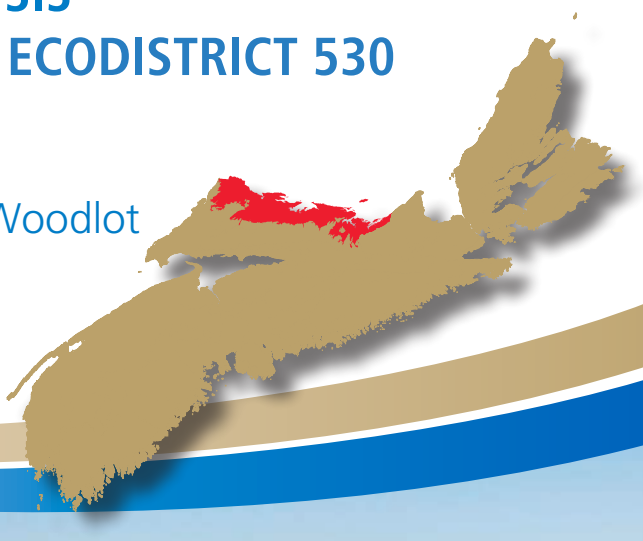
Department of Natural Resources

ECOLOGICAL LANDSCAPE ANALYSIS
NORTHUMBERLAND LOWLANDS ECODISTRICT 530

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



ELA 2015-530

NOVA SCOTIA

Ecological Landscape Analysis, Ecodistrict 530: Northumberland Lowlands

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This report, one of 38 for the province, provides descriptions, maps, analysis, photos, and resources of the Northumberland Lowlands 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 (1995) – 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 2015-530

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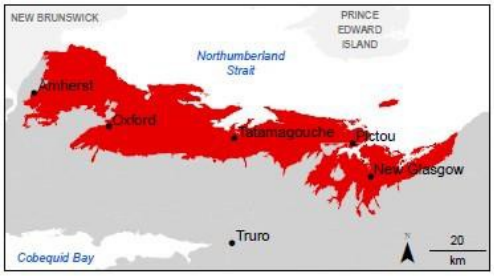


Ecodistrict Profile

Ecological Landscape Analysis Summary
Ecodistrict 530: **Northumberland Lowlands**

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

This Ecological Landscape Analysis (ELA) provides detailed information on the forest and timber resources of the various landscape components of Northumberland Lowlands Ecodistrict 530. 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.

This low plain area in northern Nova Scotia, where elevations rarely exceed 50 metres, follows the Northumberland Strait coastline from the New Brunswick border in the west to northeastern Pictou County. The ecodistrict is bordered on the south by the Cobequid Mountains, Pictou Antigonish Highlands, and the Cumberland Hills.

The ecodistrict has a significant moisture deficit during the growing season, second only to the Annapolis Valley.

Mixedwood forests of aspen, spruce and red maple cover the hummocky topography along the Northumberland Strait near Wallace Bay, Cumberland County. Many wetlands associated with estuaries of major rivers are important migratory bird areas.

Twenty-one rivers are found in the ecodistrict, most of which flow in a northeast direction, emptying into the Northumberland Strait through numerous saltwater harbours. Freshwater in lakes and rivers comprise only 1.6% of the ecodistrict.

The surficial till of the ecodistrict is derived from the underlying Carboniferous sedimentary rocks. The most prominent of these are the fine red sandstones, siltstones, and shales that are conspicuous on the cliffs along the Northumberland shore. Scattered throughout the ecodistrict are deposits of coal, gypsum, and salt.

Quarrying of building stone has been an important industry since the 1800s. The famous Wallace Quarries supplied sandstone for some of the most important buildings in North America, including Province House in Halifax, Confederation Building in Charlottetown, and the Parliament Buildings in Ottawa.

The ecodistrict is dominated by coniferous forest, with black and red spruce the main species. Following a disturbance, either by natural causes or forest harvesting, sites are usually invaded by early successional species such as balsam fir, red maple, white birch, grey birch and aspen, both trembling and largetooth.

The better-drained, upper slopes and hilltops of the ecodistrict will naturally support a forest of tolerant hardwoods but these are uncommon. Eastern white cedar is found scattered throughout the ecodistrict, most notably near Oxford and Pugwash, on poorly and imperfectly drained soils.

Private land ownership accounts for nearly 91% of the ecodistrict, which has a total area of approximately 287,000 hectares. Northumberland Lowlands is the largest of the six ecodistricts in the Northumberland / Bras d'Or Ecoregion. Less than 6% of the ecodistrict is under provincial Crown management.

The beaches and coastal flats are important feeding areas for shorebirds, particularly in the spring and fall as they migrate to and from their northern breeding areas.

Cormorants nest on the shore and on piers at the Harvey A. Veniot Causeway in Pictou.

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

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

Spruce Pine Hummocks is the matrix element, representing 49% of the ecodistrict. This element naturally supports a softwood forest of red and black spruce and white pine, but land use and harvesting has left only 40% of the forest with vegetation types comprising these species.

Red Spruce Hummocks, the largest patch element, has had about one-third of its area converted to agriculture and other human uses. Other patch elements, in order of size, are **Tolerant Mixedwood Hills**, **Red and Black Spruce Hummocks**, **Jack Pine Hummocks and Ridges**, and **Wetlands**. *Two other tiny patch elements, Coastal Beach and Salt Marsh, are also found in the ecodistrict.* **Valley Corridors** is a linear element associated with several prominent river corridors in the ecodistrict.

Forest Ecosystem Management
For Northumberland Lowlands Ecodistrict

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

This ELA provides detailed information on the resources and descriptions of various components of the landscape for Northumberland Lowlands Ecodistrict 530. 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 Northumberland Lowlands Ecodistrict was up to 2006. These baseline measurements can be used to assess trends through comparison with present and future inventories.

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

Finally, the relationship between inherent structure and existing conditions is used to guide future direction. The ELA is part of an ecosystem approach that will expand to encompass other initiatives of Department of Natural Resources (DNR), such as The Path We Share: A Natural Resources Strategy for Nova Scotia 2011 - 2020 (http://novascotia.ca/natr/strategy/pdf/Strategy_Strategy.pdf).

The intention is to describe important ecological characteristics to consider during resource planning – the ELA is not a plan in itself.

Part 1: An Overview of Northumberland Lowlands – *Learning About What Makes This Ecodistrict Distinctive*

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

Ecodistrict Characteristics

This lowland ecodistrict in northern Nova Scotia borders the Northumberland Strait. The ecodistrict is bounded on its southern border by the Cobequid Mountains, Pictou Antigonish Highlands, and Cumberland Hills. The elevation of this low plain seldom exceeds 50 metres above sea level with the exception of an area around Streets Ridge, Cumberland County, which rises to 100 metres above sea level.

The area is characterized by imperfectly drained compact soils derived from red sandstones and shales. Most water must be removed laterally or through evapotranspiration because of the compact nature of the subsoil. The better-drained soils are found on the upper slopes on the permeable sandy loam tills.

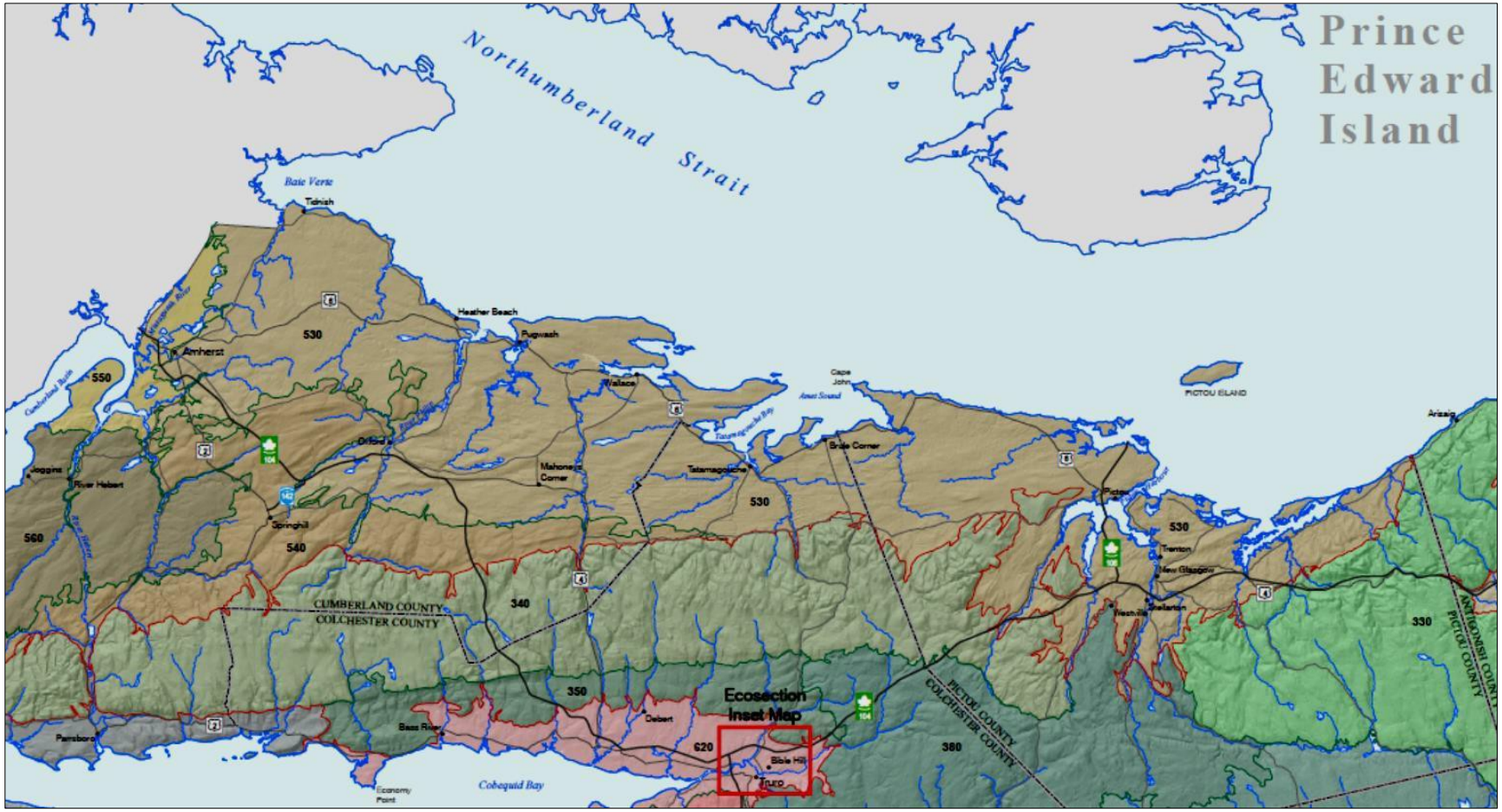
Of all the watersheds in this ecodistrict, only the Nappan drains westward to the Cumberland Basin. The other river systems and watersheds drain north to the Northumberland Strait.

