizontal entrances to underground mines – were driven on several of the more promising showings. The exact location and character of these old workings are often poorly recorded, and undocumented abandoned mine openings (AMOs) may exist. Some AMOs are difficult to find because they have become overgrown and in some instances plugged at the surface with debris. Approximately 70 AMOs (shafts, pits, subsidence and collapse features) are documented in the provincial database. Although AMOs are scattered across the area, they are somewhat clustered in the Coxheath, Ironville, and Upper Glencoe areas. Currently there are no active mines in the Cape Breton Hills 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 DNR office.

A number of carbonate showings (limestone, dolomite, and marble) occur within the ecodistrict. Significant carbonate deposits occur in the Late Precambrian George River Metamorphic Suite at several locations including: Glencoe (more than 315 million tonnes of cement grade crystalline limestone, of which 230 million tonnes is metallurgical grade and more than 5 million tonnes dolomite); Kewstoke (more than 280 million tonnes of cement grade crystalline limestone, of which 80 million tonnes is metallurgical grade – deposit includes a zone of very pure metallurgical grade dolomite); Glendale (preliminary estimate of 90 million tonnes of crystalline limestone, of which 5 million tonnes are white limestone – potential large dolomite reserve though deposit is virtually unexplored); and Campbells Brook (90 million tonnes of calcitic and dolomitic marbles).

Testing has identified carbonate deposits and occurrences with characteristics desirable in the cement, dimension stone, and filler-extender industries (e.g. paint, paper). These characteristics, in addition to their proximity to tidewater, make the carbonate deposits attractive for development.

Former quarry operations at Marble Mountain, George River, Frenchvale, and Churchview produced carbonate product for building stone, ornamental stone, quicklime, paint filler, and flux for the Sydney steel mill. Marble was formerly quarried at Kennedys Brook by MacLeod Resources for local and export dimension stone markets.

Marble was formerly quarried at Kennedys Brook for local and export stone markets.

Important metallic mineral deposits exist on the north side of the Coxheath Hills (porphyry copper-molybdenum-gold and Lime Hill (carbonate hosted zinc). Significant metallic mineralization occurs at Mullach Brook (copper), Upper Glencoe (iron), Steeles Brook (iron), Sporting Mountain (copper-lead-zinc-gold-silver), and the Mabou highlands (copper-zinc).

A number of gypsum showings occur within the ecodistrict and at least two have supported quarries. The Big Brook gypsum quarry (1962 to 1987) produced 16 million tonnes of gypsum and a substantial high grade anhydrite reserve remains. Quarry St. Anns (1884 to 1916) produced gypsum and possibly anhydrite (production records are incomplete).

Graphite occurrences are documented at Glendale, Glencoe, Lime Hill, and Christmas Island. Of the many recorded graphite occurrences within Nova Scotia, the Glendale occurrence is the deposit with the most development potential.

A small quantity of barite was produced from the Pine Brook barite deposit (southwest of Lake Uist) in 1983, and a significant reserve remains. The Creignish Hills contain several quartzite occurrences with development potential. A salt deposit occurs near Southwest Mabou. To date, the only known Nova Scotian occurrence of wollastonite is located at Lime Hill.

Evaporate minerals of the Windsor Group (particularly the Middle and Lower Windsor groups), consisting of gypsum, anhydrite and salt can be dissolved by circulating groundwater and contribute undesirable calcium, sodium, sulphate, and chloride to the water. Surface and near-surface evaporate karst terrains present challenges for construction, agriculture, forestry, and development activities.

The St. Rose-Chimney Corner coalfield (Cumberland Group) is situated 15 kilometres north of Inverness. The coal-bearing strata at St. Rose and Chimney Corner are separated by 3 kilometres of faulted strata.

Except for two small onshore areas, the coalfield is mostly submarine. Total historical production for the coalfield is approximately 3 million tonnes of coal. Limited resources remain. The coalfield contains approximately 45 coal-related AMOs in the provincial database. Currently there is no mining activity in the St Rose-Chimney Corner coalfield.

Sedimentary rocks of Carboniferous age are prime targets for oil and gas exploration since they provide source and reservoir rocks for hydrocarbons. Approximately 30 boreholes and five surface locations were reported to have petroleum shows. The petroleum showings are clustered in the Lake Ainslie and Mabou areas. Reports of oil seepages near MacIssac Point on Lake Ainslie date back to the 1850s. One hole drilled near MacIssac Point yielded 490 litres of oil. Most of the Carboniferous rocks of the ecodistrict are currently held under petroleum agreements. A low grade oil shale occurs near McAdams Lake, in Devonian-aged sediments. The St. Rose-Chimney Corner coalfield contains a coalbed methane resource.

