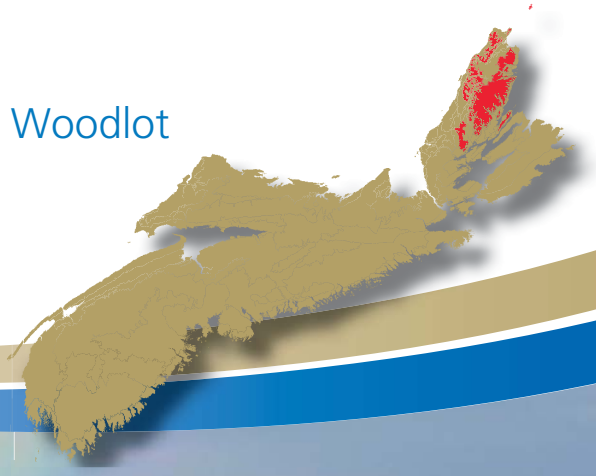
Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS
CAPE BRETON HIGHLANDS ECODISTRICT 210

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



ELA 2015-210

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 210: Cape Breton Highlands

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This report, one of 38 for the province, provides descriptions, maps, analysis, photos and resources of the Cape Breton Highlands 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 2015-210

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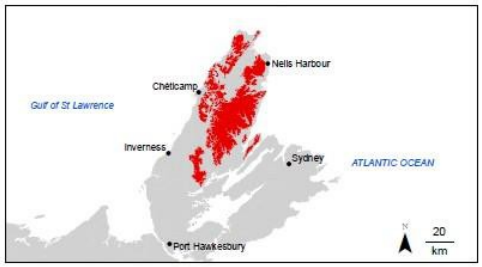


An objective of ecosystem-based management is to manage landscapes in as close to a natural state as possible. The intent of this approach is to promote biodiversity, sustain ecological processes, and support the long-term production of goods and services. Each of the province's 38 ecodistricts is an 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 Highlands Ecodistrict 210. 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.

Cape Breton Highlands is the forested region of northern Cape Breton Island and generally includes the plateau and its rolling topography of hummocks and hills. Total area is 185,101 hectares.

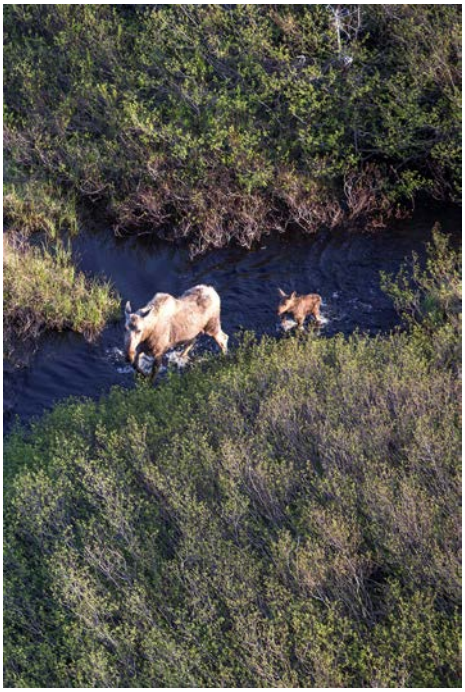
The ecodistrict is covered by an almost unbroken forest of balsam fir, spruce, and white birch. Cape Breton Highlands also includes the shoulder of the plateau where hardwood forests on steep slopes meet the balsam fir forests of the plateau. Barrens and wetlands are dispersed throughout and the headwaters of the island's major rivers – such as the Margaree, Aspy, and Baddeck – start their descent down the escarpment through steep ravines.

The ecodistrict has cold, late springs, heavy snowfalls and parts of the highlands receive some of the highest winds in the province.

The most predominant physical feature occurring within the ecodistrict is the Aspy Fault which is easily seen in satellite imagery. The location of this fault is defined by a straight escarpment that crosses Cape Breton Highlands and influences the position of the Aspy and Margaree river valleys. The oldest rocks in Nova Scotia are found in the northwestern area of the ecodistrict.

The Cape Breton Highlands Ecodistrict includes 73,143 hectares of designated provincial and federal protected areas, or nearly 40% of the ecodistrict. Provincial protected areas, representing 38,851 hectares, include all or portions of several wilderness areas and Cape Smokey Provincial Park.

Federal protected areas of 34,292 hectares include a major part of the Cape Breton Highlands National Park.



Moose populations have significantly increased since the spruce budworm epidemic in the late 1970's. Young regenerating balsam fir has been their main food source.

The Cape Breton population of the American marten and Canada lynx, both listed as at risk and endangered in Nova Scotia, can be found in low numbers in some parts of the ecodistrict.

The most common disturbance agents associated with Cape Breton Highlands are insects – particularly the spruce budworm – and wind storms. Fire has also played a role within the Cape Breton Highlands National Park.

Following the spruce budworm epidemic, extensive even-aged forests of balsam fir have re-established on the rolling topography of the Cape Breton Highlands.

One of the unusual aspects of the ecodistrict is that it has the largest percentage of land base as protected area in the province. Provincial Crown or federal ownership together account for 94% of the ecodistrict. Private landowners occupy only 4% with the remaining lands in other uses.

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 Cape Breton Highlands.

Highland Fir Spruce, representing 77% of the ecodistrict area, is the matrix element. This is primarily a boreal softwood forest dominated by balsam fir, with scattered black spruce and white spruce. The element also includes a transitional mixedwood forest of yellow birch and balsam fir, which occurs where the hardwood forests of the slopes meet the softwood forests of the plateau.

This ecodistrict includes an unusual patch element, known as **Rockland**, consisting of extensive areas of exposed bedrock, mainly on the eastern side of the ecodistrict. The main tree species here are slow-growing balsam fir, black spruce, larch, and white birch.

The other patch elements are **Highland Mixedwood,** a mixedwood forest of balsam fir and white birch with scattered white spruce and red maple, **Highland Barrens**, which commonly comprises stunted forests along with heath barrens, and **Wetlands**, usually located near headwaters of brooks and rivers.

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

Forest Ecosystem Management
For Cape Breton Highlands 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 Cape Breton Highlands Ecodistrict 210. 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 Highlands 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 Highlands – *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 185,101 hectare Cape Breton Highlands Ecodistrict is part of the Cape Breton Highlands Ecoregion, which extends from the waters of the Cabot Strait to the mountains east of Lake Ainslie. The elevation for most of the ecodistrict is between 300 and 450 metres.

The underlying strata are belts of gneissic, metasedimentary, metavolcanic and igneous rocks. The faulting and uplifting of this strata has resulted in a plateau characterized by gently rolling hills which trend toward the steep slopes of the plateau. This results in a low gradient drainage pattern that generally radiates out from the centre of the plateau. Where watercourses flow near the edge of the plateau, they become deeply incised into the slopes resulting in steep narrow gorges and numerous waterfalls.

