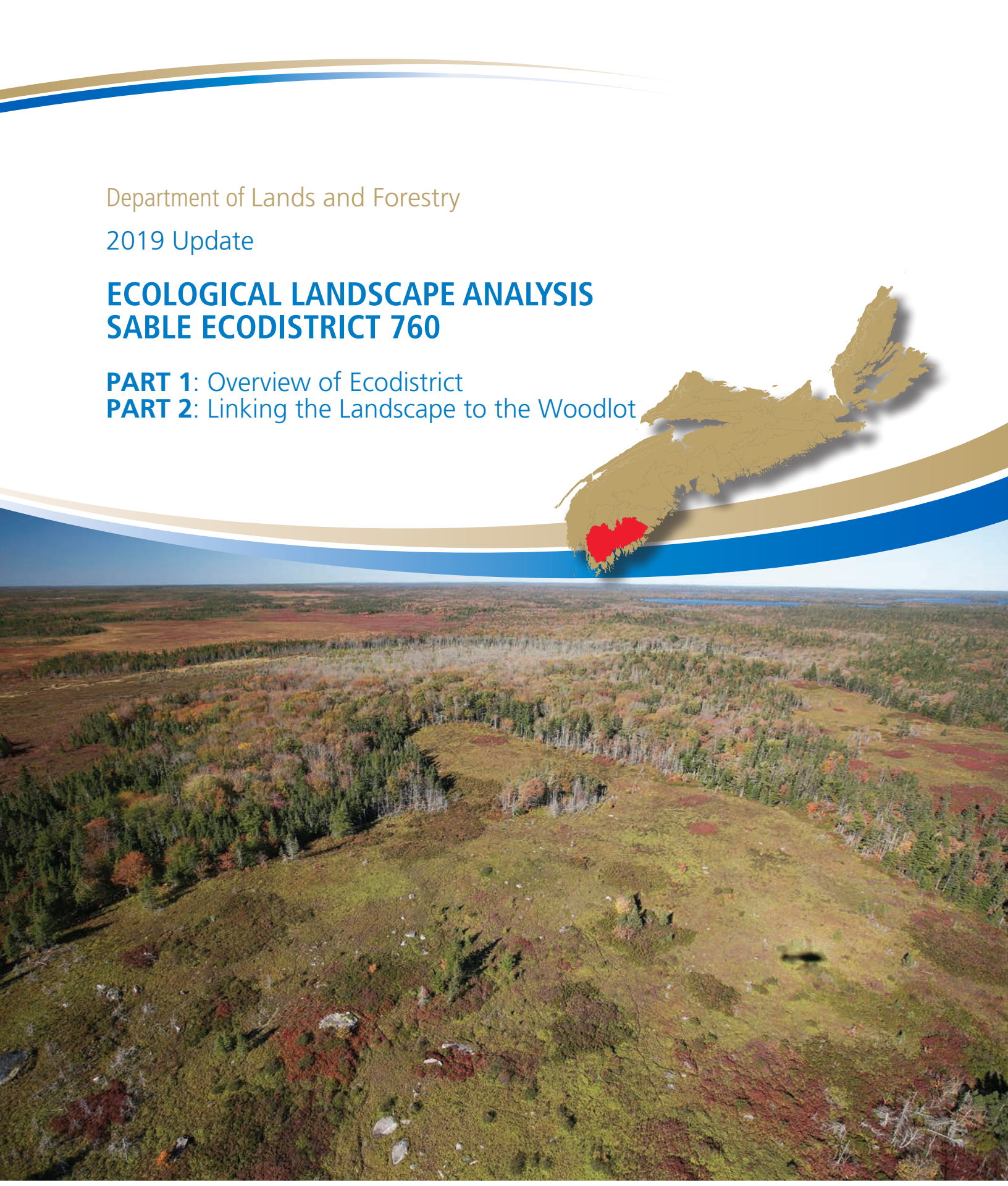
Department of Lands and Forestry

2019 Update

# ECOLOGICAL LANDSCAPE ANALYSIS SABLE ECODISTRICT 760

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



ELA 2019-760

NOVA SCOTIA

***Ecological Landscape Analysis, Ecodistrict 760: Sable***
***2019 Update for Part 1 and 2***

*Prepared by the Nova Scotia Department of Lands and Forestry*
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This report, one of 38 for the province, provides updated figures and tables to supplement the original Ecological Landscape Analysis documents.

Information sources and statistics (benchmark dates) include:

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

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

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

**Selected updated Tables and Figures**

This document provides recalculated values for the following:

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

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

# Table of Contents – Parts 1 and 2



**Tables**

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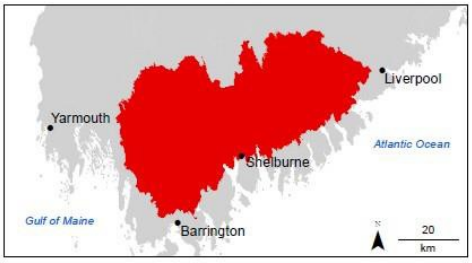
# Ecodistrict Profile

## Ecological Landscape Analysis Summary
## Ecodistrict 760: **Sable**




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 Sable Ecodistrict 760. 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.

Distinguishing characteristics of the Sable Ecodistrict – which spans Shelburne, Yarmouth and Queens counties – include a generally flat landscape with poor drainage. Only a few hills reach elevations higher than 100 metres and much of the area is less than 60 metres above sea level. Wetlands account for about 15% of the ecodistrict's area, with bogs – mainly peatland – making up four-fifths of the wetlands. The primary source of water for bogs is rainfall. Several individual bogs are hundreds of hectares in size. Two examples of large continuous bogs are Dunraven Bog in Queens County and Quinns Meadow in Shelburne County.