The loss of land by coastal erosion can have a significant negative impact on waterfront property values and related investment. Rising sea level is driving sections of shoreline inland, depending on the erodibility of shoreline material, general beach gradient, water depth, and wave exposure.

Parks and Recreation / Protected Areas

The Cape Breton Hills Ecodistrict includes 31,646 hectares of provincial wilderness areas, parks, protected areas, and other areas of legislated protection. The largest category is wilderness areas which account for 28,862 hectares.

National parks and adjuncts represent another 20,740 hectares.

DNR manages 18 properties through the provincial parks program which are either entirely or partially within the ecodistrict.

Operational provincial parks include day-use sites at Irish Cove, Ben Eoin, Barachois, St. Anns, Mabou, and West Mabou Beach. In addition, Whycocomagh Provincial Park also offers camping.

For the most part, these provincial parks are located on the fringes of the ecodistrict and/or have a small land base. Consequently, with the exception of Ben Eoin and Whycocomagh, the parks do not offer recreational opportunities typically associated with upland areas.

Park reserves are located at Hay Cove, Mineral Springs, Gaspereaux River, MacNeils Vale, Barra Forest, Kellys Mountain, Marble Mountain, North Ainslie, Chimney Corner, Broad Cove Marsh, and Melford. These are properties with potential to contribute to provincial park objectives and are set aside for possible future development.

The East Bay Hills meet the Bras d'Or lowlands at the community of Ben Eoin, on the East Bay of Bras d'Or Lake, which is home to a provincial park and an all-season resort featuring a golf course and ski hill.

The MacFarlane Woods and Bornish Hill nature reserves, both managed by the Nova Scotia Department of Environment, are also located within the Cape Breton Hills Ecodistrict.

The Bornish Hill Nature Reserve is located near Melford, Inverness County, and it protects a representative example of climax hardwood forest in the Creignish Hills area.

From a parks and protected areas perspective, the Cape Breton Hills Ecodistrict is significant primarily because of its topographic relief. These hills provide a scenic landscape which is an important tourism attraction. In addition, the varied topography offers numerous scenic look-offs and provides a variety of opportunities for both motorized and non-motorized trail activities.

Sections of the Trans-Canada Trail cross the ecodistrict in several locations. Because Cape Breton Hills receives greater amounts of snow cover than surrounding areas, the ecodistrict provides important opportunities for winter sports such as snowmobiling and cross-country skiing. A number of snowmobile trails already cross the ecodistrict. Hiking, hunting, fishing, off-highway vehicle use, and other recreational activities are popular in the area.

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 Cape Breton 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 Cape Breton 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 Canada lynx, listed as endangered under the Nova Scotia Endangered Species Act, is found in the Cape Breton Hills Ecodistrict on Cape Breton Island. Lynx require mature softwood areas for denning and are generally restricted to the higher elevations due to competition from their main competitors: the bobcat and coyote.

The Canada lynx, an endangered species in Nova Scotia, is found in the Cape Breton Hills Ecodistrict.

The lynx population size tends to follow the cycle of their main prey item, the snowshoe hare. As hare population decreases, so does the lynx population. At present the population of hare seems to be on the increase and so an increase in lynx numbers should follow. There is a provincial lynx recovery team in place developing a lynx recovery plan that should aid in maintaining the long-term viability of the population. Other predators, such as black bear, fox, coyote, and bobcat, are also abundant in this area.

Moose were an abundant and dominant animal in the region prior to the arrival of the first European settlers. By 1825, as a result of over-harvesting for commercial and subsistence purposes, the population was in serious decline. Moose appears to have disappeared from Cape Breton by the early 20th century. In 1928 and 1929, seven mainland moose were introduced into the highlands but this introduction was unsuccessful. In 1947 and 1948, 18 moose from Alberta were released in the Cape Breton Highlands National Park. This introduction was successful and has resulted in the present population, which numbers in the thousands.

Currently, moose densities are highest in the areas within the national park and north of the park. The population density decreases in the southern and lower elevation areas of Cape Breton Island. Moose are found in low number in the McIntyres Mountain area, the hills around Lake Ainslie, and in the St. Anns area. Recently there has been a small population on Boularderie Island. There has been a licensed lottery hunt for the moose in Inverness and Victoria counties since 1986. At present, 345 licenses are issued and the overall success rate has been around 90%. There is also a First Nations harvest which has been going on for a number of years.