Coniferous forests of red and black spruce dominate the ecodistrict. Balsam fir, red maple, white birch, and aspen are early successional species that invade most sites after disturbance. A history of fire has produced several areas, most notably along the Cobequid Pass and the Trans-Canada Highway near Oxford and Springhill, where jack pine and black spruce form the climax forest community.

The upper slopes and hilltops are better-drained and support a forest of tolerant hardwoods but these areas are quite rare in the ecodistrict. An example would be at Leicester Ridge, where we find mixedwood stands of red spruce, hemlock, sugar maple, yellow birch, and beech. Pure stands of red spruce are common on the better-drained sites in Cumberland County.

Tamarack often grows on farmlands, particularly on wet fields along the coast. On other, better-drained abandoned fields, white spruce will become established after alders.

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



The Northumberland Lowlands Ecodistrict 530 stretches from northwestern Cumberland County to northeastern Pictou County.
(From Ecodistricts of Nova Scotia map 2007)

Land Area

The Northumberland Lowlands Ecodistict is rural and predominately under private ownership at 91% (Table 1).

Only 6% of the land area is under the administration of provincial Crown.

Inland water bodies, transportation corridors, and other uses are the other main category at 3% of the area.

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

Ownership	Area* (hectares)	Percent of Total Area
Provincial Crown land	16,745	5.8
Private	259,864	90.7
Federal	500	0.2
Aboriginal	270	0.1
Other (Includes inland water bodies and transportation corridors)	9,238	3.2
Total	**286,617**	**100**

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

IRM Resource Classification for Provincial Crown Lands

The Integrated Resource Management (IRM) classification for Crown lands was developed through a public consultation process during the strategic phase of IRM completed in 2002.

Table 2 provides a summary of Crown lands designated as either C1, General Resource Use; C2, Multiple and Adaptive Use (allows most uses, but special management may be required); or C3, Protected and Limited Use (such as beaches and sites of cultural and historic significance).

Table 2 – IRM Land Use Categories for Provincial Crown Lands in Ecodistrict

IRM Land Use Category	Hectares	Percent of Crown Lands
C1 – General Resource Use	10,492	62.7
C2 – Multiple and Adaptive Use	4,661	27.8
C3 – Protected and Limited Use	1,039	6.2
Unclassified	552	3.3
Total	**16,744**	**100**

The Cumberland Trails Association has a license to develop an 18 kilometre section of the Trans-Canada Trail on Crown land between Oxford and the Amherst Marsh. The association has also carried out trail development on a 39 kilometre section of the abandoned rail line beginning to the east of Oxford and running to the Colchester County line. The Colchester Trails Association has licensed the 27 kilometre section of abandoned railbed within Colchester County, and the Pictou County Trails Association is licensed to develop and use the 38 kilometre railbed between the Colchester County line and Browns Point in Pictou County.

Other commitments DNR has made within this ecodistrict include a seven hectares lease near Middleboro, Cumberland County, to the Girl Guides of Canada for their activities. This ecodistrict has one campsite lease near Oxford. Many permits are issued for operating machinery below the ordinary high water mark (OHWM) on the shoreline for seawall and wharf work.

Forests

Within this ecodistrict, 197,487 hectares, or 69%, is forested (Table 3). This is in line with the provincial average of 72%.

Within the non-forested category, wetlands and agriculture are the two largest sectors, accounting for 5% and 13%, respectively, of the landbase.

Of interest is that 4%, or 11,000 hectares, of the Northumberland Lowlands Ecodistrict is classified as urban whereas on average, less than 1% of the adjacent ecodistricts (Cobequid Hills and Chignecto Ridges) have this classification.

The current forests comprise a mixture of softwood (45%), hardwood (32%), and mixedwood forests (19%).

Table 3 – Area Distribution by Land Category for All Owners

Category	Hectares	Percent
Forested	197,487	68.9
Wetland	13,705	4.8
Agriculture	37,265	13
Barrens	73	<0.1
Urban	11,065	3.8
Road, Trail, Utility	6,251	2.2
Other	20,769	7.2
Total	**287,023**	**100**

Red and black spruce are the two most dominant softwood species. These species are commonly found on imperfectly drained hummocky sites. White spruce is the next most common softwood species. White spruce stands are frequently located on imperfectly drained, fine-textured soils associated with or adjacent to abandoned agricultural land or planted after harvest.

This ecodistrict is also known to have a few isolated stands of eastern white cedar, which is considered uncommon in Nova Scotia.

This ecodistrict has seen an increase in harvest activity over the past 15 years. This is reflected in the abundance of early successional stands dominated by intolerant tree species, such as poplar and red maple. These species are found throughout the ecodistrict on well-drained sites as both pure stands of hardwood and as a minor component of most softwood stands.

Hardwood and mixedwood covertypes combined account for 53% of the forest cover. Less than 1% of the hardwood stands are classed as shade-tolerant (e.g. yellow birch, sugar maple).

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 5.2 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.

Nearly 85% of the forested land within this ecodistrict has an LC 5 or higher rating.

Table 4 – Area of Forested Land by Land Capability Rating

Land Capability (LC) Rating (m^3/ha/yr)*	Hectares	Percent
2 or less	2,293	1.2
3	8,748	4.4
4	19,176	9.7
5	90,803	46
6	60,925	30.9
7 or more	15,542	7.8
Total	**197,487**	**100**

*Based on growth potential for softwood species.

Given the above average land capability of this area, this ecodistrict has a high level of forest management activity. The majority of forest management work is conducted on private land, as only 6% of the area is Crown land.

The majority of land in this ecodistrict is owned by private individuals. Two of the larger private companies operating in this area are North Nova Forest Owners Co-op and Athol Forestry Co-op, private cooperatives that have been active in managing private woodlots since the 1970s.

Some of the larger forest landowners in this area include Neenah Paper and J.D. Irving. Several of the larger softwood processing facilities in this region include Two Rivers Lumber of Tatamagouche, the former Deniso Lebel mill of Scotsburn, Prime Lumber of West River, and Dickson Forest Products of Westville. Hardwood processing mills include M.R. MacDonald in Thorburn and Group Savoie in Westville.

Water Resources

Within the Northumberland Lowlands Ecodistrict, there are only five lakes of any significant size. These include three in Cumberland County (Big Lake, Lake Killarney and Angevine Lake), one in Colchester County (Mattatall Lake), and one in Pictou County (Forbes Lake). The largest of the lakes is Angevine Lake (145 ha), located near Wentworth, Colchester County. There are a number of smaller lakes scattered throughout this region but most are less than 10 hectares in size.

There are 21 rivers identified in this ecodistrict. Most of the rivers flow in a northeast direction, emptying into the Northumberland Strait through numerous saltwater harbours. The larger

harbours include: Northport, Pugwash, Fox Harbour, and Wallace in Cumberland County; Tatamagouche and Brule in Colchester County; Pictou, Caribou and Merigomish in Pictou County.

The major rivers in Northumberland Lowlands are River Philip, Wallace River, Tidnish River, Pugwash River and the Shinimicas River in Cumberland County; Waughs River, French River, and the Pugwash River in Colchester County; and River John, Dewar River, Toney River, Caribou River, Three Brooks, West River, Middle River, East River, Sutherlands Rivers, and Barneys River in Pictou County.

There are three water supply areas within this ecodistrict. These are divided into those designated under the Environment Act and those which are non-designated areas. The only designated area is the Tyndal wellfield located east of Amherst which provides water to the Town of Amherst. The two non-designated water supply areas are the French River, located south of Tatamagouche and the East River, located south of New Glasgow. These two areas provide water to the village of Tatamagouche and the town of Stellarton, respectively. Forbes Lake supplies water to New Glasgow.

Minerals, Energy and Geology

The Northumberland Lowlands Ecodistrict comprises mainly the Cumberland and Stellarton basins, which are part of the larger Maritime Basin. These subbasins contain Carboniferous age sedimentary rocks 280 to 350 million years old that contain significant mineral resources.

There are several active mines and quarries in the Northumberland Lowlands. In Pugwash, the Canadian Salt Company mines salt at its underground operation, shipping from the port of Pugwash. In Stellarton and Coalburn, coal is being mined at surface by Pioneer Coal.

Surface coal mining is carried out in Stellarton by Pioneer Coal.