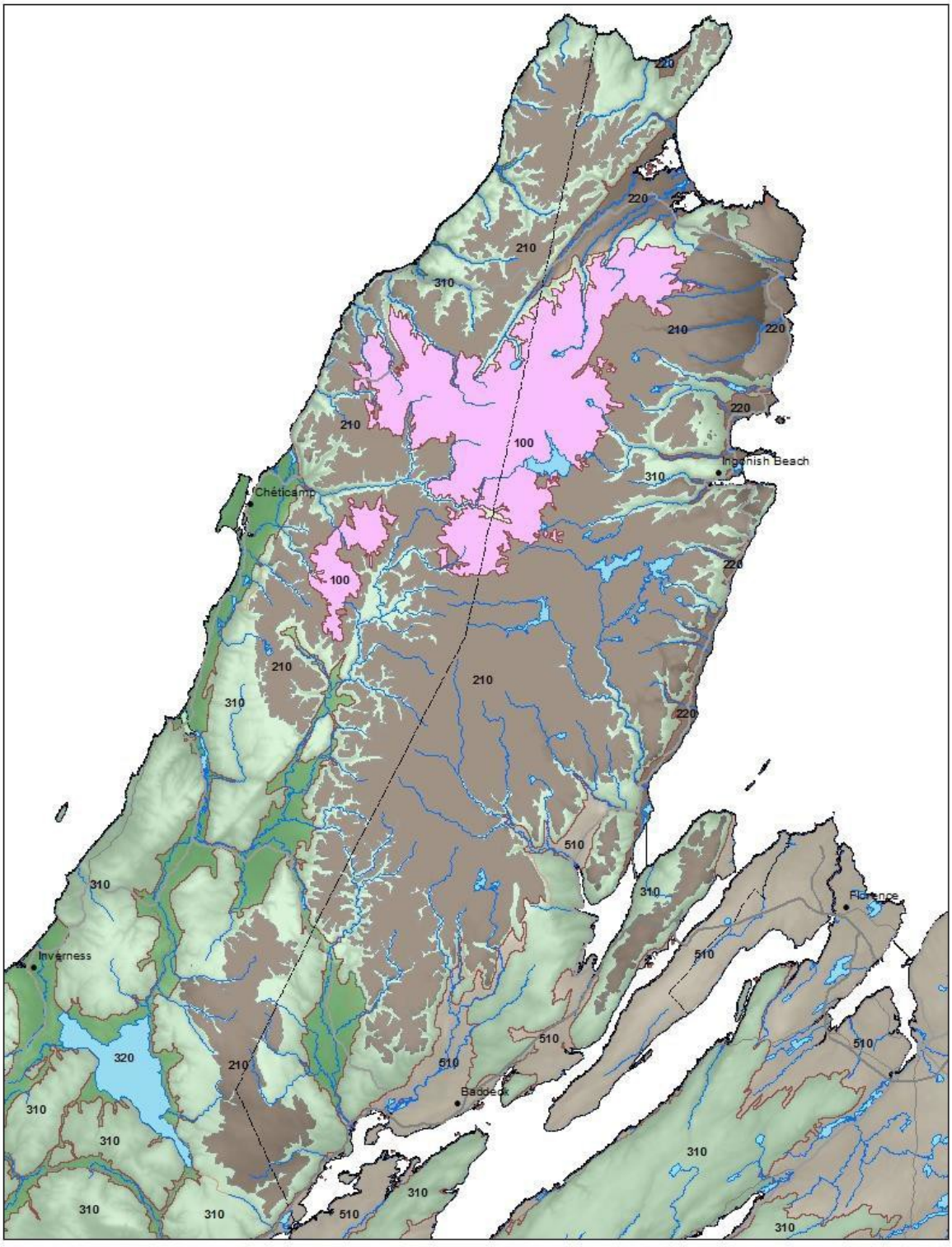
The overlying soils of the plateau are influenced mainly by weathered bedrock and a discontinuous veneer of moderately coarse-textured glacial till and are best described as well-drained, moderately course-textured soils. Most of the soils would be considered stony yet fertile enough for the growth of forest species adapted to the area.

The majority of the plateau is covered in a boreal fir spruce forest dominated by balsam fir, with lesser amounts of black spruce, white spruce, white birch, and yellow birch on the well-drained sites. Poorly drained forested sites are characterized by black spruce and eastern larch.

A significant highland forest type occurs where the plateau boreal forest of fir meets the Acadian Forest hardwoods of the steep slopes, creating a transitional mixedwood forest of yellow birch and balsam fir.

The dominant natural disturbance on the plateau is from insect infestation with eastern spruce budworm being the major defoliator of the balsam fir-dominated forests. Wind storms and fire have also contributed to the natural succession of this forest.

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



Cape Breton Highlands 210 covers much of northern Victoria and Inverness counties on Cape Breton Island.
(From Ecodistricts of Nova Scotia map 2007 *Revised*)

Land Area

Cape Breton Highlands is one of two ecodistricts in the Cape Breton Highlands Ecoregion.

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

Ownership	Area (hectares)	Percent of Total Area
Provincial Crown land	140,471	75.9
Private	7,226	3.9
Federal	34,297	18.5
Aboriginal	0	0
Other (Includes inland water bodies and transportation corridors)	3,107	1.7
Total	**185,101**	**100**

*Note: Figures may vary slightly from table to table because of rounding, averaging, and overlapping of categories and other factors.

The ecodistrict is rural and almost all of the ownership is either provincial Crown or federal, which together account for 94% of the area (Table 1). Private landowners occupy only 4% of the area, one of the lowest percentages of private ownership in the province.

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 Highlands, the largest category is C2 (82%), followed by C3 (18%) with the remainder in C1.

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	974	0.7
C2 – Multiple and Adaptive Use	114,834	81.7
C3 – Protected and Limited Use	24,663	17.6
Unclassified	0	0
Total	**140,471**	**100**

Forests

Within this ecodistrict, 79% is forested (Table 3). Non-forested land includes barrens, roads, agriculture, and other categories. Wetland accounts for 11% of the area and barrens for 6%.

The current forests contain a distribution among softwood stands (53%), hardwood stands (11%), and mixedwood stands (19%) with 17% unclassified.