Extensive heathlands, wetlands, and poorly stocked forests of white pine, black spruce and red oak are features of this ecodistrict near Great Pubnico Lake.

This ecodistrict has the highest concentration of peat deposits in the province. Some of the peat deposits reach fuel grade and could be an important energy source in the future.

A major geological feature within this ecodistrict is the Shelburne Dyke. This is the most prominent dyke in Nova Scotia and extends from Lower West Pubnico to Sambro Island for a distance of 200 kilometres and averages 100 metres in width. A geologic dyke is a flat sheet of rock that cuts through other types of rock.

Sable has some of the longer river systems in the province, such as the Clyde, Roseway, Jordan, Sable, and Broad rivers, which all flow in a north-south direction. The largest lakes within the ecodistrict are Great Pubnico Lake and the complex of Great Barren Lake, Big Gull Lake and Quinan Lake, all located at the western edge of Sable.

The area of the ecodistrict is about 294,450 hectares, and of this about 78% is owned by the Crown. A further 21% is held privately. The remaining 6% is primarily inland waters and transportation routes.

Nearly three-quarters of Sable is forested. Black spruce is common on the less well-drained soils. White pine is abundant where drainage improves and is also found in combination with red spruce and hemlock on the better sites. Red oak is present on some of the drier sites. Mixedwoods are dominated by red maple occurring with softwoods. The hardwood covertype is predominately shade-intolerant species, usually red maple.

Shade-tolerant hardwoods are not common. The Sable Ecodistrict supports part of a globally significant cool moist coastal forest that has the highest diversity of lichens in Nova Scotia. A number of lichen species of global significance and rarity occur here, including the nationally endangered boreal felt lichen.

The ecodistrict supports a variety of wildlife, including black bears, which inhabit the forest, preferring wooded areas and swamps.

In preparation for winter hibernation, black bears forage for huckleberries on the extensive heathlands of the Sable ecodistrict.

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 five key landscape elements – one dominant matrix element and four smaller patch elements – in Sable.

**Spruce Pine Hummocks** is the matrix element, representing a little over half of the ecodistrict. Black spruce is the main softwood species, with lesser amounts of white pine and some red spruce and hemlock. Red maple is the most common hardwood.

**Wetlands** is the largest patch element, representing about one-quarter of the ecodistrict. This element is dominated by wetlands, with bogs most common.

The other patch elements, in order of size, are **Spruce Hemlock Pine Hummocks and Hills**, **Pine Oak Hills and Hummocks**, and **Tolerant Mixedwood Drumlins**. *The ecodistrict also contains a tiny area of the element Salt Marsh.*

# Forest Ecosystem Management
# For Sable 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 Sable Ecodistrict 760. Resources and their components include the natural elements that make up the landscape and may affect functions like connectivity – how a landscape enables or impedes movement of resources, such as water and animals – as well as conditions of forest composition, road density, and land use intensity.

Only brief summaries are presented for other land values, including minerals, energy and geology, water resources, parks and protected areas, wildlife and wildlife habitat. These summaries are included in the document to present the range of land values that must be balanced during the design stage of the land management process and are not intended to be exhaustive treatments of the respective land values. Where possible, the reader will be referred to additional sources for detailed information.

## Application

The data in this ELA represent inventory based off the Forest Inventory Database (FID) current as of the end of 2015 and the Crown Land Forest Model (CLFM) current as of 2017. The update provides a reference to compare to the baseline conditions provided in the ELA 2015, which in the case of the Sable 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 Lands and Forestry, such as The Path We Share: A Natural Resources Strategy for Nova Scotia 2011 - 2020 (http://novascotia.ca/natr/strategy/pdf/Strategy_Strategy.pdf).

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

# Part 1: An Overview of Sable – *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 Sable Ecodistrict is part of the Western Ecoregion and stretches from eastern Yarmouth County to the hills bordering the Mersey River in Queens County. This ecodistrict is approximately 294,450 hectares (including water) in size and covers about 17% of the ecoregion. Adjacent ecodistricts include South Shore 830 on the south; Tusket Islands 840 and Clare 760 on the west; Western Barrens 770 and South Mountain 720 on the north; and Rossignol 750 on the east and north.

Lack of relief and poor drainage are distinguishing characteristics of Sable. Much of the area is less than 60 metres above sea level and only a few of the higher hills reach elevations greater than 100 metres. Extensive areas of wetlands are bogs supporting stunted black spruce. White pine may occur on higher areas within the wetlands. Dunraven Bog is the largest wetland in the ecodistrict.