Deer were abundant in Cape Breton Hills during the 1950s, 1960s, and early 1970s. Currently, deer numbers are low in the ecodistrict, as they are throughout the rest of the island, but show some signs of recovery. There are 78 deer wintering areas (DWA) identified throughout the ecodistrict, with most on south or southwest-facing slopes of the hills. These areas provide mature softwood for cover and shrubs and hardwood for browse. The largest DWA area is on North Mountain in West Bay, covering about 1,100 hectares. The smallest DWA is an area of 4 hectares in the East Bay Hills. Special management practices are in place for conducting forest management in or around these areas to help preserve their function.

Species at risk found in this ecodistrict include: American marten in the St. Anns Bay and North River area; Gaspé shrew in the Kellys Mountain and Lewis Mountain areas; yellow lampmussel in some small lakes and streams in the East Bay Hills around Island Lake and McLeod Lake that feed into Sydney River; wood turtle in a number of streams in the McIntyres Mountain and River Denys area.

There are several limestone caves in the area that are home to little brown bats.

Little brown bats have hibernated in caves in the ecodistrict and also in old mines, such as the Coxheath copper mine.

The endangered Atlantic salmon, brook trout, and

gaspereau are found in many of the feeder streams and tributaries of some of the larger rivers on the island. These streams act as hatchery areas for many of the larger trout-salmon rivers, such as the Margaree, Middle, Baddeck, and Mira.

Eagles nest in large numbers – second only to the Bras d'Or Lowlands Ecodistrict – in mature pines and hardwood along the slopes of the hills usually within easy flight of water. Special forestry practices are in place to protect their breeding sites during the active season. There are 40 nesting sites in the district and 26 of these were active in 2008.

Red-tailed hawks and great horned owls have been recorded as nesting in the Campbells Mountain and West Bay areas. Other notable birds found in the ecodistrict include goshawks, loons, blue herons, and ospreys.

Bicknell's thrush, listed as vulnerable in Nova Scotia, breed in the stunted softwood forests at higher elevations. Little is known about this reclusive bird. Bird Studies Canada – a national bird conservation organization – is studying the decline of Bicknell's thrush over most of its range.

Eagles nest in large numbers in the ecodistrict.

There are a number of rare and species of conservation concern plants recorded, including showy lady slipper, small yellow lady slipper, northern blueberry, northern bog sedge, giant rattlesnake plantain, dwarf rattlesnake plantain, lesser wintergreen, and black ash.

A rare dragonfly, Williamson's emerald, is found at one small peat pond near Baddeck, the only site in Nova Scotia where this species of dragonfly is found.

Margaree Island (Sea Wolf Island) is a National Wildlife Reserve administered by the Canadian Wildlife Service. A survey of the island in 2007 showed the presence of a number of colonial nesting birds including double-crested cormorants, great cormorants, razorbills, black guillemont, herring gulls, and black-back gulls.

Blue heron and bank swallows are recorded as nesting on the island, along with song birds such as Swainson's thrush, American robin, yellow warbler, fox sparrow, and song sparrow. Grey seals use the shores of the island for breeding.

There are two nature reserves in the Ecodistrict. MacFarlane Woods and the Bornish Hills nature reserves are both good examples of climax hardwood forests. As well, there seven wilderness areas that are in part or wholly within the ecodistrict. An ecological monitoring and assessment site is located at Irish Cove and it shows up in the old growth layer.

Caves, such as this one at Cape Dauphin, can provide important habitat for bats and other wildlife.

For more detailed and current information on species at risk and species of conservation concern in this ecodistrict, refer to Appendix 3 and Map 6 in a separate Part 3 of this document. These species are important components of the landscape and are given priority attention in planning, management, and stewardship activities.

With much of the ecodistrict privately owned, effective wildlife management will to a great extent rely on active, informed stewardship by the many landowners. The 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
- and 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 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.

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 (see http://www.gov.ns.ca/natr/forestry/veg-types)*

Cape Breton 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.