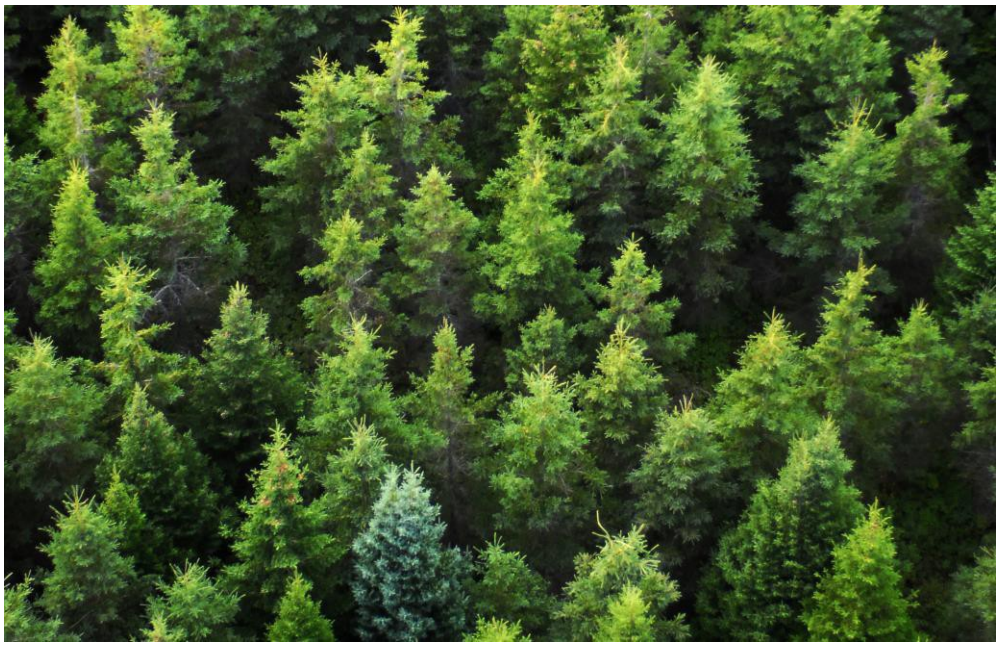
Softwood stands dominate the matrix element of the ecodistrict on the plateau with balsam fir and black spruce being the principal species.

Mixedwood stands dominate the patch elements along the edges of the plateau with a mixture of balsam fir and yellow birch forming important components of these areas.

The ecodistrict includes a transition zone, an informal term used to describe the area where forest conditions blend between the climatic climax Acadian Forest hardwood slopes and the climatic climax balsam fir plateau.

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	145,781	78.8
Wetland	20,128	10.9
Agriculture	24	<0.1
Barrens	11,398	6.2
Urban	37	<0.1
Road, Trail, Utility	69	<0.1
Other	7,663	4.1
Total	**185,101**	**100**



Forests of balsam fir dominate the Cape Breton Highlands Ecodistrict.
(J.-F. Bergeron, Enviro foto)

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 4.7 cubic metres per hectare per year (m^3/ha/yr), based on the ratings in Table 4. The average forest LC for the province is 4.9 m^3/ha/yr.

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	592	0.4
3	11,190	7.6
4	42,390	29.1
5	73,285	50.3
6	13,772	9.4
7 or more	4,552	3.2
Total	**145,781**	**100**

*Based on growth potential for softwood species.

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

The largest landowner in this ecodistrict is the provincial Crown, which owns 76% of the land base.

The areas outside of the protected areas of the provincial Crown are leased to and managed by Stora Enso (*now Port Hawkesbury Paper*) for fibre production for their pulp mill at Point Tupper, Inverness County. Forest management conducted by Stora Enso is reviewed and approved by DNR.

Harvesting and silviculture (e.g. planting and thinning) activities have been carried on by Stora Enso since the early 1960s. The private land portion of the ecodistrict accounts for 4% of the land base. Forest management operations on these parcels are conducted mainly by forest management groups.

Water Resources

The water resources of this ecodistrict consist of the scattered freshwater lakes, numerous upland bogs, and wetlands and abundant rivers and brooks.

The major rivers of the area all find their headwaters in the large raised bogs and scattered lakes of the ecodistrict and the neighbouring Northern Plateau Ecodistrict. These include the Margaree and Chéticamp rivers, which flow into the Northumberland Strait.

The Aspy, Ingonish, Indian, and North rivers flow into the Atlantic Ocean while the Baddeck and Middle rivers flow into Bras d'Or Lake.

The Chéticamp River has its headwaters in the highlands and flows into the Northumberland Strait.

(J.-F. Bergeron, Enviro foto)

The ecodistrict also includes a number of smaller rivers and many brooks which flow into both the Atlantic Ocean and the Northumberland Strait.

Nova Scotia Power Inc. has developed an important hydroelectric project in the Wreck Cove area and has dammed the headwater sections of the Chéticamp River, Indian Brook, Ingonish River, and Wreck Cove Brook. The catchment basin of this project covers an area of 207 square kilometres.

Polletts Cove and Blair rivers flow into Polletts Cove on the western side of the Cape Breton Highlands Ecodistrict. Also shown is the highland plateau and neighbouring Cape Breton Hills Ecodistrict. (J.-F. Bergeron, Enviro foto)

There are no designated water supply areas within the ecodistrict. There are two non-designated water supply areas located at South Aspy River and Indian Brook near Neils Harbour.

Water is an important provincial resource that must be considered in the context of IRM in general, and specifically within individual ecosystems.

The Environmental Goals and Economic Prosperity Act, which was enacted in early 2007, has committed the province to prepare a comprehensive water strategy. This strategy will include a high-level evaluation of water resources. *Nova Scotia's water strategy can be found at http://www.novascotia.ca/nse/water.strategy/docs/WaterStrategy_Water.Resources.Management . Strategy.pdf*

Minerals, Energy and Geology

The Cape Breton Highlands Ecodistrict forms an uplifted peneplain – generally level land produced by long-term erosion – with a maximum altitude of 531 metres. Cape Breton Highlands is characterized by north-northeastward-trending belts of metamorphosed rocks (gneiss, metasedimentary, and metavolcanic) and associated intrusives.

The oldest rocks in Nova Scotia – at 1.4 billion years old – are found in the northwestern area of the ecodistrict, part of the Blair River Complex that consists of metacarbonate, metasedimentary, and igneous intrusive rocks more than 542 million years old.

Sedimentary rocks of the Horton Group overlie significant areas in the southern and southwestern regions of the ecodistrict, as well as localized areas along the ecodistrict's perimeter (e.g. Meat Cove and Polletts Cove). The drainage pattern is generally radial with low gradient streams in the middle of the plateau. Near the margins of the plateau, streams are deeply incised with many gorges and extensive waterfall sections.

Faulting has defined the straight sides of the highlands on the east and west, influencing the angular drainage patterns of many rivers and streams. The two main fault directions are north-northeast and west-northwest, with the former predominating. The principal fault in the Cape Breton Highlands is the Aspy Fault. The escarpment associated with the Aspy Fault continues for 40 kilometres into the highlands as a line of river valleys.