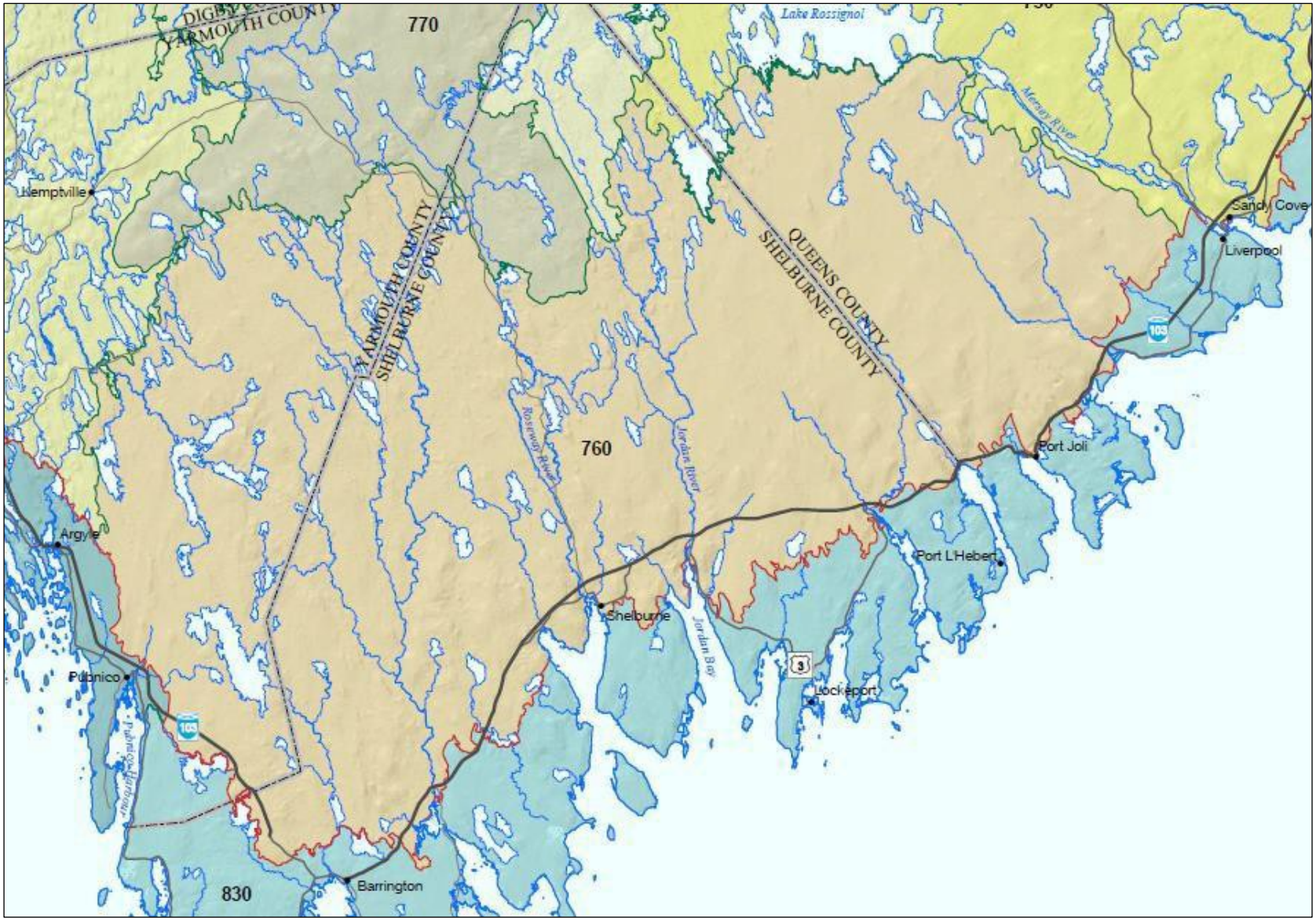
Over 50% of the ecodistrict has imperfectly drained, coarse-textured soils with a climax forest of black spruce, with white pine on the better drained sites and hills.

Those well-drained, coarse-textured soils on higher ground develop into a climax of white pine and red oak. Well-drained loamy soils are characterized by tolerant softwood climax forests of red spruce, white pine, and hemlock.

About 12,000 hectares in Sable is barrens, some of it the result of a long history of burning, others caused by a dense or compacted layer (hardpan) which is impervious to water movement and significantly reduces water depth to a few centimetres below the surface. Over time, many of the barrens have begun to seed in from the edges with open-grown white pine, black spruce, and occasionally larch. Red maple can often be found in the moister swales between barrens. Heath-like vegetation is a common ground cover throughout the ecodistrict and has proliferated over time as a result of fire and harvesting operations.

Eskers – long, narrow ridges of sand or gravel deposited by streams flowing through glacial ice – can be found in many of the river valleys but are most prevalent along the Jordan and Sable rivers.

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




Sable Ecodistrict 760 covers parts of Shelburne, Queens, and Yarmouth counties.
(From Ecodistricts of Nova Scotia map 2007)

## Land Area

In the Sable Ecodistrict, one of eight ecodistricts in the Western Ecoregion, most of the land, 72.7%, is held by the Crown (Table 1) in large, generally continuous blocks, with a few scattered privately-owned inholdings. Private land ownership (21.1%) is concentrated along the major rivers. Individual parcel sizes may be quite large.

**Table 1 – Land Area by Ownership in the Sable Ecodistrict***

| Ownership | Area (hectares) | Percent of Total Area |
|---|---|---|
| Provincial Crown land | 214,127 | 72.7 |
| Private | 62,167 | 21.1 |
| Federal | 0 | 0 |
| Aboriginal | 0 | 0 |
| Other (Includes inland water bodies and transportation corridors) | 18,135 | 6.2 |
| **Total** | **294,429** | **100** |

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

The ecodistrict is sparsely settled with most of the human habitation along a few of the major rivers, such as the Roseway and Clyde. The communities of Barrington, Clyde River, Shelburne, Jordan Falls, Sable River, Port Joli, Port Mouton, and Liverpool are along or just outside the ecodistrict's southern boundary.