Quarrying of building stone has been an important industry since the 1800s, and the most famous of these is Wallace Quarries in Wallace, which supplied sandstone for some of the most important buildings in North America, including Province House in Halifax, Confederation Building in Charlottetown, Parliament Buildings in Ottawa, and McGill Medical Building in Montreal.

In addition to the red sandstone found in the area, there are also gypsum, clay, and peat deposits.

Numerous aggregate and shale deposits occur throughout the ecodistrict, which provide an important source of sand, gravel, and shale for the local area. There are numerous concentrations of base metals throughout the ecodistrict with several small past mining operations of copper deposits associated with the Pictou Group redbeds. Uranium deposits are known within the Pictou County redbeds, although an exploration moratorium is currently in place.

Exploration and development drilling for conventional oil and gas and for coalbed methane is currently ongoing across the entire Northumberland Lowlands. The Stellarton Formation contains extremely thick coal seams that are being assessed as a potentially important source for coalbed methane gas. The sandstones and shales of the Horton Group are of particular interest in oil and gas exploration in this part of the province since they provide a source of hydrocarbons. They are also of interest in areas of structural traps or where overlain by Windsor Group salt and gypsum.

The Canadian Salt Company mines salt in Pugwash, Cumberland County.

The most notable karst topography – formed in areas where bedrock of carbonate-rich rock, such as limestone and gypsum, creates underground streams, fissures and sinkholes – is near Oxford, where many of the smaller sinkholes are filled with water.

The Northumberland Lowlands bedrock geology comprises mostly the late Carboniferous, Cumberland and Pictou groups with small exposed areas of the early Carboniferous Windsor and Mabou groups throughout the ecodistrict. The older Fountain Lake Group (Devonian) and Horton Group (early Carboniferous) rocks constitute a small part of the bedrock geology at the eastern end of the ecodistrict in Pictou County.

The Cumberland Group of rocks includes grey and red sandstone, mudrock, conglomerate, coal seams, and thin limestone beds. In the Stellarton Basin of the Pictou County area, the Cumberland

Group includes the Stellarton Formation of the Pictou coalfield. The Pictou Group comprises predominantly red mudstone, sandstone and conglomerate and rare limestone.

The Windsor Group includes salt and gypsum deposits of the Pugwash Mine Formation that are chiefly concentrated in structures along the northern and eastern margins of the Athol Syncline, and as diapiric bodies in the Roslin, Malagash and Pugwash areas.

The Horton Group contains grey sandstone, conglomerate and mudrock. The Fountain Lake Group in this ecodistrict consists of volcanic basalt, rhyolite, sandstone, and siltstone.

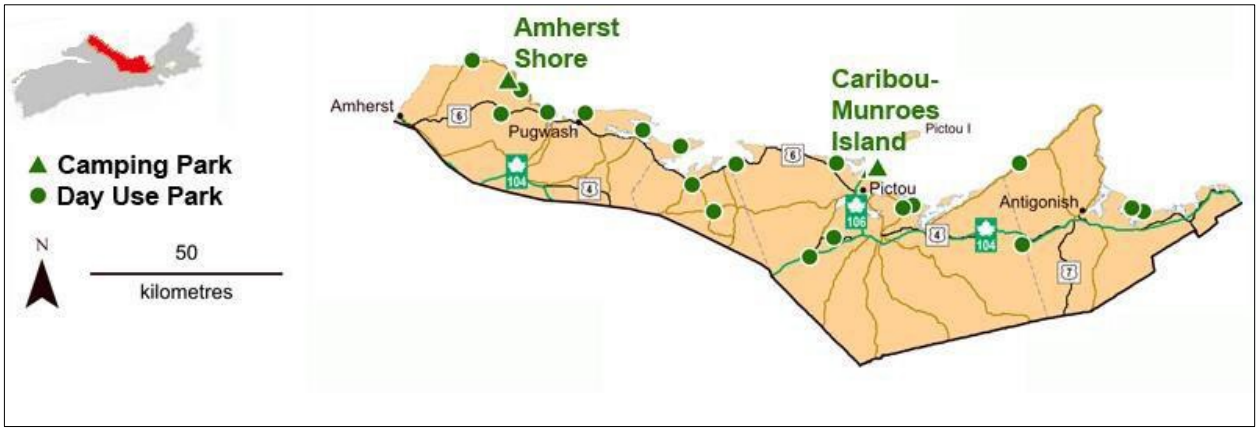
The structural geology is only moderately complex, with northeasterly trending faults and fold patterns, especially between Springhill and Tatamagouche Bay. Recent seismic records illustrate that the sedimentary infilling of the basins has been affected greatly by subsurface movement of Windsor Group salt in the geologic past.

Since 2003, there has been heightened interest in the Cobequid-Chedabucto Fault Zone for deposits of iron oxide, copper, and gold. This interest arose from the development of a new geological model based on characteristics of deposits being explored and mined in other parts of the world.

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

Parks and Recreation / Protected Areas

The Northumberland Lowlands Ecodistrict includes 1,050 hectares of provincial parks and park reserves. The ecodistrict encompasses much of the *Northumberland Shore Beaches Region* identified in the Provincial Parks Concept Plan and, in addition to several provincial parks, includes three protected beaches and a number of waterways and recreational trails.



Map shows locations of the Amherst Shore and Caribou-Munroes Island provincial camping parks.

The ecodistrict is characterized as a large, gently undulating coastal plain of low elevation. The most significant opportunities for nature-based outdoor recreation are associated with the warm, coastal waters and many fine sandy beaches and river estuaries along much of the coastline.

Caribou-Munroes Island is a popular park adjacent to a provincial entry point.

Two popular camping parks occur adjacent to provincial entry points – a 134 hectare core destination park at Caribou-Munroes Island and a 255 hectare secondary park at Amherst Shore.

Operational day-use parks also offer a range of outdoor recreation activities, such as swimming, picnicking, coastal walking, and cross country skiing. These parks are located at Tidnish Dock, Northport Beach, Shinimicas, Heather Beach, Gulf Shore, Fox Harbour, Blue Sea Beach, Tatamagouche, Balmoral Mills, Rushtons Beach, Waterside Beach, Salt Springs, Powells Point and Melmerby Beach. Eight provincial park reserves encompassing 126 hectares are also included in this ecodistrict.

The three designated protected beaches in the ecodistrict include Beatty Marsh, adjacent to Blue Sea Beach Park near Malagash and at Chance Harbour, and Merigomish Beach in Pictou County. A provincially owned abandoned rail line corridor forms a portion of the Trans-Canada Trail and stretches approximately 115 kilometres between the towns of Oxford and Pictou. Historically known as the Short Line, this “linear park” falls under the Provincial Rails to Trails Policy providing opportunities for recreation, tourism, and community development.

Three trail development agreements are in place with community-based groups in Cumberland, Colchester and Pictou counties. A portion of this trail is also licensed under the Snowmobilers Association of Nova Scotia (SANS) agreement. The abandoned rail line is considered “shared-use” which provides for both motorized and non-motorized trail users. Recreational snowmobiling and ATV riding are common with many riders belonging to organized clubs. Riders make use of the abandoned rail trail and many other trails in the ecodistrict.

Lower tidal estuaries of several rivers provide extensive canoeing and kayaking opportunities in all seasons. These include River Philip, Waughs, Wallace, River John, Pugwash, Caribou, and the East and West rivers of Pictou County. Limited canoeing is also available on the upper reaches on some of these rivers, but canoeing is mainly done when water levels are highest in spring. Recreational fishing on these rivers is also very popular.

Extensive coastal kayaking opportunities exist in Caribou Harbour, Merigomish, and Roy Island (adjacent to Melmerby Beach Provincial Park) areas and also in the bays and harbours along the coast. Recreational boating of all types is popular along the Northumberland coastline.

Nova Scotia is promoted a “Seacoast Destination” and the Sunrise Trail (Highway 6) is a popular tourist route following the coastline. The Sunrise Trail is an important link for many nature-based recreational activities and scenic vistas are common along this route.

No wilderness protected areas or nature reserves, managed by the Department of Environment, exist in the ecodistrict. *In 2008, the 970-hectare Chignecto Isthmus Wilderness Area was established north of Amherst, providing additional protection for the town's drinking water supply. The area protects bogs, marshes, coniferous and mixed forest, and the endangered mainland moose. Its importance also stems from its location in the narrow, low-lying land bridge that connects Nova Scotia to New Brunswick.*

The Chignecto Isthmus Wilderness Area was established north of Amherst in 2008.

Legal and policy reserves exceed 15% of the total Crown land in the ecodistrict. The small percentage of Crown land in the ecodistrict means representivity will need to be sought through other means (e.g. Nature Conservancy of Canada and Nova Scotia Nature Trust).

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

Wildlife information for Northumberland Lowlands and other ecodistricts comes from a number of sources, including surveys, harvest statistics, hunter and trapper reports (abundance rankings), biological collections from harvested and road killed animals, and observations and reports from the public and 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 characteristic wildlife features of the Northumberland Lowlands are principally a result of geomorphology and location.

A relatively flat to gently undulating plain, the ecodistrict is bounded on the north by the waters of the Northumberland Strait and on the south by the uplands of the Cobequid Hills and the Pictou Antigonish Highlands. The contrast between the ocean, plain, and high country and the resulting "edge effects" add to the diversity of wildlife features found in the ecodistrict.

Extensive wildlife surveys have not been completed. However, based on limited DNR wildlife surveys, inventory plots, hunter and trapper reports, annual bird counts, forest management plan reviews, and reports from experienced naturalists, it is likely the ecodistrict supports a broad diversity of populations.