The surficial geology of the Cape Breton Highlands is variable. Significant areas are dominated by weathered, exposed bedrock overlain by a discontinuous veneer of till. Glacial till covers much of the area south of Ingonish, along the eastern side of the highlands. Colluvial deposits (mixture of glacial deposits, weathered and frost shattered rock and soils) cover steep valley walls.

Unconsolidated granular aggregate has been extracted at a number of locations, especially in the Margaree, Dingwall, and Pleasant Bay areas. Scattered across the ecodistrict are small organic deposits of sphagnum moss and peat found in swamps and bogs. Several peat moss deposits are present; one is considered significant.

Numerous metallic mineral showings (e.g. gold, copper, lead, iron, arsenic, zinc, silver, nickel, molybdenum and cobalt) occur within the ecodistrict. Mineral exploration dates back to the late 1800s. Shafts and adits were driven on the more promising showings, resulting in about 35 documented abandoned mine openings (AMOs). Undocumented AMOs may exist.

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

The Meat Cove zinc deposit is estimated to have a resource of 4 million tonnes. The geology of the Cape North peninsula represents potentially favourable environments for sulphide mineralization and contains approximately 30 minor metallic and related mineral showings. Irregular copper and iron mineralization occurs in an area west of Ingonish.

A zone of gold-silver-copper-lead-zinc-nickel mineralization stretches from Chéticamp to Middle River. This mineralized zone includes the Chéticamp and Middle rivers gold districts as well as mineral showings at Daphiné, Rocky and Campbell brooks, and Trout Lake. The Middle River Gold District produced approximately 42,524 grams (1,500 ounces) of gold. Numerous gold showings occur west and south of McMillan Flowage. Irregular copper, molybdenum, silver, and gold mineralization occurs in the Murray Mountain area.

Barite and fluorite were historically mined east of Lake Ainslie; remaining resources are estimated at 4.3 million tonnes. Unexplored mineral occurrences and deposits may exist within the ecodistrict. Currently, there are no active mines in the Cape Breton Highlands Ecodistrict.

The sedimentary rocks of the Carboniferous Period – about 300 to 360 million years ago – are targets for oil and gas exploration. The southern portion of the ecodistrict, underlain by Carboniferous strata, is currently held under petroleum agreements.

Intrusive rocks, particularly those close to tidewater, are potential sources of aggregate materials for local and export markets. Several quarries were developed in granitic bedrock to serve local markets (e.g. Wreck Cove, Pembroke Lake, Neils Harbour, and Smokey Mountain).

The building of a sluiceway for the McMillan Flowage, part of the Wreck Cove hydroelectricity project.

Several of the areas considered to have high to intermediate geological value occur within the Cape Breton Highlands National Park and/or provincial wilderness areas. These areas are currently closed to mineral and petroleum exploration and development and include: Meat Cove zinc deposit; southern portion of the Cape North peninsula; Clyburn Brook gold showing; northern half of the mineralized area west of Ingonish; northern portion of the Chéticamp to Middle River mineralized zone; a significant portion of the Chéticamp Gold District; Middle River Gold District; and Trout Brook Wilderness Area (hydrocarbon potential).

Parks and Recreation / Protected Areas

In the Cape Breton Highlands Ecodistrict and also in the adjacent Northern Plateau Ecodistrict, the vast majority of the land base is publicly owned. Provincial and federal lands account for 174,767 hectares, or 94% of Cape Breton Highlands.

Provincial protected areas include all or portions of the Middle River Wilderness Area, Margaree River Wilderness Area, Polletts Cove - Aspy Fault Wilderness Area, French River Wilderness Area, North River Wilderness Area and the Cape Smokey Provincial Park.

Portions of three International Biological Program (IBP) sites are also located within the provincial Crown land of the ecodistrict.

Total provincial Crown protected areas, including old forests, account for 38,851 hectares.

Federal protected areas account for 34,292 hectares of the ecodistrict and are all included within the Cape Breton Highlands National Park. Within the area of the national park, provincially recognized IBP sites are also located.

Scenic views, such as this one overlooking Pleasant Bay, are among the recreational attractions of Cape Breton Highlands.

(J.-F. Bergeron, Enviro foto)

The Cape Breton Highlands Ecodistrict has the largest percentage of its land base as protected area in the province and therefore provides one of the best wilderness recreation opportunities in the Nova Scotia.

The ecodistrict is part of a nationally significant tourist destination (i.e. The Cabot Trail and Cape Breton Highlands National Park).

Traditional outdoor recreation activities including hunting, fishing, and snowmobiling, which are common throughout the ecodistrict, outside of the protected areas.

Recreational fishing occurs mainly in the impoundment areas of the Wreck Cove hydroelectric project and the larger natural lakes of the ecodistrict, such as Timber Lake, Trout Lake, and Big Lake.

Small game hunting is also popular throughout the ecodistrict where road access is available. Snowshoe hare and ruffed grouse are the main species of interest.

Big game hunting is focused mainly on the moose herd, with Cape Breton Highlands experiencing most of the moose hunting activity occurring in the province. Both a provincial licensed hunt (chosen by lottery) and a traditional First Nations hunt occur.

Snowmobiling is popular in the southern two-thirds of the ecodistrict. The high elevations allow for deeper snow loads and longer winter season conditions compared to the remainder of the province. A well-organized system of groomed trials is maintained by the Crowdis Mountain, Margaree, and Chéticamp snowmobile clubs. These trails form part of the provincial network established under the auspices of the Snowmobilers Association of Nova Scotia (SANS).

Hiking is a popular activity, especially in the protected areas of the ecodistrict. The Cape Breton Highlands National Park maintains a system of front country and back country hiking trails providing both interior and coastal hiking experiences.

Other recreational activities such as mountain biking and ATV riding are increasing in popularity.

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 Highlands 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 Highlands 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 bythe 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.

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 overharvesting for commercial and subsistence purposes, the population was in serious decline. Moose appear 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 southward and into the lower areas of the island. There are 12 moose wintering areas noted in the ecodistrict. 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 over a number of years.

Since their re-introduction to Cape Breton in the late 1940s, moose populations have grown in the ecodistrict. (J.-F. Bergeron, Enviro foto)

Deer were abundant on the highlands during the 1950s, 1960s, and early 1970s.

Areas known as moose meadows, where moose have grazed young fir trees, are common in the Cape Breton Highlands Ecodistrict. (Envirofoto)

At present, deer numbers are very low as they are throughout the rest of the island. There are four deer wintering areas located in the areas of Pleasant Bay, North Shore, Big Intervale, and Ingonish. Guidelines are in place for conducting forest management in or around these areas to help preserve their function.

The Cape Breton population of the American marten, listed as at risk and endangered in Nova Scotia, can be found in low numbers in some of the mature and over-mature softwood or softwood-dominated mixedwood areas in the ecodistrict. Population estimates put the marten population at fewer than 50 animals remaining on the island.