## IRM Resource Classification for Provincial Crown Lands

The Integrated Resource Management (IRM) classification for Crown lands was developed through a public consultation process of 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 – Land Use Categories for Provincial Crown Lands in Ecodistrict | | |
|---|---|---|
| **IRM land use category** | **Hectares** | **Percent of Crown Lands** |
| C1 – General Resource Use | 393 | 0.2 |
| C2 – Multiple and Adaptive Use | 146,834 | 85.6 |
| C3 – Protected and Limited Use | 24,203 | 14.1 |
| Unclassified | 16 | <0.1 |
| **Total** | **171,446** | **100** |

Table 2 shows that nearly all the Crown land is designated C2 (85.6%) or C3 (14.1%). The area classified C2 in Sable is largely the result of lands set aside for a small remnant population of endangered mainland moose.

There are a large number of campsite leases in the ecodistrict. No new campsite leases are being issued. However, under the Tobeatic Wilderness Area campsite lease relocation plan, leaseholders may choose to move their lease to Sable.

The Sable Ecodistrict comes in contact with the Atlantic shoreline in a few locations at the upper end of major inlets such as Shelburne Harbour and Barrington Bay. Land below the mean high water mark is provincial Crown land. Permits are required for activities that take place on this land. Nova Scotia Power has flowage rights or leases on a number of lakes and river systems in the ecodistrict.

| Table 3 – Area Distribution by Land Category for All Owners | | |
|---|---|---|
| **Category** | **Hectares** | **Percent** |
| Forested | 224,685 | 76.3 |
| Wetland | 42,287 | 14.4 |
| Agriculture | 266 | 0.1 |
| Barrens | 8,336 | 2.8 |
| Urban | 1,347 | 0.5 |
| Road, Trail, Utility | 1,120 | 0.4 |
| Other | 16,387 | 5.6 |
| **Total** | **294,429** | **100** |

## Forests

Within the Sable Ecodistrict, nearly three-quarters of the land is forested (Table 3).

Non-forested land includes barrens, agriculture, and urban sites. Wetlands account for 42,287 hectares, or 14.4% of the area. Other land use includes areas of brush, alders, and gravel pits.

The forests contain about 115,000 hectares of softwood stands (>75% softwood) which account for 51.2% of the forest cover. Black spruce stands dominate the imperfectly drained soils while red spruce, eastern hemlock, and white pine thrive on the side slopes and better-drained soils.

Mixedwood stands of red spruce, eastern hemlock, white pine, red oak, sugar maple, yellow birch, and beech as well as intolerant hardwoods account for 35.4%. Hardwood stands (>75% hardwood composition) account for 10.4% of the forest cover. The remaining 3% is unclassified lands.

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 4.1 cubic metres per hectare per year ($m^3$/ha/yr), based on the ratings in Table 4. The average 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.

About two-thirds of the land is LC 4 and lower. This rating indicates the Sable Ecodistrict is below the provincial average for forest growth.

**Table 4 – Area of Forested Land by Land Capability Rating**

| Land Capability (LC) Rating ($m^3$/ha/yr)* | Hectares | Percent |
|---|---|---|
| 2 or less | 5,092 | 2.4 |
| 3 | 45,880 | 21.2 |
| 4 | 94,880 | 43.9 |
| 5 | 57,723 | 26.6 |
| 6 | 12,090 | 5.6 |
| 7 or more | 635 | 0.3 |
| **Total** | **216,415** | **100** |

*Based on growth potential for softwood species.

Mixedwood stands represent a little more than a third of the forest covertype in Sable 760.

## Water Resources

Inland waters make up about 17,000 hectares, or approximately 6% of the ecodistrict.

Sable has some of the longer river systems in Nova Scotia. These include the Clyde, Roseway, Jordan, Sable, and Broad rivers, which all flow in a north-south direction. The long axis of the ecodistrict's many lakes is also north-south, a result of past glacial history.

The largest lakes within Sable are Great Pubnico Lake and the complex of Great Barren Lake, Big Gull Lake, and Quinan Lake, all located at the western edge of the ecodistrict. Nova Scotia Power has a dam controlling water flow out of this three-lake complex, which feeds the Quinan River, a branch of the Tusket River. Lake Rossignol, a Nova Scotia Power reservoir, is located along the northeastern boundary.

The surface water has a fairly high acid level with pH levels from 4.0 to 6.1 (*Natural History of Nova Scotia, Volume 2: Theme Regions*). Wetlands, primarily in the form of bogs and fens, occupy about 43,000 hectares, or 15% of Sable.

Hayden Lake is a water supply area for the community of Lockeport. Rodney Lake, just outside the ecodistrict's southern boundary, is in a watershed that extends into Sable. This lake is a non-designated water supply area for the Town of Shelburne.

## Minerals, Energy and Geology

The Sable Ecodistrict extends from Pubnico in the southwest, inland and parallel to the Atlantic coast through to Beech Hill in the east. The northern limit is adjacent to the western tip of the South Mountain Batholith and the southern shores of Lake Rossignol.

A major geological feature within this ecodistrict is the Shelburne Dyke. This is the most prominent dyke in Nova Scotia and extends from Lower West Pubnico to Sambro Island for a distance of 200 kilometres and averages 100 metres in width. The dyke, made of fine-grained black granite, is an excellent target for industrial development in the home improvement sector and dimension stone work. The Shelburne Dyke is offset by minor faults. Many of the rivers and harbours in this ecodistrict trend northwest and may be related to other northwest trending faults in adjacent ecodistricts.