Coastal Habitat

The coastal zone is a rich diversity of habitat types: sandstone cliffs, bays, harbours, river mouths, coves, mud flats, salt marshes, headlands, beaches, and islands. The currents and climatic effects of the Northumberland Strait waters have a major influence on the species that live here.

Waterfowl (primarily black ducks and Canada geese) are common and in the fall numbers increase as they congregate at Wallace Bay National Wildlife Area, River John estuary, and Caribou, Pictou, Little, and Merigomish harbours. When the Northumberland Strait freezes (December to March) most of these birds leave, many travelling to the ice-free eastern shore or Minas Basin.

Winter open water in Pictou Harbour adjacent the Harvey A. Veniot Causeway and the Trenton Power Plant seasonally attract approximately 4,000 greater scaup with lesser numbers of common golden eye, black ducks, and Canada geese.

The beaches and coastal flats are important feeding areas for shorebirds, particularly in the spring and fall as they migrate to and from their northern breeding areas. Several beaches within the region are potential breeding locations for the endangered piping plover with usually at least one beach per year having a successful breeding pair. In addition, significant colonies of common terns can be found on at least two sand spits and islands.

Several beaches in the ecodistrict are potential breeding areas for piping plover.

Pictou Island, measuring 9.5 kilometres long by 2.5 kilometres wide, located 8 kilometres off the coast, is the largest island in the Northumberland Strait. Several of the beaches have potential for piping plover nesting and are commonly used by feeding shorebirds. Eagles and osprey have nested here and the security of the island provides ideal habitat for the colonial-nesting great blue heron.

Pictou Harbour has long been known for its colonies of double crested cormorants, particularly those that occupy the abandoned wharf pilings adjacent to the Harvey A. Veniot Causeway where these birds continue to attract tourists and local residents.

The bays, estuaries, and river valleys are important bald eagle nesting areas with a plentiful supply of fish to support the population. There are in excess of 40 nests within the ecodistrict with major concentrations at Pictou and Merigomish harbours.

The sharp-tailed sparrow, a species at risk, breeds within the salt marshes along the coast and the red throated loon is known to frequent the coastal waters during fall migration.

Plain Habitat and Wildlife

Much of this ecodistrict, particularly west of Pictou Harbour, is a relatively flat plain with imperfect drainage, dendritic streams and an abundance of wetlands; many resulting from the work of beavers, one of the more common species in the area.

Most of the major river valleys, such as River Philip, Waughs River, and the West, Middle, and East rivers, have uncommon plants such as blue cohosh and Canada lily, specific to the rich alluvial soils of the river flood plains. In addition, anadromous fish species – that migrate upriver from the sea to spawn – are found in these rivers, in particular the endangered Atlantic salmon.

Wood turtles, listed as vulnerable, are found in several watersheds and ongoing surveys may locate other rivers with breeding populations. The freshwater mussel eastern river pearl is found in several rivers and the eastern lamp mussel is found in one of the few lakes within the district.

Beaver ponds, such as this one, are common in the flat plains of the ecodistrict.

Northern white cedar is found in the Oxford area.

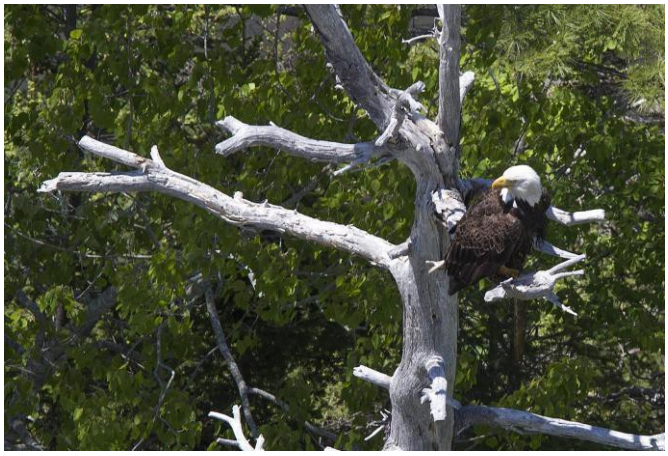
Highland and Plain Edge

In harsh winters, deer tend to migrate from the Cumberland Hills and Pictou Antigonish Highlands to the adjoining northern edge of the Northumberland Lowlands because of reduced snow depths. Where these concentrations are significant the locations have been noted and mapped as deer wintering areas. The endangered mainland moose is occasionally observed throughout the lowlands.

Wildlife Management

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

In order to achieve this representivity within the Northumberland Lowlands, there has to be an increase in the number of areas of intact forest greater than 100 hectares and a restoration of late successional climax species since the ecodistrict is currently skewed to early successional stands. This becomes a management challenge since only 6 % of the land is Crown. The cooperation of private landowners will be needed.



Bald eagles are common along estuaries of the Northumberland Lowlands Ecodistrict.

Where species at risk or of concern are an issue, special management practices will be employed (e.g. for mainland moose, raptors, herons, turtles, bats, and for deer wintering areas) or where appropriate, management practices will be adopted or modified to fit the situation. For example, special management zones along watercourses, as outlined in the Wildlife Habitat Watercourse Protection Regulations, may be increased in width as necessary to provide for adequate habitat, travel, or connectivity.

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

With much of the ecodistrict privately owned, effective wildlife management will to a great extent rely on active, informed stewardship by the many landowners. The DNR can assist private land stewardship by providing knowledge and information on various management strategies. Legislation such as the Wildlife Habitat and Watercourse Protection Regulations, the Endangered Species Act, and the Environment Act's Activities Designation Regulations address species and habitat concerns within the forest and wetland ecosystems.

Part 2: Linking the Landscape to the Woodlot – *How Woodland Owners Can Apply Landscape Concepts to Their Woodland*

This second part of the report provides information on how landscape concepts can be applied at the woodlot level. The starting point is an introduction to natural disturbances and succession to provide a foundation for better understanding forest ecosystems. The focus then shifts to elements that make up each ecodistrict and the forest groups and vegetation types at the stand level. This allows woodland owners to move between elements and stands to see how their woodland fits in with the larger landscape.

Forest Disturbances and Succession

Forest Disturbances

A disturbance can be described as an event, either natural or human-induced, that causes a change in the existing condition of an ecological system.

Disturbance pattern controls forest development classes (establishment, young, mature, multi-aged / old forest) and their distribution over area and time.

Due to the coastal location of Nova Scotia and its Maritime climate, the extent, intensity, and frequency of natural disturbances is difficult, for the most part, to predict. Prior to European settlement, natural disturbances were only curtailed by natural barriers such as water, climate, topography, and vegetation change. After about 400 years of activity by European settlers, the frequency, intensity, and magnitude of these natural processes has been affected.

New disturbances have been introduced as a result of human activity and include:

- clearing of forests for agriculture
- timber harvesting
- urbanization and development
- introduction of exotic animals, plants, and insects
- disease-causing agents, such as viruses or bacteria
- fire suppression in the forest
- changes in the chemical and physical characteristics of the atmosphere

Understanding how ecosystems respond to disturbances is critical to understanding how they function and how they can be managed. This will assist woodland owners and forest managers in:

i. assessing the potential for old forest stands and development class distributions
ii. determining appropriate patch sizes and species composition to emulate natural structures and processes

iii. prescribing the appropriate rotation age and development class structure across a forested landscape
iv. projecting future changes to the forest due to climate change and human disturbances
v. maintaining and conserving biodiversity

Natural disturbances are agents that abruptly change existing conditions and initiate secondary succession to create new ecological communities.

By adapting forest management practices to create the structures and processes that emulate natural disturbances, woodland owners and forest managers can help shape forest landscapes.

One approach that closely mimics nature is to allow ecosystems to naturally develop without active management. This approach is particularly effective on lands with long-lived tree species, such as red spruce, white pine, hemlock, sugar maple, yellow birch, and beech. One of the roles of protected areas is to allow this to occur and also provide a model to compare with managed forests.