The American marten, an endangered species in Nova Scotia, is found in the Cape Breton Highlands Ecodistrict.

A provincial marten recovery team has a recovery plan in place. Among the items that the plan proposes is augmenting the present population with animals live-trapped from other jurisdictions.

The plan has special management practices for developing and maintaining marten habitat, including a Marten Habitat Management Zone (MHMZ). Within the zone or in close proximity, 53 home ranges have been identified. Of these, 28 will be suitable habitat by 2019 and the rest by 2030. These patches are a minimum of 500 hectares in size, circular shaped, contain a minimum of 60% (300 ha) marten habitat and the areas may migrate over time and space. The objective is to produce at least 50,000 hectares of marten habitat in the highlands and lowlands of Cape Breton in the future.

The Canada lynx, listed as at risk and endangered in Nova Scotia, is also a resident of the highland plateau and several other upland areas 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: bobcat and coyote.

The lynx population size tends to follow the cycle of its main prey, the snowshoe hare. As hare population size decreases, so does the lynx population size. At present, the population of hare seems to be on the increase and so an increase in lynx numbers is expected to follow.

There is a provincial lynx recovery team is place developing a lynx recovery plan that should aid in maintaining the long term viability of the population.

The Canada lynx, another endangered species in Nova Scotia, is found in the ecodistrict.

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.

Loons have been recorded breeding at several lakes. There are several eagle nests and a few osprey nests along the slopes of the plateau in the ecodistrict although eagles tend to nest along the shores of Bras d'Or Lake. Some of the steep shoreline cliffs of the ecodistrict provide nesting areas for cormorants and gulls. The spruce grouse can be found in much of the ecodistrict's forested area.

The ecodistrict boasts many rare and unique plants due mainly to its altitude and climate. As a result, the area acts as a refuge for several rare arctic and boreal cordillera plants. An example of such a site would be the Corney Brook area where purple alpine saxifrage, yellow mountain saxifrage, small flowered wood rush, giant rattlesnake plantain and northern bedstraw can all be found in a relatively small area.

The wetlands form the headwaters of some of the best salmon streams in the province, such as the Margaree, North, Baddeck, and Middle rivers. Many of the lakes in the ecodistrict have healthy populations of brook trout that support a recreational fishery.

A large portion of the habitat in the ecodistrict is protected through the national park, provincial parks, provincial wilderness areas, IBP sites and government policies like the Nova Scotia Old Forest Policy.

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

Cape Breton Highlands– 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.

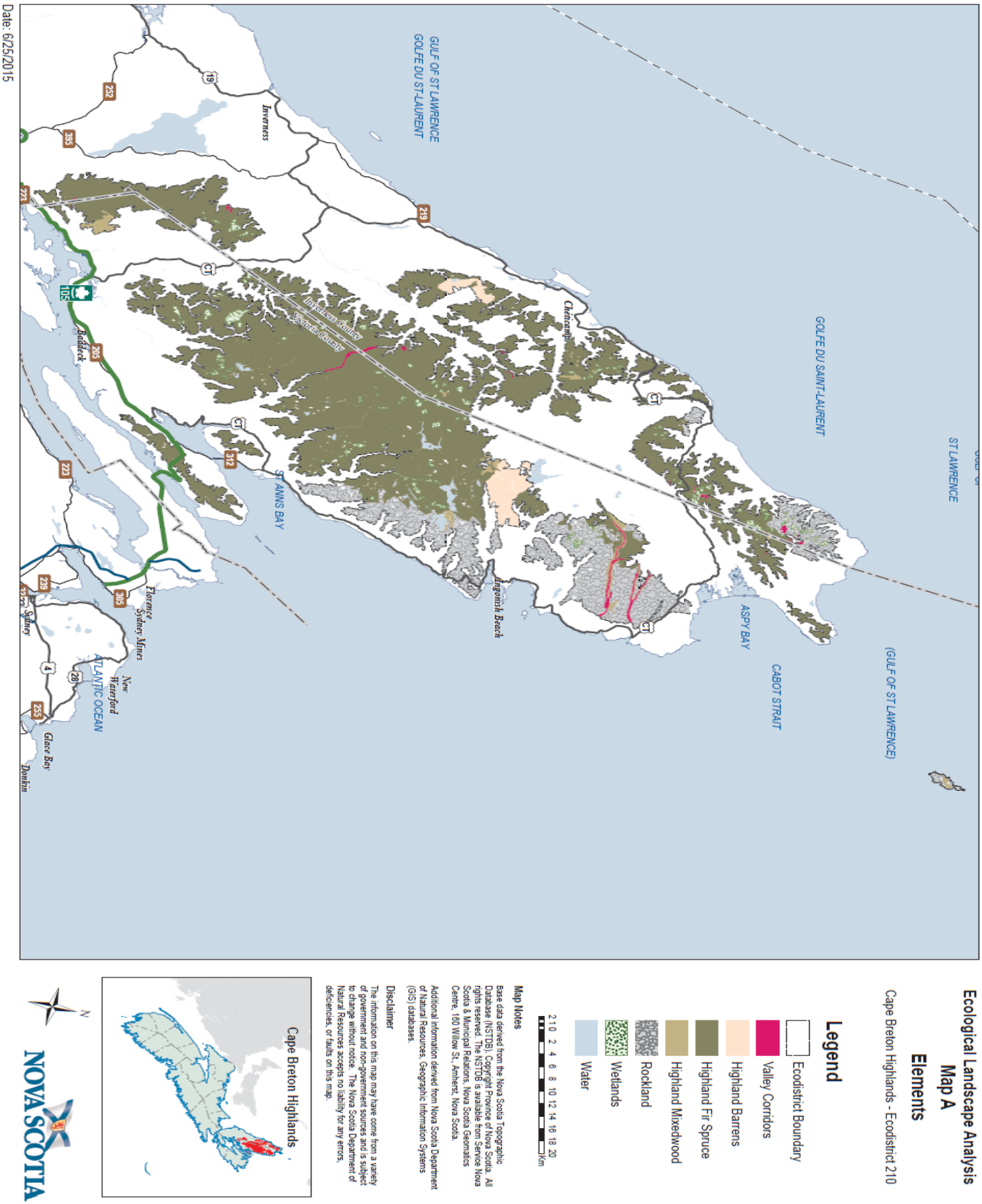
A landscape profile identified and mapped six distinctive elements in the Cape Breton Highlands Ecodistrict – one matrix, four patches, and a corridor (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types. Corridors are natural linear communities,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

Highland Fir Spruce, representing 77% of the ecodistrict area, is the matrix element. This is primarily a boreal softwood forest dominated by balsam fir, with scattered black spruce and white spruce. The element also includes a transitional mixedwood forest of yellow birch and balsam fir, which occurs where the hardwood forests of the slopes meet the softwood forests of the plateau.