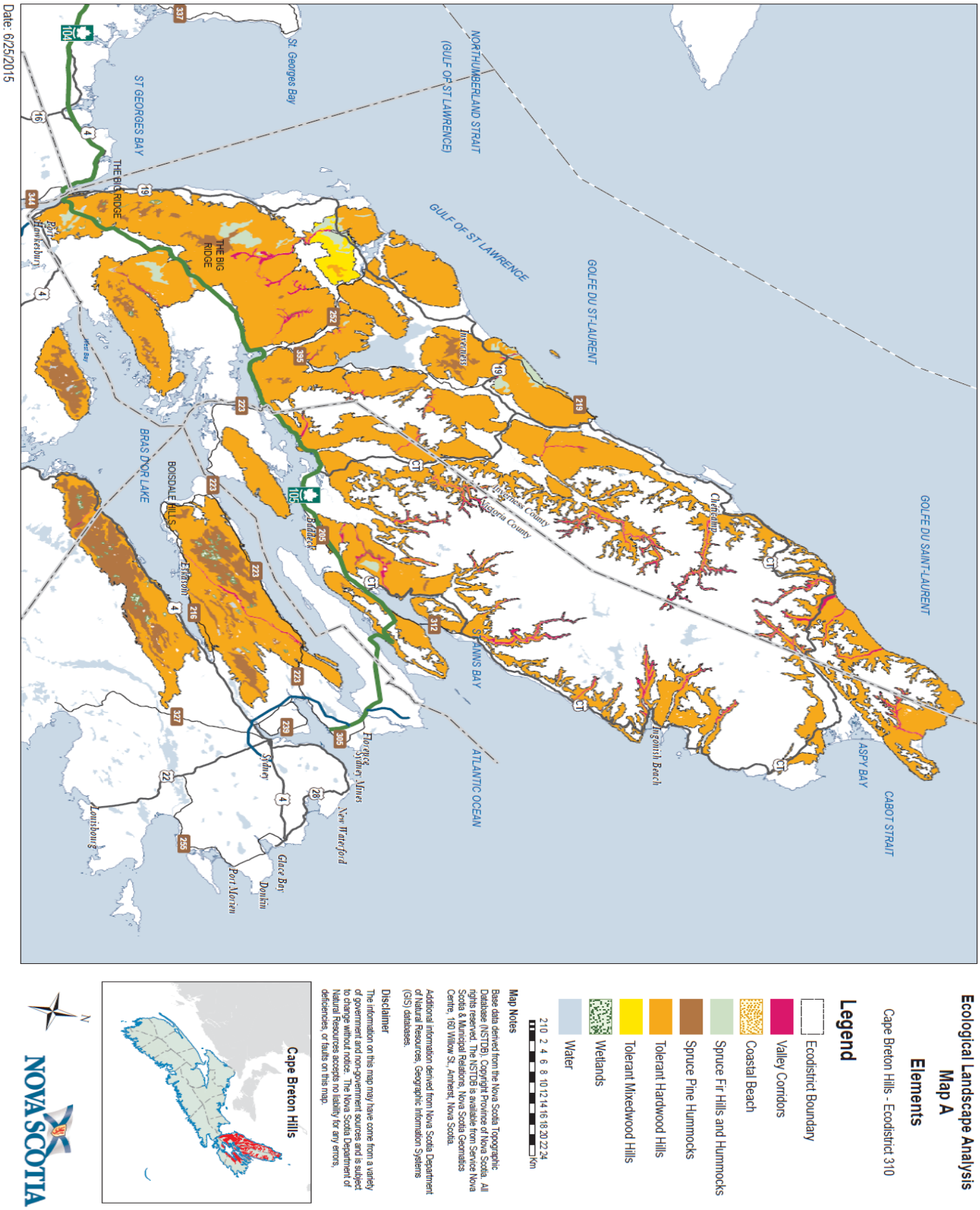
A landscape profile identified and mapped seven distinctive elements in the Cape Breton Hills Ecodistrict – one matrix, five patches, and a corridor (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types. Corridors are natural linear communities,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

Tolerant Hardwood Hills is the matrix element, representing 85% of the ecodistrict. The element is dominated by tolerant hardwoods typical of the Acadian Forest, such as sugar maple, beech, and yellow birch, with white ash and ironwood on richer sites.

Spruce Pine Hummocks, representing 8% of the ecodistrict, is the largest patch element. The main tree species are black spruce, balsam fir, and scattered white pine with some tamarack and red maple. The other patch elements, in order of size, are **Spruce Fir Hills and Hummocks**, **Tolerant Mixedwood Hills**, **Wetlands**, and **Coastal Beach**.

Valley Corridors is a linear element associated with 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)*** (see 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.

Though hardwood species dominate the ecodistrict, they are at times interspersed with softwood species in areas such as the Boisdale Hills.