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

Northumberland Lowlands – Elements Defined

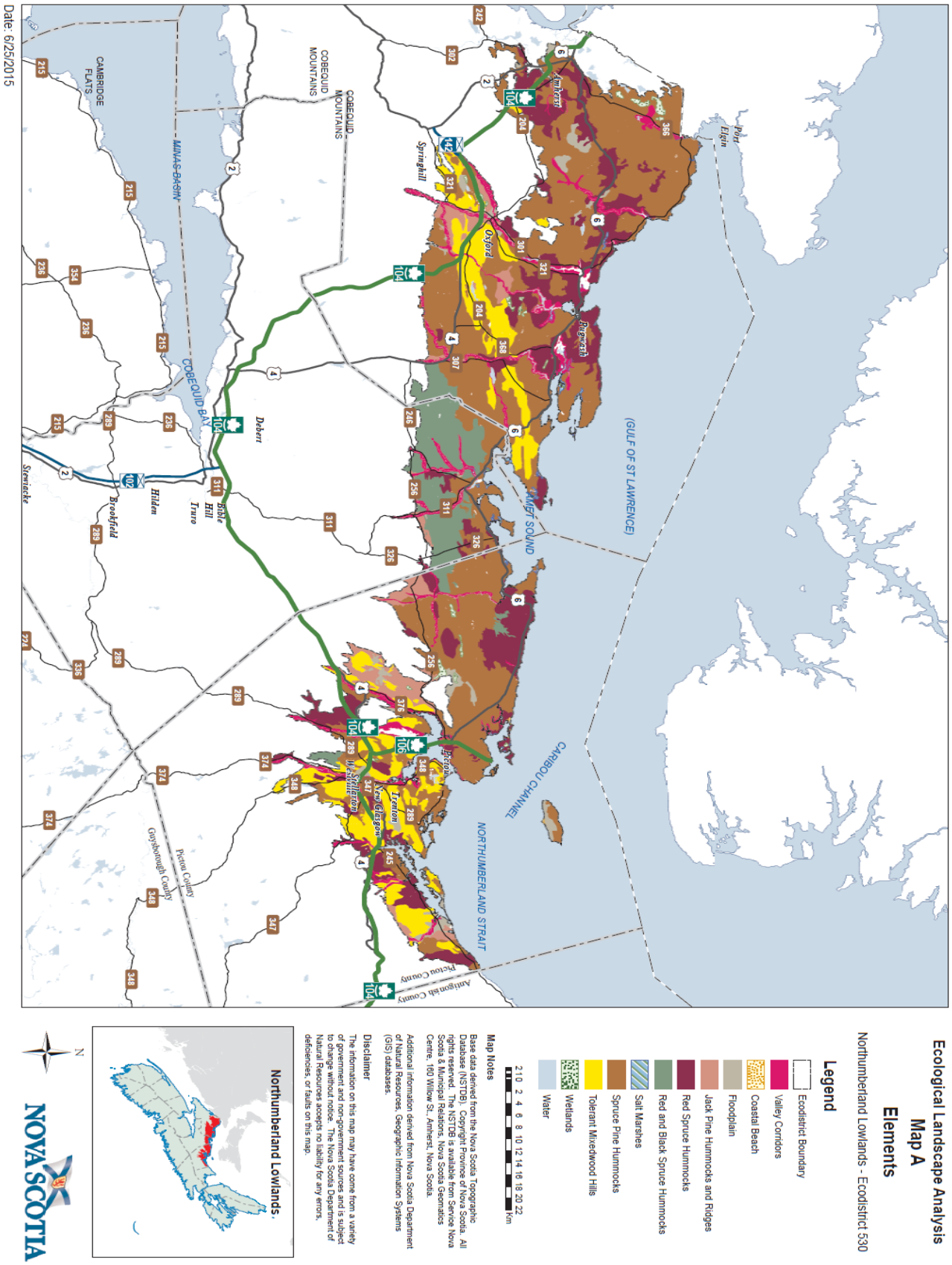
Landscapes are large areas that function as ecological systems and respond to a variety of influences. Landscapes are composed of smaller ecosystems, known as elements. These elements are described by their physical (e.g. soil, landform) and ecological features (e.g. climax forest type). These characteristics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

A landscape profile identified and mapped eight distinctive elements in the Northumberland Lowlands Ecodistrict – one matrix, six 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.

Spruce Pine Hummocks is the matrix element, representing 49% of the ecodistrict. This element naturally supports a softwood forest of red and black spruce and white pine, but land use and harvesting has left only 40% of the forest with vegetation types comprising these species.

Red Spruce Hummocks, the largest patch element, has had about one-third of its area converted to agriculture and other human uses. Other patch elements, in order of size, are **Tolerant Mixedwood Hills**, **Red and Black Spruce Hummocks**, **Jack Pine Hummocks and Ridges**, and **Wetlands**. *Two other tiny patch elements, Coastal Beach and Salt Marsh, are also found in the ecodistrict.* **Valley Corridors** is a linear element associated with several prominent river corridors in the ecodistrict.

Map of Elements in Ecodistrict



Forest Stands Within Elements

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

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

Viewed from a landscape level, some of the various types of forest stands and forest communities can be seen in Northumberland Lowlands.

Table 5a – Elements Within Northumberland Lowlands		
Element	**Size (Hectares)**	**Element Description**
Spruce Pine Hummocks (Matrix)	139,916 49.0%	The matrix level element in this ecodistrict occurs on hummocky terrain. The imperfect drainage conditions expressed in the soils underlying this terrain can be attributed to the gentle slope of the landscape, shallow soils and compaction, and clay content. When combined with the inherent low fertility of the substrate, derived from sandstones, siltstones and shales, the forests tend to be dominated by black spruce, jack pine, red pine, and white pine. With progressively poorer drainage, black spruce, tamarack, and red maple dominate the forest vegetation and wetlands are embedded throughout the ecodistrict. Red spruce, hemlock, and the shade-tolerant hardwoods are uncommon although occurrences can be found where soils are better-drained and enriched.
Red Spruce Hummocks (Patch)	48,364 16.9%	This patch level element occurs on gently undulating terrain throughout the ecodistrict and is very extensive at several locations along the Northumberland Strait such as Toney River, Wallace, Pugwash, and Port Philip. The soils are well-drained and underlain with fertile sandy loams and loams. The forests are comprised of red spruce, white spruce, and balsam fir and where soils are imperfectly drained black spruce and the hybrid red-black spruce are more common. Stands with a high component of hemlock and white pine are not uncommon. Early and mid-successional forests will have red maple, white birch, grey birch, aspens and pin cherry with balsam fir.
Tolerant Mixedwood Hills (Patch)	36,937 12.9%	This patch level element occurs predominantly on the higher elevations of the ecodistrict (75 to 100 m above sea level). Most of the element is located on rounded hilly terrain near Oxford which extends eastward to Wallace Ridge. The well to moderately well-drained soils of variable textures supports a late successional forest dominated by the shade-tolerant species of the Acadian Forest. On the upper slopes and crests mixedwood forests include sugar maple, yellow birch, red spruce and hemlock with the softwood component increasing on the middle and lower slope positions. A large percentage of the element has been converted to other uses including agriculture where abandoned farmland will reforest to white spruce, tamarack, and occasionally aspen.
Red and Black Spruce Hummocks (Patch)	21,027 7.4%	This is a patch element occurring on ridged terrain primarily in north Colchester County. Both medium and fine-textured soils are common and are derived from sandstones, siltstones, and shales. On the well-drained zonal condition forests are dominated by red spruce, hemlock, and white pine. The lower slopes and flat terrain between hummocks is usually imperfectly drained and supports a forest of black spruce and white pine. Shade-tolerant hardwoods are uncommon. Following frequent stand-level natural disturbances such as fire and hurricane early successional forests may include shade intolerant hardwoods such as red maple, white birch, grey birch, pin cherry, and aspens. Beaver-flooded forests are common between the ridges and can be extensive.

Table 5a – Elements Within Northumberland Lowlands		
Element	**Size (Hectares)**	**Element Description**
Jack Pine Hummocks and Ridges (Patch)	12,619 4.4%	Coarse-textured loamy sands of low fertility give rise to a patch element of jack pine and black spruce forests. These soils occur on hummocky and ridged topography and can dry out quickly during the summer creating an opportunity for wildfire. The dominant natural disturbance agent is fire due to the fuel nature of pine and spruce litter and the ericaceous vegetation associated with this element. Fires of severe intensity can have a significant negative impact on site productivity especially where soils are very sandy and/or gravelly. The largest and most notable areas of this element are near Springhill and Oxford. The abundance of a fire species such as jack pine has probably been exacerbated by fires originating from the nearby railroad during the late 1800s.
Wetlands (Patch)	1,825 0.6%	The wetlands element is an ecosystem comprising freshwater bogs, fens, swamps, and poorly drained areas. At several wetlands in the ecodistrict, eastern white cedar can be found, such as those wetlands along Racetrack Brook and Dochertys Brook. On the higher ground with better-drained soils softwood and mixedwood forests of red and black spruce, white pine, white birch, and red maple will occur. This element plays a critical role in water collection, filtering, and ground water recharge. Waterfowl habitat enhancements have been completed on many wetlands in this ecodistrict.
Salt Marsh (Patch)	*981 (.3%)*	*The twice daily tidal actions along the Northumberland Strait have created many salt marshes with the largest at Wallace Bay and others of significant size at Malagash Point and Brule. Deposits of silty clay loam sediments with semi-decomposed grasses and sedges trapped in the accumulating layers, formed along the tidal shores and in estuaries found at the mouths of rivers and streams subjected to tidal conditions.*
Coastal Beach (Patch)	*250 (.1%)*	*In this ecodistrict beaches tend to be classified as barrier beaches and have formed as a result of rising sea level and the erosion of adjacent headlands forcing a landward retreat of the beach. Good examples are at Oak Island (Fox Harbour), Caribou Island, Braeshore, and Melmerby/Merigomish Island. Many other smaller beaches of varying origins are scattered along the Northumberland coastline, many resulting from the erosion of the sandstone and siltstone cliffs.*
Valley Corridors (Corridor)	23,673 8.3%	This element type consists of several prominent river corridors which are generally dominated by red/black spruce, jack pine, and white pine community. The higher, better-drained slopes have gap disturbance regime with elm, sugar maple, and ash as the expected species.
Total	**285,592***	*Area is not the same as in Table 1 because water has not been included.