This ecodistrict includes an unusual patch element, known as **Rockland**, consisting of extensive areas of exposed bedrock, mainly on the eastern side of the ecodistrict. The main tree species here are slow-growing balsam fir, black spruce, larch, and white birch.

The other patch elements are **Highland Mixedwood,** a mixedwood forest of balsam fir and white birch with scattered white spruce and red maple, **Highland Barrens**, which commonly comprises stunted forests along with heath barrens, and **Wetlands**, usually located near headwaters of brooks and rivers. **Valley Corridors** is a linear element associated with major watercourses.

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.

Yellow and white birch are among the hardwood species found in the Cape Breton Highlands Ecodistrict.

Table 5a – Elements Within Cape Breton Highlands		
Element	**Size (Hectares)**	**Element Description**
Highland Fir Spruce (Matrix)	139,618 76.7%	An unbroken forest of balsam fir with white spruce covers most of the rolling topography of the Cape Breton Highlands Ecodistrict and is reflected in Highland Spruce Fir, the matrix element in the ecodistrict. Black spruce can be found on moist riparian soils and shallow stony soils over bedrock. White birch follows stand-level disturbances and a few remain as remnants in mature stands of fir. Occasionally a few large mountain ash will make it into the canopy. Due to the significant influence of climate, this element can be quite variable in terms of stand quality. Typically, it occurs on well to imperfectly drained medium-textured soils derived from glacial tills. The cool, moist climate slows decomposition rates resulting in sites with unusually thick duff layers. Coarse woody debris loads are among the highest for any forested element in Nova Scotia due to the frequent stand-level disturbances and slow decomposition. Wind and exposure significantly limit tree growth with most stands less than 15 metres in height. White spruce is second in importance in this element but only approaches the balsam fir in abundance on steeper slopes. seedbed conditions seem to favour establishment of white spruce with stands having similarities with those establishing on abandoned farmlands. A significant transitional forest occurs in this element where forest conditions blend between Acadian hardwood slopes and the balsam fir plateau. On the perimeter of the plateau, a mixedwood forest of yellow birch and balsam fir occurs on well-drained, nutrient medium to rich loams and sandy loams. In this forest two development classes are usually present, an older yellow birch cohort and a younger balsam fir cohort. The longevity of the fir is dependent on the spruce budworm cycle. The yellow birch can achieve old growth age. On similar sites, a white birch yellow birch hardwood forest may also develop.
Rockland (Patch)	29,584 16.2%	Over a large part of the eastern plateau the bedrock is covered by a thin soil and a noticeable reduction of the Highland Fir Spruce forests. These areas, part of the Rockland element, have been described as granite ledges deeply cracked by glaciation and frost where crumbling rock is sometimes found. Denuded hilltops with exposed granite, diorite, and gabbro bedrock and large boulders define a rugged landscape. Woody heath-like shrubs are the prevailing vegetation and in the heath, lichens – most notably various reindeer mosses – are conspicuous. Sedges, grasses, shrubs, and severely stunted trees are less prominent. The Highland Fir Spruce element occurs where soils are deeper and conditions less severe, such as sheltered aspects and swales. The Rockland element is a large patch within the ecodistrict but given its localized extent and prominence it has matrix level landscape characteristics. The Highland Barrens element is well represented within this complex and extensive areas of dwarf shrubs, stunted Spruce, and krummholz – stunted forest growing on exposed slopes – are prominent. Forest productivity in this element is extremely low and very few areas would have forests of commercial quality. Wildlife habitat values are likely to be more noteworthy and at one time included the now extirpated woodland caribou.

Table 5a – Elements Within Cape Breton Highlands		
Element	**Size (Hectares)**	**Element Description**
Highland Barrens (Patch)	4,708 2.6%	This element is best described as a complex of well-drained and poorly drained upland sites with bogs and swamps interspersed. Where medium-textured soils are deep, forests of fir and spruce occur. Elsewhere, shallow soils over bedrock give rise to sparsely forested woodlands and/or rockland covered with heath-like shrubs, stunted trees, and reindeer moss. Wetlands tend to be treeless and covered with short woody shrubs and are associated with depressions and small streams slowly wandering over gentle terrain before cascading off the highlands. This element near Pembroke Lake is a mottled landscape of fir forests, barrens, and wetlands. South of the Chéticamp Flowage, rockland and barrens are dominant.
Wetlands (Patch)	3,956 2.2%	This is a patch element comprising freshwater bogs, fens, swamps, and poorly drained areas. Wetlands occurs as a large wetland complex associated with small 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. The plateau wetlands are the headwaters of many of Cape Breton's notable rivers, including the Northeast Margaree, Middle, North, French, Indian Brook, and Baddeck. This element plays a critical role in water collection, filtering, and groundwater recharge.
Highland Mixedwood (Patch)	2,732 1.5%	This is a localized small patch element with variable forest cover responding to microclimate, slope, topography, and soils. On the steep slopes, red maple and white birch take over from the Acadian hardwood forest which has followed these ravines up from the lowlands until climatic conditions have become too cold for their continuation. On the plateau, white birch and yellow birch mix with balsam fir and white spruce on hummocky and ridged terrain that has coarse-textured, well-drained soils of medium to rich nutrient levels. However, the dominant condition is a mixedwood forest of balsam fir and white birch with scattered white spruce and red maple. Similar species follow after stand-level disturbances with balsam fir, usually already established in the understory.
Valley Corridors (Corridor)	1,460 0.8%	A mixture of late seral stage hardwood and softwood stands. Typically, the hardwood stands are located on the steeper slopes while the softwood stands are found more toward the headwaters of the patches. These corridor areas typically are located along the major watercourses of the ecodistrict and are an important component for travel of many species. Current conditions of the corridors have been influenced by past insect and disease outbreaks. Eastern spruce budworm, birch dieback, and beech canker have been the main influences over the past two rotations and have resulted in a gap disturbance regime.
Total	**182,058***	*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 Highlands

Element	Seral Stage			
	Early - Middle	%	Late	%
Highland Barrens	OW2, SP6, SP7	30	**HL1,** SP5	49
Highland Fir Spruce	HL1a, HL2	27	**HL1,** HL3, HL4	58
Highland Mixedwood	MW4, MW5, HL1a	22	**HL1,** HL3, HL4	57
Rockland	OW1, OW2, OW3, OW6			
Wetlands	WC1, WC2, WC6, WC7, WD2, WD3, WD6, 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.