Table 5a – Elements Within Cape Breton Hills		
Element	**Size (Hectares)**	**Element Description**
Tolerant Hardwood Hills (Matrix)	312,194 84.6%	The iconic hardwood-forested slopes of the Cape Breton hills comprise this matrix element. The high visibility of this element from major travel routes throughout the Island, especially during the autumn leaf colouration, provides an aesthetic value that contributes significantly to the Island's attraction as a tourist destination. The element is dominated by mid to late successional shade-tolerant hardwood forests typical of the Acadian Forest. Representative species include sugar maple, beech, yellow birch, and white ash with ironwood on the richer sites. Early successional forests following stand-level disturbances are typically of similar species with white birch and red maple usually more abundant. About 85% of the ecodistrict is represented by this element. It occurs on the slopes of hilly and hummocky terrain where soils are well-drained and enriched with moisture and nutrients from upper slope positions. Soils are typically coarse to medium-textured loams and sandy loams but better-drained fine-textured clay loams will also support this element on steeper slopes. Between Dunvegan and Belle Côte the western facing slopes of the hills have been altered by a landform feature called slumping which has created a unique ridge-like pattern that also supports this element. Natural stand-level disturbances are rare and stands will usually maintain themselves through gap replacement leading to an uneven-aged climax forests and the opportunity to develop old forest characteristics. Seepage areas are common on the slopes and provide an important habitat for biodiversity. Under these closed canopy forests the shrub layer consists of regenerating trees and shrubs such as fly honeysuckle and beaked hazelnut. These forests also have an abundant cover to ferns and club mosses. The forests of this element currently reflect two province-wide disturbance events of the early and mid-1900s: beech bark canker and birch dieback. Beech is now primarily an understory species and yellow birch is gaining abundance.
Spruce Pine Hummocks (Patch)	30,795 8.4%	The Spruce Pine Hummocks element is generally a large patch-level element with imperfectly drained, coarse to medium-textured soils associated with the hummocky to level terrain on top of several hill systems including the East Bay Hills, Boisdale Hills, North Mountain, and Sporting Mountain. The imperfect drainage conditions expressed in the soils underlying this terrain can be attributed to the gentle slope of the landscape. The inherent low fertility and imperfect drainage give rise to forests of black spruce and scattered white pine. With progressively poorer drainage wet forests of black spruce, tamarack, and red maple or shrubby wetlands will occur. Occasionally open woodlands of black spruce and reindeer lichen occur where soils are either shallow to bedrock or extremely gravelly. This element also occurs as a small linear patch in some of these hilly regions occurring along watercourses that eventually make their way to the lowlands. Examples of this feature are in the hills near Glencoe and Dunakin and throughout the Boisdale and East Bay Hills. Along these riparian zones small alluvial deposits can provide enriched conditions for small floodplain forests. Otherwise forests comprise black spruce on the imperfectly drained soils and balsam fir on the better-drained upper slopes.

Table 5a – Elements Within Cape Breton Hills		
Element	**Size (Hectares)**	**Element Description**
Spruce Fir Hills and Hummocks (Patch)	7,404 2%	This is a small to large patch level landscape element occurring on imperfectly drained hummocky terrain underlain by fine-textured soils (clay loams). The forests tend to be dominated by black spruce on the moister sites and balsam fir with white spruce on the better-drained soils usually associated with the upper slopes of the hummocky terrain. With progressively poorer drainage black spruce, tamarack, and red maple dominate the forest vegetation and wetlands are embedded throughout the element. This element is primarily found on the upper elevations of the hilly topography of western Cape Breton Island.
Tolerant Mixedwood Hills (Patch)	4,303 1.2%	This is a localized patch element south of Mabou (Alpine Ridge and Southwest Ridge) supporting shade-tolerant species of the Acadian Forest. The element occurs on the slopes of rounded hills underlain by imperfectly drained fine-textured soils. On the upper slopes and crests, forests comprise sugar maple, yellow birch, and beech but at the middle and lower slope positions forests tend to comprise white spruce and balsam fir mixed with yellow birch and maple. At lower and toe slope positions and where there are seepage sites along the slope, soils are moister and richer with trees such as white ash and ironwood indicating this improved condition.
Wetlands (Patch)	1,513 0.4%	The wetlands element is a patch ecosystem comprising freshwater bogs, fens, swamps, and poorly drained areas. It may occur as a large wetland complex associated with rivers, 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. The East Bay Hills have one of the largest concentrations of large wetlands in the ecodistrict.
Coastal Beach (Patch)	25 <0.1%	Coastal beaches are wave-dominated deposits composed of a mixture of sand, gravel, and other sizes of sediments. The deposit of sand, gravel, and larger particles such as boulders and cobbles occur under a variety of circumstances leading to several types of beach landforms. In this ecodistrict the hills slope quickly to the Bras d'Or Lake near Ben Eoin and St. Andrews Channel and several beaches have been included.
Valley Corridors (Corridor)	12,564 3.4%	The most evident linear features within this ecodistrict are faults, folds, and associated watercourses. A number of corridors have significant levels of land use, including settlements, agricultural fields, power lines, roads, and railways. A significant man made feature on one of the corridors is a reservoir dam. These land use changes reduce the connective function of the corridor for some species, and may also increase the barrier effect of the corridors for species that must move across or through them.
Total	**368,723***	*Area is not the same as in Table 1 because water has not been included.