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

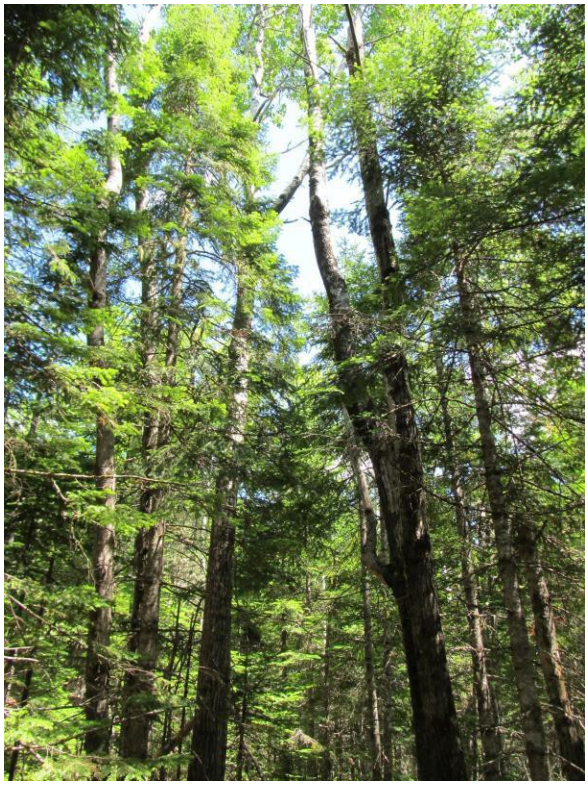
Element	Seral Stage					
	Early	% *	Middle	%	Late	%
Jack Pine Hummocks and Ridges	IH1, IH6, OW1, OW2, OW4, SP1, SP2	29	CE2, SP3, SP4, SP6, SP8	23	**SP5**	23
Spruce Pine Hummocks	IH1, IH2, IH4, IH6, OW2, OW4, SP1, SP2, SP10	27	CE2, SP3, SP4, SP6, SP8	25	**SP5**, SP7, SP9	28
Red Spruce Hummocks	IH1, IH3, IH4, IH5, IH6	37	MW2, MW4, MW5, SH5, SH6, SH7, SH8, SH10	26	**SH1**, SH2, **SH3**, SH4	19
Red and Black Spruce Hummocks	IH1, IH4, IH5, IH6, SP10	24	MW4, MW5, SH5, SH6, SH7, SH8, SH10, SP4, SP6, SP8	30	SH1, SH2, **SH3**, SH4, **SP5**, SP7	26
Tolerant Mixedwood Hills	IH3, IH5, IH6	39	IH7, MW2, MW4, MW5, SH5, SH6, SH8, SH10	27	**MW1, MW3**, SH1, SH2, SH3, TH1, TH2, TH3, TH4, TH8	17
Salt Marshes	Grasslands of *Spartina spp.*					
Coastal Beaches	CO7, beach grass, bayberry, rose spp., white spruce					
Wetlands	CE1, WC1, WC2, WC3, WC4, WC5, WC6, WC7, WD1, WD2, WD3, WD5, WD6, WD7, WD8					

View forest groups and vegetation types at
http://novascotia.ca/natr/forestry/veg-types/veg-navigation.asp
To help with identification of vegetation types, the 14 forest groups in Nova Scotia designated by 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.

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



Trembling aspen – White ash / Beaked hazelnut / Christmas fern (IH5) is an early successional vegetation type found in Red Spruce Hummocks, the largest patch element.

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

White spruce – Red spruce / Blueberry / Schreber's moss (SH7) is a mid-successional vegetation type found in the Red and Black Spruce Hummocks element.

Black spruce / Lambkill / Bracken (SP5) is a late successional vegetation type found in the Jack Pine Hummocks and Ridges patch element.

Red maple / Sensitive fern – Lady fern / Sphagnum (WD3) is one of three wet maple forests in Nova Scotia and is found in the Wetlands element.

Landscape Composition and Objectives

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

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

Natural Disturbance Regimes

Three natural disturbance regimes dominate natural forests:

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

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

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

During the growing season, a significant moisture deficit can occur, second only to the Annapolis Valley. The ecodistrict also has the lowest annual mean precipitation in the province. On the Northumberland Lowlands, frequent stand-initiating disturbances are the predominant natural disturbance shaping the diversity of forest ecosystems. These disturbances occur frequently enough such that there is a rapid mortality of an existing stand and quick establishment of a new stand of relatively even age. Compacted soils, soil moisture deficit, and low rainfall make this ecodistrict especially prone to forest fires. As well, winds from the Northumberland Strait, often recorded at twice the speed of winds inland, are a strong influence.

Spruce budworm is also an important disturbance agent in the softwood forests. Infrequent stand-initiating disturbance is possible on the scattered hills and ridges throughout the ecodistrict. However, very few stands would have gap processes occurring in the canopy due to the frequency of fire and so old growth forest is primarily restricted to steep sided slopes, sheltered coves, and in valleys along rivers and large streams.

Forest Composition

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

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

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

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

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

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

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

- early
- mid
- late

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

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

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

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

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

Forest Composition Objectives

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

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

Four hundred years of European settlement in the Acadian region has left insufficient natural landscape structure to confirm these ranges. Facing similar challenges, a comprehensive modeling approach was used by the Ontario Ministry of Natural Resources to support "range of variation" targets for natural disturbance regimes in the Great Lakes St. Lawrence region (http://www.ontario.ca/document/forest-management-great-lakes-and-st-lawrence- landscapes).

A full description of definitions and mapping of Nova Scotia's disturbance regimes is contained in the report "Mapping Nova Scotia's Natural Disturbance Regimes" available from the DNR website (http://novascotia.ca/natr/library/forestry/reports/NDRreport3.pdf).

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

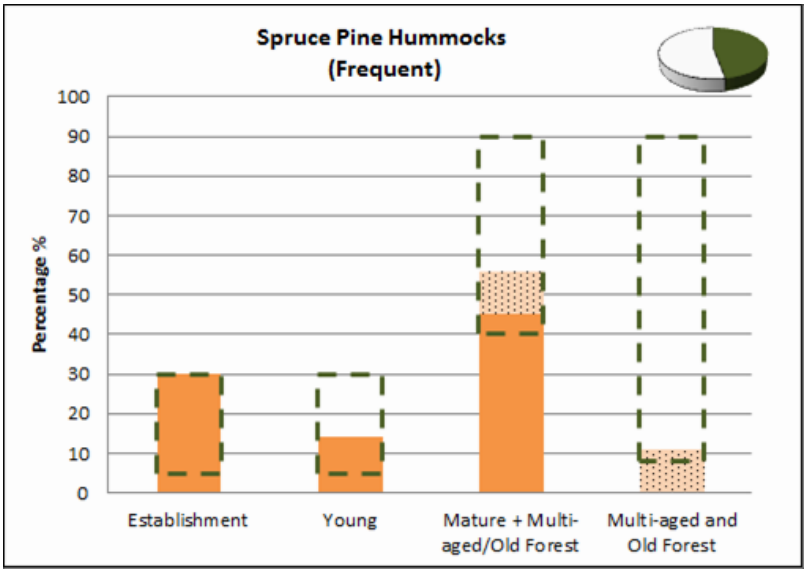
Natural Disturbance Regime	Development Class			
	Forest Establishment	Young Competing Forest	Mature Forest (including multi-aged and old forest)	Multi-aged and Old Forest
Frequent Stand Initiating	5 - 30%	5 - 30%	>40% early, mid, and late seral representation	>8%
Infrequent Stand Initiating	5 - 20%	5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

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

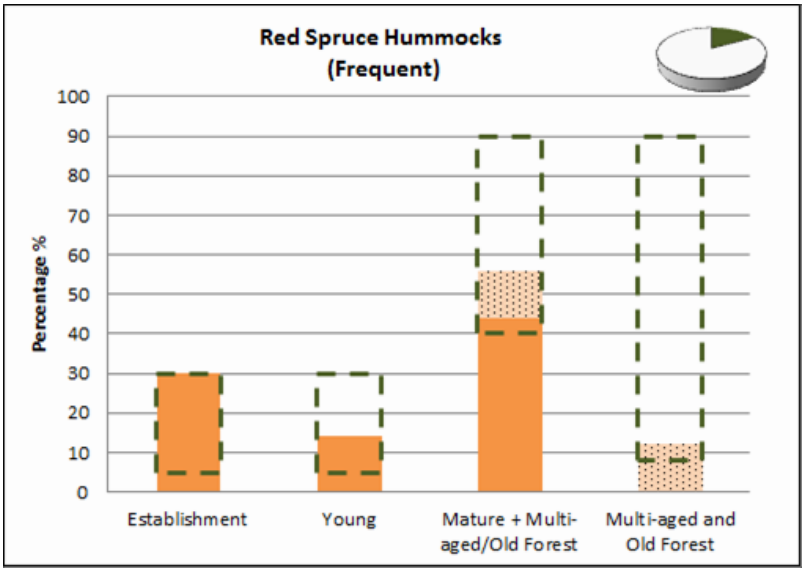
Development Class Targets by Element

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

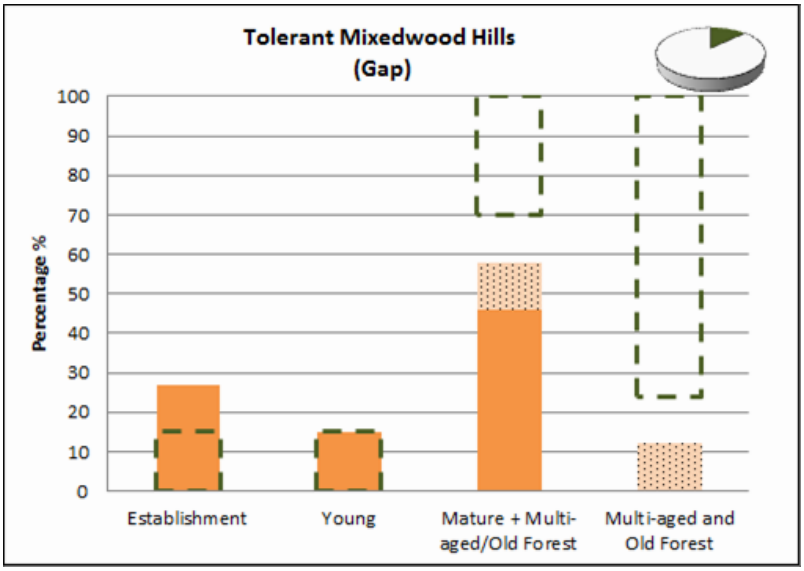
In the matrix element, **Spruce Pine Hummocks**, all of the development classes are within their target ranges. These frequent natural disturbance regime forests support periodic stand-initiation events that favour establishment of an even-aged forest, often with scattered surviving mature pine that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