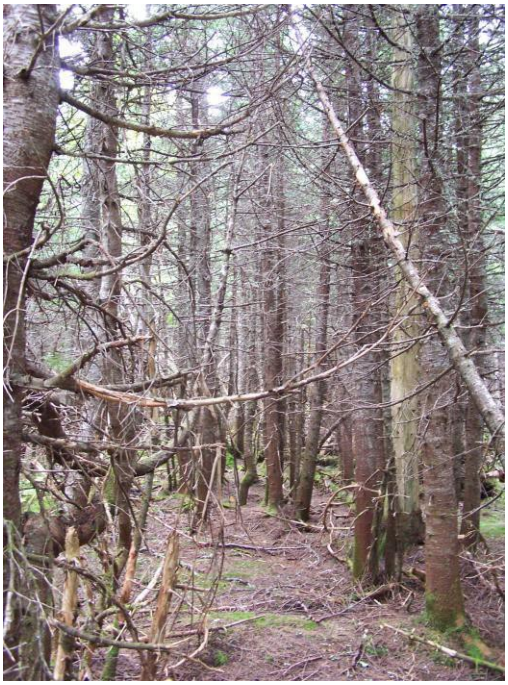
Photos Illustrating Vegetation Types in Elements

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

Black spruce / Lambkill / Reindeer lichen (OW2) is a vegetation type found in the Rockland element.

Balsam fir / Mountain- ash / Large-leaved goldenrod (HL1) is a late successional vegetation type found in the Highland Fir Spruce matrix element.

An old forest part of a Birch – Wood fern – Wood sorrel (HL4) late successional vegetation type is found in the Highland Mixedwood patch element.



Balsam fir / Mountain-ash / Large-leaved goldenrod (HL1) is a late successional vegetation type found in the Highland Barrens patch element.

Black spruce / Cinnamon fern / Sphagnum (WC1) 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 Cape Breton Highlands, frequent stand-initiating disturbances are the predominant natural disturbance shaping the diversity of forest ecosystems. These disturbances occur frequently enough that there is a rapid mortality of an existing stand and quick establishment of a new stand of relatively even age.

The disturbance agents on the Cape Breton Highlands associated with frequent disturbances include insects, wind and, to a lesser extent, fire. The forest ecosystems that arise from these disturbance agents are softwood forests of balsam fir and white birch.

There is evidence that fire has played a role within the ecodistrict. Ecologists with the Cape Breton Highlands National Park report that up to 20% of the park has evidence of past fire events.

Budworm infestation

The eastern spruce budworm is the most damaging reoccurring insect pest within the ecodistrict. During the mid-1970s a large outbreak of this insect devastated the mature balsam fir and white spruce across Cape Breton Highlands. On the provincially owned Crown lands, large salvage operations harvested many of the dead trees for use at the pulp and paper mill in Port Hawkesbury.

Forest management efforts since the infestation of the 1970s have attempted to reduce the impact of future budworm epidemics by diversifying both species and development classes. Following the salvage of stands killed by the budworm, many stands were replanted with white and black spruce. These two species are less susceptible to budworm due to their later bud break.

Currently, harvesting of young fir stands is putting more area into the establishment development class. It is anticipated younger forests will be less susceptible to the budworm.

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 (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)

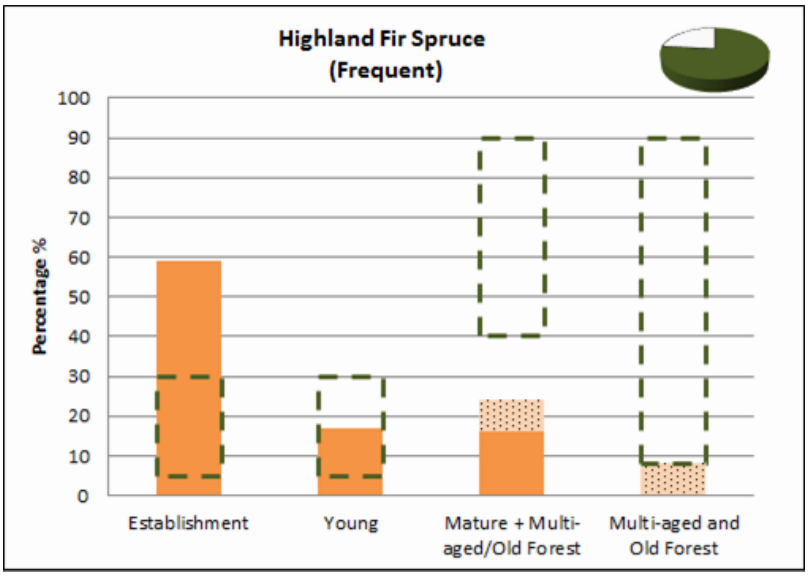
Natural Disturbance Regime	Development Class			
	Forest Establishment	Young Competing Forest	Mature Forest (including multi-aged and old forest)	Multi-aged and Old Forest
Frequent Stand Initiating	5 - 30%	5 - 30%	>40% early, mid, and late seral representation	>8%
Infrequent Stand Initiating	5 - 20%	5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

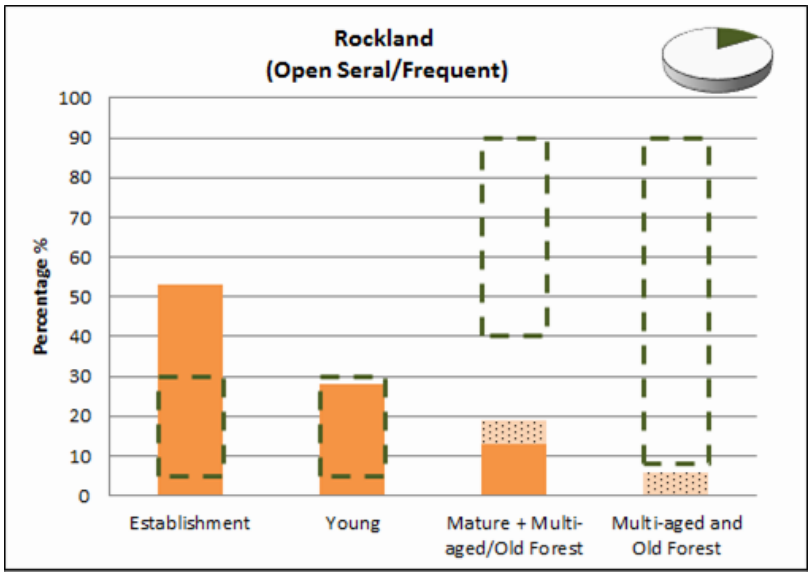
Development Class Targets by Element

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.