Large peat resources dominate the Sable Ecodistrict, which has the highest concentration of peat deposits in the province. Within the ecodistrict, the highest concentration of peat bogs is in the eastern half, south of Lake Rossignol. Some of the peat deposits reach fuel grade and could be an important energy source.

Significant industrial mineral deposits dominate this ecodistrict. The western half of the ecodistrict has extensive glaciofluvial deposits (kames, eskers, and glacial outwash fans) which are excellent sources of sand and gravel. The construction industry relies on these deposits to produce

The Sable Ecodistrict has the highest concentration of peat deposits in Nova Scotia.

cement and asphalt. In Granite Village, there is a large aggregate quarry that produces crushed gravel from the northern portion of the Port Mouton Pluton. Plutons granite are rocks that have crystallized from magma that slowly cooled below the Earth's surface. Large boulders are used to construct breakwaters along waterways and coastlines. There is potential for dimension stone production within the granites of the plutons within the ecodistrict.

The only gold occurrence within this ecodistrict is located in quartz veins along Broad River. Historical exploration activity has been modest, mostly centred on uranium exploration and some activity for gold exploration. Abandoned mine openings are currently not a major concern within this ecodistrict as there are only two suspected openings at Broad River.

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.

The area is dominated by the sedimentary rocks of the Meguma Group, changed by heat and pressure, which are about half a billion years old.

The Meguma Group covers approximately 90% of the Sable Ecodistrict. It is divided into two formations, the Goldenville Formation and Halifax Formation. The Goldenville Formation consists of sandstones and siltstones that have been changed by pressure and heat, and black slates.

A distinct and unusual geological feature within the Goldenville Formation is the presence of large crystals (up to 3 cm wide, 15 cm in length) of the mineral andalusite. The Halifax Formation consists of black to rust-brown / grey slate that locally contains pyrite, pyrrhotite, and arsenopyrite.

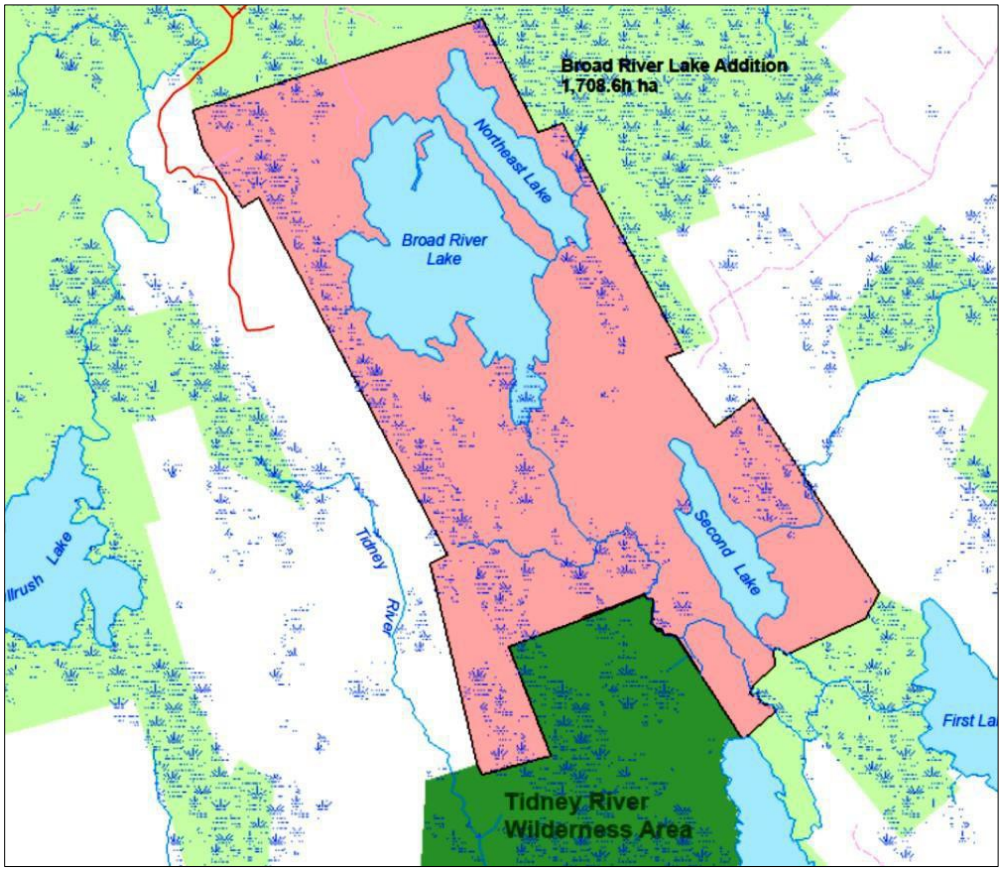
The Goldenville and Halifax formations are folded into a series of southwest trending folds. Several narrow shear zones (<2m wide) are present in the Port Mouton Pluton, formed during the folding and deformation of the rocks in this area. The shear zones and plutons within this ecodistrict are excellent targets for future economic exploration and development.

The remaining 10% of the ecodistrict consists of granite rocks of the Barrington Passage, Shelburne and Port Mouton plutons, the Shelburne Dyke, and several smaller unnamed plutons.

The Halifax Formation is susceptible to acid rock drainage due to the high iron and sulphide content within some slate units of the formation.

## Parks and Recreation / Protected Areas

For the parks and protected areas within your ecodistrict, please refer to the Park and Protected Areas website (http://novascotia.ca/parksandprotectedareas/plan/interactive-map/) and the Provincial Landscape Viewer, at the following url: https://nsgi.novascotia.ca/plv/.