Table 5b – Forest Vegetation Types[1] Within Elements in Cape Breton Hills						
Element	**Seral Stage**					
	Early	**% ***	**Middle**	**%**	**Late**	**%**
Spruce Pine Hummocks	OW2	9	SP4, SP6, SH9	27	**SP5, SP7,** SH8, SH10	59
Spruce Fir Hills and Hummocks	IH4, IH6, MW4, SP6, SP8, SP10	13	**SH8**, SH9, MW5, **SP7**	27	**SH8, SH10, SP7**	52
Tolerant Hardwood Hills	OF1, OF2, OF4, OF5, IH4, IH5, IH6, IH7, MW5	9	MW4, TH7, **TH8**	33	**TH1, TH2**, TH3, TH4, TH5	52
Tolerant Mixedwood Hills	IH4, IH5, IH6, MW5, SH8	10	MW4, IH7	36	**MW3,** SH1, **MW1**	45
Coastal Beaches	Beach grass, Bayberry, Rose spp., White spruce					
Wetlands	FP3, WC1, WC2, WC6, WC7, WD1, WD2, WD3, WD6, WD7, 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 – White ash / Christmas fern (TH3) is a late successional vegetation type found in the Tolerant Hardwood Hills matrix element.

White pine / Blueberry / Bracken (SP4) is an uncommon mid-successional vegetation type found in the Spruce Pine Hummocks patch element.

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

Hemlock – Yellow birch / Evergreen wood fern (MW3) is a late successional vegetation type occasionally found in the Tolerant Mixedwood Hills patch element.

Balsam fir – White ash / Cinnamon fern / New York fern / Sphagnum (WD7) is a vegetation type found in the Wetlands patch element.

Landscape Composition and Objectives

Landscapes contribute to the maintenance and conservation of native biodiversity. Managing landscapes for biodiversity requires a variety of planning approaches and tools. Sustaining forest composition diversity by reflecting natural patterns of disturbance and succession is one approach that 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.

In the Cape Breton Hills Ecodistrict, gap replacement is considered to be the predominant natural disturbance regime in late successional forests. This type of disturbance pattern is characteristic of tolerant hardwood forests. Openings are subsequently filled with regeneration, creating multi-layer, multi-aged stands.

Fire in Cape Breton Hills 310

Historically fire has played a role in forest succession in portions of Cape Breton Hills, although confined mainly to the ridge tops where softwood stands dominate the landscape. The tolerant softwood patches along the ridge tops of Kellys Mountain, for example, show evidence of past fire events. Land-clearing fires of the early settlers also contributed to the fire history of the area.

More recently, the majority of the fires have occurred on the eastern side of the ecodistrict close to the urban centre of Sydney. Most fires currently are generally confined to small areas.

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 / Old Forest Policy)

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 (see 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)

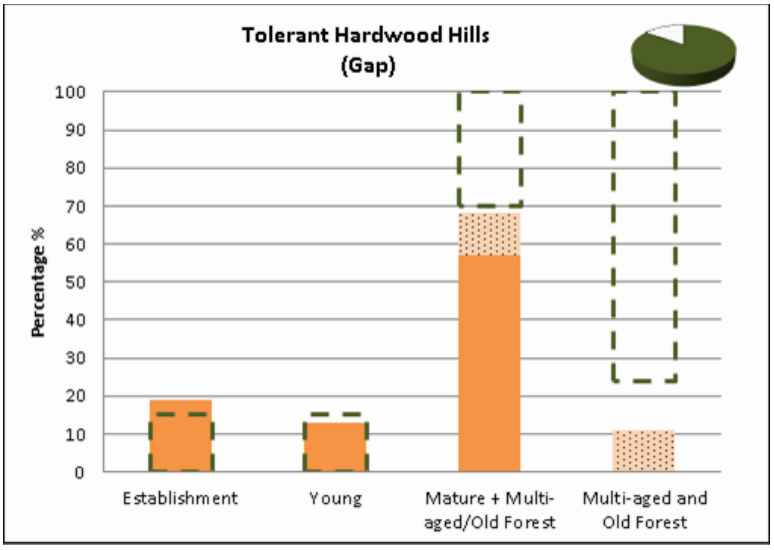
Natural Disturbance Regime	Development Class			
	Forest Establishment	Young Competing Forest	Mature Forest (including multi-aged and old forest)	Multi-aged and Old Forest
Frequent Stand Initiating	5 - 30%	5 - 30%	>40% early, mid, and late seral representation	>8%
Infrequent Stand Initiating	5 - 20%	5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