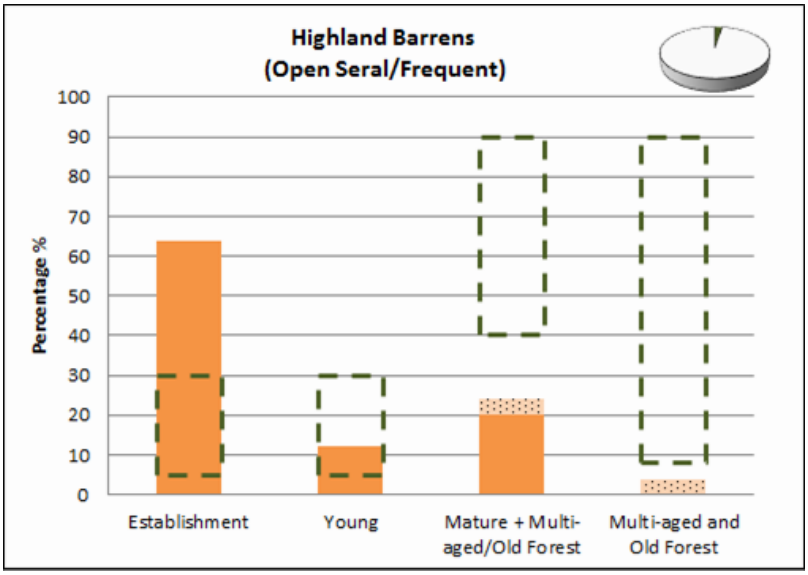
In the **Highland Fir Spruce** element, due to forest management strategy and the extensive browsing of regenerating fir by moose, almost 80% of the element is in the establishment and young development classes. Pre-commercial thinning and partial harvesting can be used to speed up diameter growth and other older forest attributes.



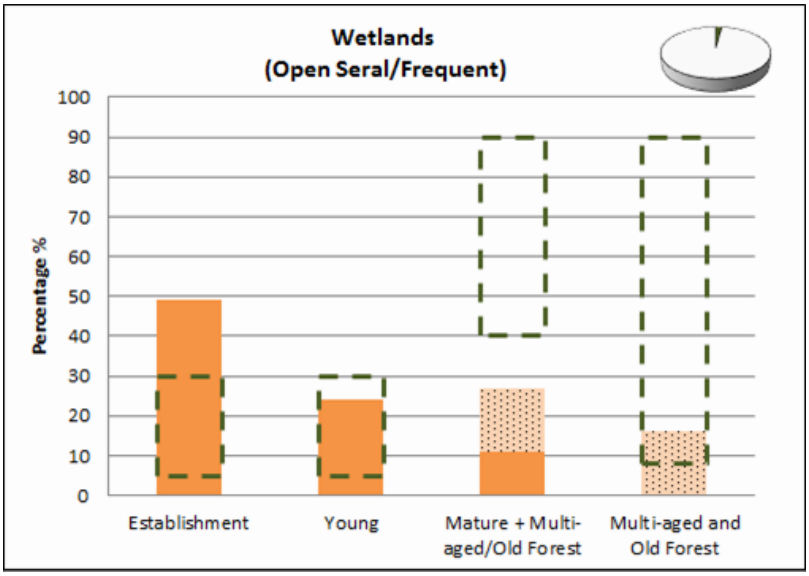
Much of **Rockland** element is not operational for forestry due to low stand volume and site productivity. Extensive moose browsing of regenerating fir has been the primary contributor to the large area in the establishment development class. A large percentage of this element occurs in Cape Breton Highlands National Park.



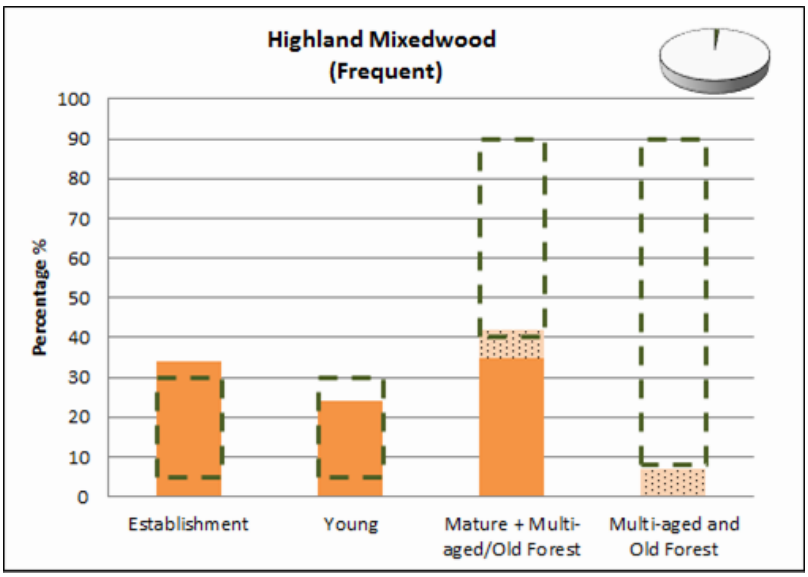
A complex of operable and inoperable site and stand conditions limit forest management options in the **Highland Barrens** element. With almost 65% of the element in the establishment development class and low site productivity, forestry will have limited opportunities to influence landscape structure.



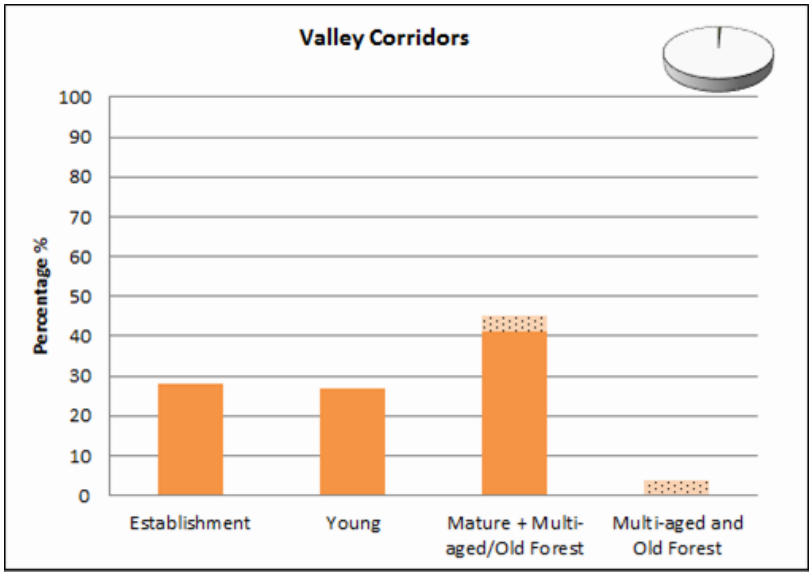
The **Wetlands** element has limited forest management opportunities due to the extensive area of treeless bogs and wet forests associated with streams. Embedded forests of fir and spruce can be managed in a similar manner as the Highland Fir Spruce.



Steep slopes restrict forest management options in much of the **Highland Mixedwood** element. Where topography is less severe forestry can follow a similar approach as would be employed in the Highland Fir Spruce element.



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.



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 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).