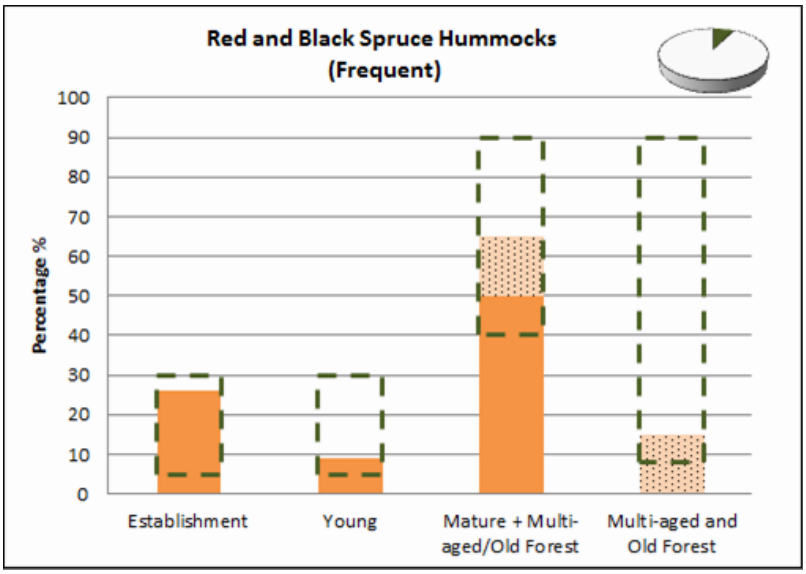
In **Red Spruce Hummocks**, the largest patch element, all classes are within their target ranges. The abundant establishment class should provide opportunities for silviculture to increase growth and promote long-lived climax species. Mature and multi-aged forests can be maintained and promoted by delaying harvests and extending rotations with selection cuts and thinning methods.



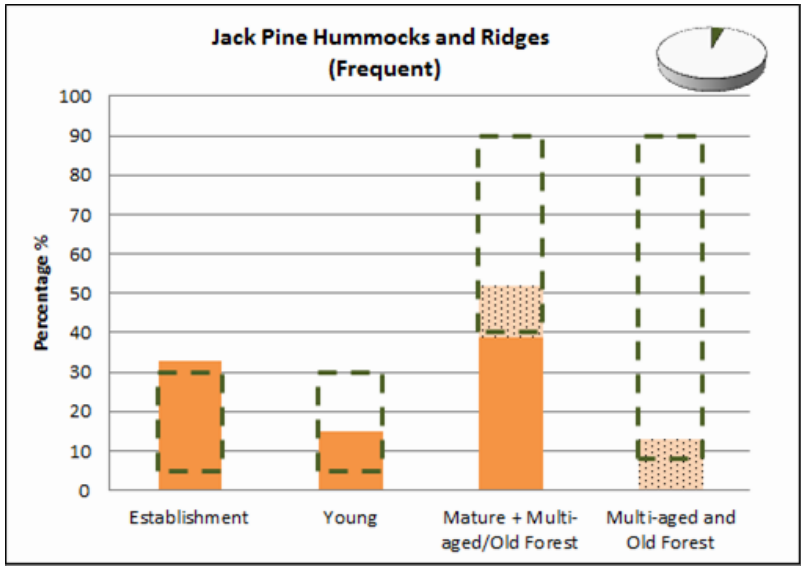
The **Tolerant Mixedwood Hills** patch element has less mature and multi-aged forest than is desired for gap ecosystems. Maintaining mature forests, delaying harvests, and extending rotations with selection cutting and thinning that retains large old trees will help restore a healthier landscape composition. Silviculture in establishment and young forests to increase growth and promote climax species will hasten development of mature habitat.



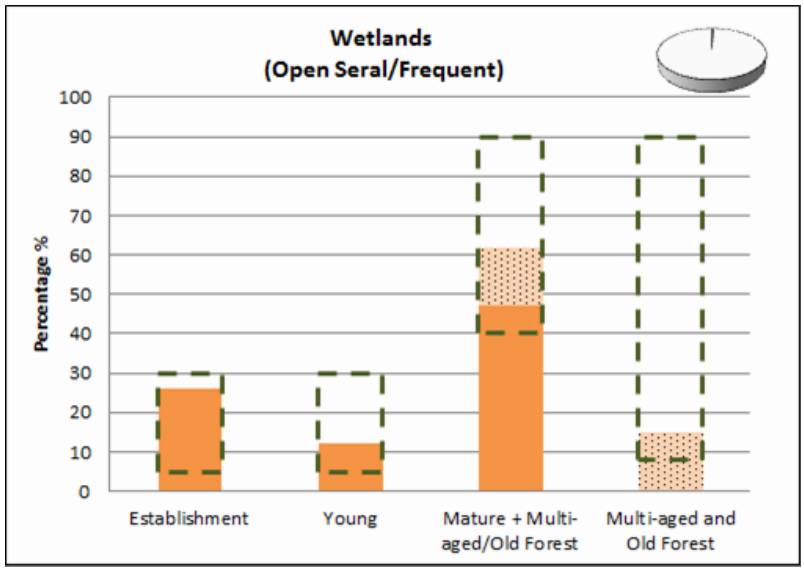
In **Red and Black Spruce Hummocks**, the composition of development classes is within target ranges. This will support habitat diversity and continuity of mature forest as well as provide management flexibility. Extended rotations, natural regeneration, and promotion of late seral species are appropriate. Opportunities exist for uneven-aged management to promote red spruce, hemlock, and white pine stands.



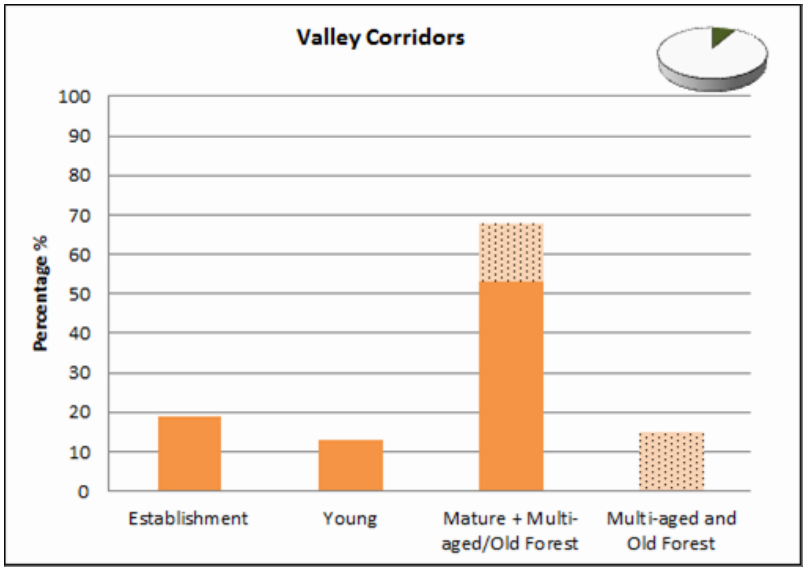
In the **Jack Pine Hummocks and Ridges** patch element the composition of development classes is near target ranges. Maintaining jack pine ecosystems may be a challenge due to the species fire dependency and successional development towards climax black spruce. Sivliculture to maintain and restore jack pine on the coarse-textured sandy soils will help.



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 may be appropriate where soil conditions permit.



The **Valley Corridors** element includes parts of several elements and does not have a specific disturbance regime or composition target. The current dominance of mature conditions should enhance forest cohesion and support connectivity functions along this linear element feature. Opportunities to restore converted land, and favour longer lived climax species will be beneficial.



Summary of Parts 1 and 2

This ends the first two parts of this report, which are available online to anyone who wants to view them. The intent was for the first part to provide a general overview of the ecodistrict for members of the public. The second part was designed for woodland owners to show how landscape ideas, such as elements, can be applied at the woodlot level.

The third part of the report, which includes more detailed information, maps, appendices, glossary, and literature citations, is designed for forest planners, managers, ecologists, analysts, and interested woodland owners.

Glossary A: Terms in Parts 1 and 2

Biodiversity	The diversity of plants, animals, and other living organisms, in all their forms and level of organization, including genes, species, ecosystems, and the evolutionary and functional process that link them.
Canopy	The uppermost continuous layer of branches and foliage in a stand of trees.
Climax forest community	A relatively stable and self-perpetuating forest community condition that maintains itself (more or less) until stand-level disturbance causes a return to an earlier successional stage. The final stage of natural succession for its environment.
Climax vegetation	A forest or non-forest community that represents the final stage of natural succession for its environment.
Coarse filter approach	A habitat-based approach to conserving biodiversity by maintaining a natural diversity of structures within stands, and representation of ecosystems across landscapes. The intent is to meet the habitat requirements of most native species over time. Usually combined with a fine filter approach to conserve specific rare species and ecosystems.
Composition	The proportion of biological components within a specified unit such as a stand or landscape: **Stand or Species Composition.** The proportion of each plant species in a community or stand. May be expressed as a percentage of the total number, basal area, or volume of all species in that community. **Landscape Composition.** The proportion of each community type within a landscape. Community type may be defined by vegetation type, covertype, seral stage, or development class (age).
Connectivity	The way a landscape enables or impedes movement of resources, such as water and animals.
Converted	Lands removed from a natural state (e.g. forest) and changed to other uses (e.g. agriculture, urban, settlement, road).
Corridor	Corridors are natural linear communities or elements, such as river valleys, that link parts of the ecodistrict. They are a fundamental feature of the "matrix, patch, corridor" concept of landscape structure.