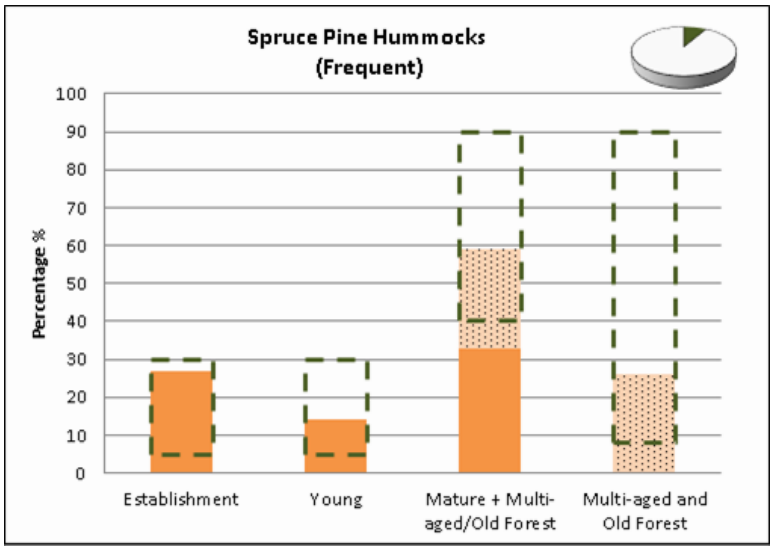
Development Class Targets by Element

A 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.

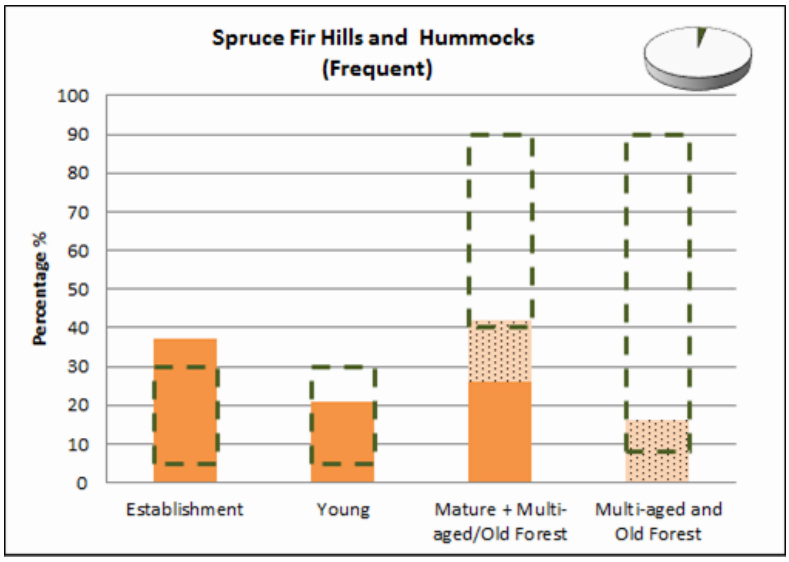
In the matrix element **Tolerant Hardwood Hills**, mature and old forest classes are below target levels. The establishment class is slightly above its target. Continuing harvest of mature forests can use partial harvesting techniques consistent with gap disturbance ecology to maintain mature forest conditions and promote multi-aged forests.



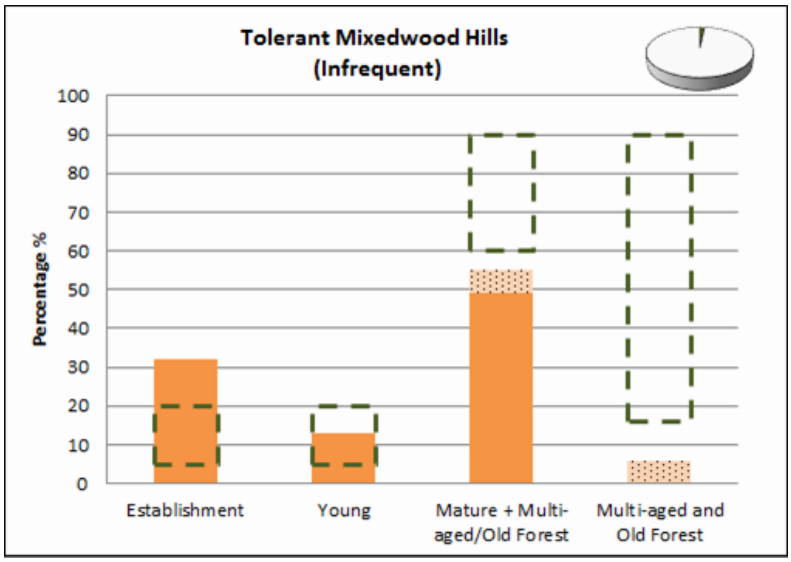
In the patch element **Spruce Pine Hummocks**, all of the development classes are within their target ranges. These frequent natural disturbance regime forests support periodic stand-initiation events that favour establishment of an even-aged forest, often with scattered surviving mature pine that provide large seed trees and super canopy structure.