Broad River Lake to the Tidney River Wilderness Area.

## Wildlife and Wildlife Habitat

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

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

### Wetlands, Aquatic Habitat and Wildlife

The Sable Ecodistrict generally consists of relatively flat terrain with occasional low hills and predominantly poorly drained soils. Within depressions and low lying areas are a considerable number of lakes, watercourses, and interconnected wetlands. In general, lakes and wetlands are more concentrated in the northern portions of the ecodistrict.

In addition to providing important habitat, wetlands perform vital environmental functions such as flood and erosion control, groundwater recharge, water filtration, and clean water. Given their abundance and potential for containing rare species in southwest Nova Scotia, all wetlands in this ecodistrict are considered to be a significant component of the landscape.

Freshwater wetlands which have been identified in the Sable Ecodistrict are of several types: bog, deep marsh, fen, lakeshore wetland, meadow, seasonally flooded flats, shallow marsh, and shrub swamp. Wetlands make up about 15% of the ecodistrict's area.

Bogs (peatland) are the most abundant wetland type in the ecodistrict, making up four-fifths of total wetland area. Bogs are not directly connected to surface water by way of watercourses as their primary source of water is from rainfall. However, they may connect hydrologically to other wetlands underground. The dominant vegetation community tends to be predominantly sphagnum/ericaceous shrubs. The next most common wetland type in the ecodistrict is fen, making up 16.6% of total wetland area. While fens can be similar in appearance to bogs, they occur along watercourses and hence receive more nutrients from groundwater movement. The dominant vegetation community is sphagnum / sedge / grass.

Wetlands dominated by red maple, often riparian habitats or fens with associated *Sphagnum* species, provide a rich habitat for lichens. Mature balsam fir supports Boreal felt lichen and other associated rare species, particularly where there are conditions of high humidity for example, balsam fir wetland habitat, adjacency to wetlands or high fog or humid offshore winds. An exceptionally large number of lichen species that are globally and nationally at risk occur in these habitats in Sable Ecodistrict.

The remaining wetland types are uncommon in the ecodistrict, with all of them combined accounting for only about 2.4%. Wooded swamp, a common wetland type in Nova Scotia overall, was not identified in the Sable Ecodistrict.

While diversity of wetland type is low, the sheer size of much of the wetland area is an impressive and distinctive feature of the ecodistrict. Several individual bogs are hundreds of hectares in size. Two examples of these large continuous bogs are Dunraven Bog in Queens County and Quinn's Meadow in Shelburne County. Fens occur along a number of Sable watercourses and in some cases are continuous over significant distances. One of the largest of these is along Turtle Creek in Shelburne County (north of Deception Lake), with 118 hectares of fen extending about four kilometres. Peat lands and fens in the ecodistrict are also sometimes interconnected with barrens, forming extensive open treeless areas throughout the landscape.

The major watercourses and their tributaries provide important aquatic and riparian habitat. In these areas aquatic plants and invertebrates support semi-aquatic mammal species, such as beaver and muskrat; several species of waterfowl, particularly ring-necked ducks, common mergansers, and black ducks; as well as amphibians and reptiles, including a number of frog, salamander, snake, and turtle species.

The rare eastern ribbonsnake occurs in vegetated freshwater wetlands, lake shorelines, and shallow coves. The riparian zone, the interface where terrestrial vegetation meets a watercourse or wetland, is one of the most productive habitat zones on the planet, and it promotes a rich diversity of wildlife species.

Freshwater habitats support a number of fish species, including white perch and yellow perch. Even small tributaries are used for spawning by brook trout. However, productivity is likely relatively low in Sable watercourses because of high acidity. Fish availability is a limiting factor for populations of fish predators, such as otters, common loon, and osprey.

Several river systems within the Sable Ecodistrict are significant for their seasonal runs of anadromous fish that migrate up river from the sea to spawn. Spring runs of gaspereau occur in the Barrington, Clyde, Roseway, Jordan, Sable, and Tidney rivers. Rainbow smelt use the Jordan River. Barrington and Clyde rivers support runs of striped bass.

Chain pickerel and smallmouth bass are highly invasive introduced species that are spreading throughout the ecodistrict. The illegal introduction of these species has created a major threat to native salmon and trout populations, freshwater invertebrates, and amphibians, through predation and competition. Brook trout have been eliminated or seriously reduced in a number of Clare watersheds, but they persist in some locations such as Cold Stream on the western side of the ecodistrict, where pickerel are unable to achieve access.

The eastern side of the Sable Ecodistrict also includes a few sections of marine coastline with important wildlife habitat: Lyles Bay and mouth of the Clyde River (salt marsh and estuarine flats); Shelburne Harbour and Birchtown Bay (estuarine flats); upper Jordan Bay and mouth of the Jordan River (salt marsh and estuarine flats); Port L'Hebert (salt marsh and estuarine flats); Port Joli (estuarine flats); Port Mouton and Jones Cove (marine flats, saline pond, salt marsh); and Summerville and mouth of the Broad River (saline pond and salt marsh).

The most notable wildlife occurrences in Sable's coastal zones are the wintering concentrations of waterfowl, including black duck, common eider, greater scaup, long-tailed duck, and common merganser. These waterfowl generally gather close to shore along the coast and in river estuaries. Black ducks also utilize salt marshes along the coast year-round.