Crown land and Provincial Crown land	Used in these Ecological Landscape Analysis reports to include all land under the administration and control of the Minister of Natural Resources under the Forests Act, Section 3; as well as the lands under the administration and control of the Minister of Environment under the Wilderness Areas Protection Act. Also includes Federal Parks in the accounting of protected area representation.
Covertype	Refers to the relative percentage of softwood versus hardwood species in the overstory of a stand. In this guide, covertype classes are: **Softwood:** softwood species compose 75% or more of overstory **Hardwood:** hardwood species compose 75% or more of overstory **Mixedwood:** softwood species composition is between 25% and 75%
Development class	The description of the structure of forests as they age and grow (e.g. establishment forest, young forest, mature forest, multi-aged / old forest).
Disturbance	An event, either natural or human-induced, that causes a change in the existing condition of an ecological system.
Ecodistrict	The third of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecoregions. Characterized by distinctive assemblages of relief, geology, landform, and vegetation. Used to define the landscape unit for these Ecological Landscape Analysis reports.
Ecological land classification	A classification of lands from an ecological perspective based on factors such as climate, physiography, and site conditions. The Ecological Land Classification for Nova Scotia Volume 1 delineates ecosystems at five hierarchical scales: ecozone, ecoregion, ecodistrict, ecosection, and ecosite.
Ecoregion	The second level of the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecozone. Used to characterize distinctive regional climate as expressed by vegetation. There are nine ecoregions identified in Nova Scotia.
Ecosection	The fourth of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecodistricts. An ecological land unit with a repeating pattern of landform, soils, and vegetation throughout an ecodistrict.
Ecosite	The fifth of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecosections. Characterized by conditions of soil moisture and nutrient regimes. Although not mapped, the Acadian and Maritime Boreal ecosites of the province are fully described in the Forest Ecosystem Classification for Nova Scotia (2010).

Ecosystem	A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size – a log, pond, field, forest, or the Earth's biosphere – but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, such as a forest ecosystem, old-growth ecosystem, or range ecosystem. Can also refer to units mapped in the DNR Ecological Land Classification system.
Element	A landscape ecosystem containing characteristic site conditions that support similar potential vegetation and successional processes. Elements were mapped by combining ecosections with similar climax vegetation and natural disturbance interpretations. Depending on their role in the ecosystem, elements may be described as matrix, patch or corridor.
Endangered species	A wildlife species facing imminent extirpation or extinction. A species listed as endangered under the federal or Nova Scotia endangered species legislation (NS Endangered Species Act or federal Species at Risk Act).
Even-aged	A forest, stand, or vegetation type in which relatively small age differences exist between individual trees. Typically results from stand-initiating disturbance.
Extinct species	A species that no longer exists. A species declared extinct under federal or Nova Scotia endangered species legislation (NS Endangered Species Act or federal SARA).
Extirpated species	A species that no longer exists in the wild in Nova Scotia but exists in the wild outside the province. A species declared extirpated under federal or Nova Scotia endangered species legislation (Nova Scotia Species at Risk Act or federal SARA).
Forest management	The practical application of scientific, economic, and social principles to the administration and working of a forest for specified objectives. Particularly, that branch of forestry concerned with the overall administrative, economic, legal, and social aspects and with the essentially scientific and technical aspects, especially silviculture, protection, and forest regulation.
Frequent stand initiating	Disturbances usually occur more frequently than the average lifespan of the dominant species and are of sufficient intensity to destroy most of the existing trees, promoting a new forest within relatively short periods of time.

Gap replacement	An absence of stand-initiating disturbances supports the development of a dominant overstory that is sustained through dynamic processes of canopy gap formation, understory development, and overstory recruitment. Gap formation ranges from individual tree mortality to periodic gap formation events that are rarely of a stand-initiating intensity.
Habitat	The place where an organism lives and/or the conditions of that environment including the soil, vegetation, water and food.
Impact assessment	A study of the potential future effects of resource development on other resources and on social, economic, and/or environmental conditions.
Infrequent stand initiating	The time between stand-initiating disturbances is usually longer than the average longevity of dominant species, thereby supporting processes of canopy gap formation and understory development in mature forests.
Inherent conditions	Refers to the natural condition of ecosystems based on their enduring physical features. This is the potential condition expected in the absence of human influence.
Integrated Resource Management (IRM)	A decision-making process whereby all resources are identified, assessed, and compared before land use or resource management decisions are made. The decisions themselves, whether to approve a plan or carry out an action on the ground, may be either multiple or single use in a given area. The application of integrated resource management results in a regional mosaic of land uses and resource priorities which reflect the optimal allocation and scheduling of resource uses.
Land capability (LC)	LC values represent the maximum potential stand productivity (m^3/ha/yr) under natural conditions.
Landform	A landscape unit that denotes origin and shape, such as a floodplain, river terrace, or drumlin.
Landscape	An expanse of natural area, comprising landforms, land cover, habitats, and natural and human-made features that, taken together, form a composite. May range in scale from a few hectares to large tracts of many square kilometres in extent.
Matrix	A widespread vegetation forest community which dominates the landscape and forms the background in which other smaller scale communities (patches) occur. The most connected or continuous vegetation type within the landscape, typically the dominant element. (Matrix is a fundamental feature of the "matrix, patch, corridor" concept of landscape structure.)

Mature forest	A development class within the sequence of: 1) forest establishment; 2) young forest; 3) mature forest; and 4) multi-aged and old forest. Mature forests include multi-aged and old forest. Forests are typically taller than 11 metres, have an upper canopy fully differentiated into dominance classes and regularly produce seed crops. Mature forests may develop over long periods, transitioning from early competitive stages where canopy gaps from tree mortality soon close, to later stages where openings persist and understories develop to produce multi-aged and old forest.
Natural disturbance	A natural force that causes significant change in forest stand structure and/or composition such as fire, wind, flood, insect damage, or disease.
Natural disturbance regimes	The patterns (frequency, intensity, and extent) of fire, insects, wind, landslides, and other natural processes in an area. Natural disturbances inherently influence the arrangement of forested ecosystems and their biodiversity on a given landscape. Three disturbance regimes recognized in Nova Scotia are: **Frequent:** Disturbances which result in the rapid mortality of an existing stand and the establishment of a new stand of relatively even age. The time interval between stand-initiating events typically occurs more frequently than the longevity of the climax species that would occupy the site – therefore, evidence of gap dynamics and understory recruitment is usually absent. This regime results in the establishment and perpetuation of early to mid-successional vegetation types. **Infrequent:** Stand-initiating disturbances which result in the rapid mortality of an existing stand and the establishment of a new stand of relatively even-age, but the time interval between disturbance events is normally longer than the average longevity of the dominant species – allowing gap dynamics and understory recruitment to evolve and become evident (eventually creating uneven-aged stands). This regime generally leads to the establishment and/or perpetuation of mid to late successional vegetation types. **Gap replacement:** Stand-initiating disturbances are rare. Instead, disturbances are characterized by gap and small patch mortality, followed by understory recruitment, resulting in stands with multiple age classes. This regime generally leads to the establishment and/or perpetuation of late successional vegetation types.
Old growth	Climax forests in the late stage of natural succession, the shifting mosaic phase, marked by mature canopy processes of gap formation and recruitment from a developed understory. Typical characteristics include a multi-layered canopy of climax species containing large old trees, decadent wolf trees, and abundant snags and coarse woody debris. In Nova Scotia, stands older than 125 years are classed as old growth.

Patch	A discrete community or element nested within a surrounding landscape, which is often a matrix forest. (Patch is a fundamental feature of the "matrix, patch, corridor" concept of landscape structure.)
Reserve	An area of forest land that, by law or policy, is usually not available for resource extraction. Areas of land and water set aside for ecosystem protection, outdoor and tourism values, preservation of rare species, gene pool and wildlife protection (e.g. wilderness areas, parks).
Riparian	Refers to area adjacent to or associated with a stream, floodplain, or standing water body.
Seral stage	Any stage of succession of an ecosystem from a disturbed, unvegetated state to a climax plant community. Seral stage describes the tree species composition of a forest within the context of successional development.
Species	A group of closely related organisms that are capable of interbreeding, and which are reproductively isolated from other groups of organisms; the basic unit of biological classification.
Species at risk	Legally recognized designation for species at federal and/or provincial levels that reflects varying levels of threats to wildlife populations. The four categories of risk are extirpated, endangered, threatened, and species of special concern.
Succession	An orderly process of vegetation community development that over time involves changes in species structure and processes.
Tolerance	The ability of an organism or biological process to subsist under a given set of environmental conditions. The range of these conditions, representing its limits of tolerance, is termed its ecological amplitude. For trees, the tolerance of most practical importance is their ability to grow satisfactorily in the shade of, and in competition with, other trees.
Vulnerable species	A species of special concern due to characteristics that make it particularly sensitive to human activities or natural activities or natural events. May also be referred to as "species of special concern." A species declared vulnerable unde the federal or Nova Scotia endangered species legislation (NS Endangered Species Act or federal SARA).
Wilderness area	A part of the provincial landbase designated under the Wilderness Areas Protection Act (e.g. Canso Barrens).