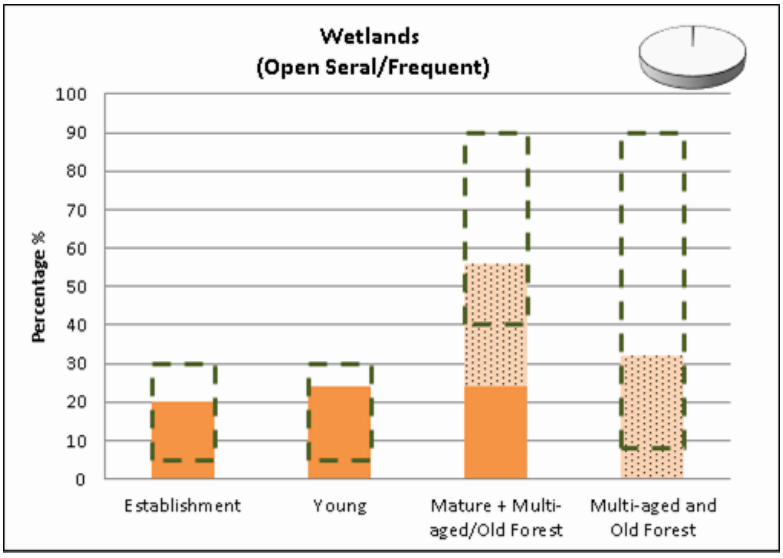
In the **Spruce Fir Hills and Hummocks** element, harvesting is pushing the area of immature forests close to the maximum desired level. Extending the rotation age of healthy spruce and fir forests can be used to maintain mature cover. Forestry practices involving partial harvests are limited due to shallow rooting of spruce and fir on the dominant moist soils of this element.



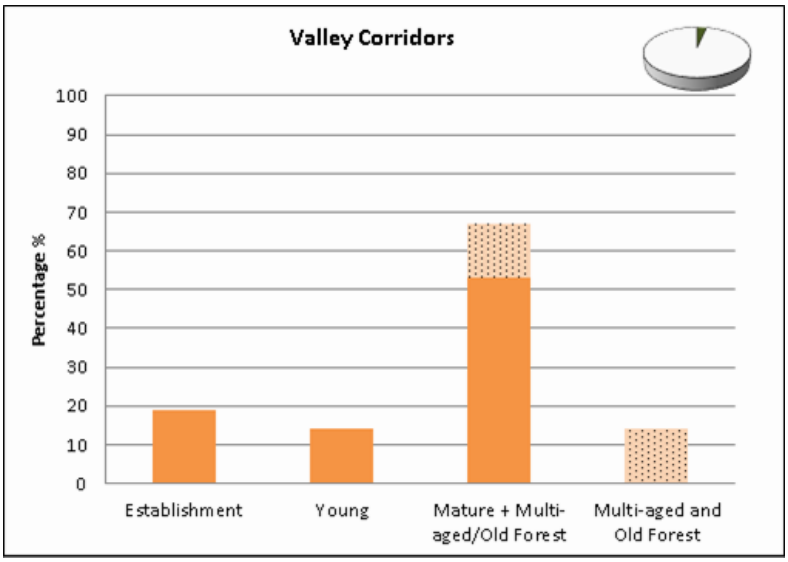
The **Tolerant Mixedwood Hills** patch element has excessive establishment stage forest and is below desired levels of mature and multi-aged habitat. Partial harvests to favour climax species and retain large old trees, will promote multi-aged forest and maintain mature conditions. Managing immature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



The **Wetlands** element, which has an open seral/frequent disturbance regime, is within the target ranges for all classes. This element is often variably composed of forest, interspersed with woodlands and open wetlands. Disturbances are often patchy, reflecting the diverse structure. Small patch harvesting following natural boundaries is appropriate.



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 and stability along these linear riparian features. Small disturbances will support development of establishment and young forest habitats.



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 growth. Mature forests include multi-aged and old growth. 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 growth.
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 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 land base designated under the Wilderness Areas Protection Act (e.g. Canso Barrens).