**Terrestrial Habitat and Wildlife**

Wildlife habitat in the forest of the Sable Ecodistrict can be generally described as predominantly late succession softwood and mixedwood. Associated with varying stand compositions is an extensive number of wildlife species that would be expected to occur in these habitats. Rarities in Sable are mainland moose and American marten. Edges and open areas are abundant, most commonly associated with barrens and low productivity wetlands. Recent research has shown that barrens support relatively unique wildlife diversity with several species that are restricted to this habitat including a number of lichens that are new to the province. Barrens are used extensively by small mammals, including snowshoe hare and bobcat.

Considerable public interest in this area is centred on habitat for white-tailed deer and snowshoe hare, common high profile hunted species. Deer prefer a mix of habitat types, as needs change seasonally. Ideal habitat for white-tailed deer would provide a combination of mature softwood cover, regenerating hardwood browse, open sites with herbaceous plants and fruits, and access to water. In general, the ecodistrict provides less than ideal habitat for white-tailed deer, as it does not have the land richness and mix of habitat types seen in other ecodistricts.

Good habitat for snowshoe hare has low dense ground cover, shrubs, and regenerating hardwoods and is near open areas that provide access to green plants in summer. The best habitat that could potentially support large populations of snowshoe hare would be early succession hardwood and mixedwood covertypes which are relatively uncommon in the ecodistrict. Also lacking here are the wooded swamps that tend to have rich soils and an understory of shrubs and other food plants. Population levels of bobcat, the major predator of the snowshoe hare, would be expected to have a similar distribution.

The habitat of the Sable Ecodistrict supports black bears.

Black bears inhabit the forest, preferring wooded areas and swamps, but sometimes search for food near human settlements.

Sable's mix of forest, wetlands, and barrens supports a scattered population of the endangered mainland moose. However, rather than showing a preference for this habitat, it is more likely that moose are restricted to the area by other factors, the most notable being a parasite carried by white-tailed deer, which can be fatal to moose. It is believed that in areas such as this where deer numbers are relatively low, moose have a lower chance of encountering the parasite.

Raptor nests are another important feature of Sable's terrestrial wildlife habitat. Information on nest locations is accumulated opportunistically, and because of their transitory nature, this data must be updated regularly.

The most prominent bird of prey in the ecodistrict is the osprey, which nests near water where fish are available. Northern goshawk are relatively uncommon because of their association with old growth forests, the need for large areas of continuous forested land, and a preference for large old growth trees (usually hardwoods) for nesting. The extensive open areas of wetland and barren could provide considerable habitat for northern harriers where small mammals are accessible, but the extent of nesting here is not known.

The provincially threatened olive-sided flycatcher occurs in coniferous forest edges and openings.

**Species at Risk**

A number of species considered to be at risk are found in the ecodistrict. The Sable Ecodistrict has a known total of 20 Atlantic Coastal Plain Flora (ACPF) species that are at risk in Nova Scotia, seven of which are listed under the Nova Scotia Endangered Species Act. Sites of occurrence are wetlands, including bogs, and along the seasonally exposed shorelines of lakes and rivers. The nationally and provincially endangered thread-leaved sundew is found on some of the larger bogs in the ecodistrict.

The Sable Ecodistrict supports part of a globally significant cool moist coastal forest that has the highest diversity of lichens in Nova Scotia. A number of lichen species of global significance and rarity occur here, including the nationally endangered boreal felt lichen.

*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.*

The nationally endangered boreal felt lichen is among a number of lichens of global significances found in the Sable Ecodistrict.

With much of the ecodistrict privately owned, effective wildlife management will to a great extent rely on active, informed stewardship by the many landowners. The Department of Lands and Forestry can assist private land stewardship by providing knowledge and information on various management strategies. Legislation such as the Wildlife Habitat and Watercourse Protection Regulations, the Endangered Species Act, and the 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*

## Sable – 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.

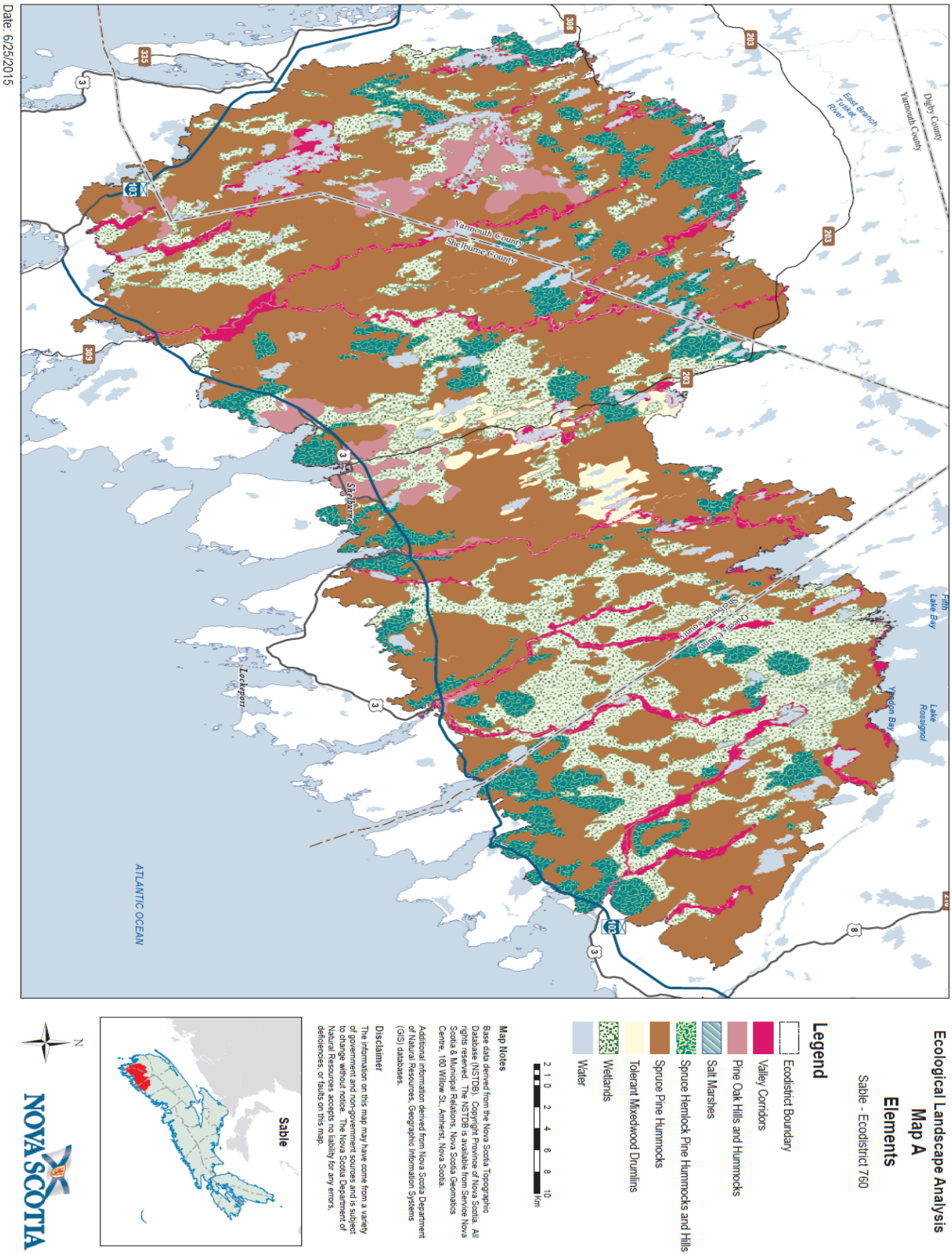
A landscape profile identified and mapped five distinctive landscape elements in the Sable Ecodistrict – one matrix, and four patches (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types.

**Spruce Pine Hummocks** is the matrix element. Black spruce dominates. White pine occurs on the dry, rapidly drained, coarse-textured soils. Red maple is the main hardwood. There is also some red oak.

**Wetlands** is the largest patch element, consisting mainly of bogs. The climax tree species is black spruce, along with much smaller numbers of white pine, as individual trees or in stands as drainage improves.

The other patch elements, in order of size, are **Spruce Hemlock Pine Hummocks and Hills, Pine Oak Hills and Hummocks,** and **Tolerant Mixedwood Drumlins.** *The ecodistrict also contains a tiny area of the element Salt Marsh.*

## Map of Elements in Ecodistrict



A variety of forest stands and vegetation types, dominated by white pine, red maple and red oak, are found within the various elements of the Sable Ecodistrict landscape.

## Forest Stands Within Elements

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

Viewed online or available in print through Department of Lands and Forestry, woodland owners can learn about the characteristics of a particular forest community. See Table 5a for descriptions of elements and Table 5b for forest stands that are likely to be found within elements, which in turn shape the landscape.

| Table 5a – Elements Within Sable | | |
|---|---|---|
| **Landscape Element** | **Size (Hectares)** | **Element Description** |
| Spruce Pine Hummocks (Matrix) | 160,565<br>57.8% | A distinguishing feature of the matrix element is the low fertility of the soils, which leads to a forest of black spruce and pine and a significant understory of woody heath-like shrubs. Black spruce, white pine, and red maple are predominant on all sites but white pine may occur as pure forests on the drier sites. With progressively poorer drainage, black spruce, tamarack and red maple dominate the forest vegetation. Where balsam fir occurs it has usually been deformed by the balsam wooly adelgid and remains in the understory often with large stem diameters and greatly reduced heights due to breakage. White pine often forms a super canopy overtopping red maple and black spruce. Red spruce, hemlock, and the shade-tolerant hardwoods are unlikely to be present in this element. Historically, these sites were frequently disturbed by fire, resulting in extensive areas of low stocking and/or barrens but suppression efforts are now encouraging natural infill. Red maple and red oak often occur in mixedwoods with white pine and black spruce but may form hardwood stands depending on the stand level disturbance. |
| Wetlands (Patch) | 70,090<br>25.2% | Wetlands is the largest patch-level element in the ecodistrict, comprised primarily of bogs (e.g. Dunraven Bog), fens and swamps, and poorly drained areas. It may occur as a large wetland complex associated with rivers and lakes (e.g. Tidney River), as narrow linear communities associated with flow accumulations and small streams, as a community of hydrophytic vegetation associated with level terrain where drainage is impeded, or as a depression in the landscape where water remains in excess year round. Smaller disjoint wetlands are often embedded within other elements. The wetlands are generally treeless or sparsely forested woodlands of black spruce, tamarack, and red maple. For the most part, sites are underlain by poorly drained mineral soils or organic soils derived from peat (sphagnum mosses) or sedges. Areas of slow-growing black spruce with huckleberry, inkberry, and high bush blueberry are common. This element plays a critical role in water collection, filtering, and ground water recharge. |
| Spruce Hemlock Pine Hummocks and Hills (Patch) | 32,116<br>11.6% | This element occurs as a patch-level ecosystem primarily in the northern portion of the ecodistrict and on drumlins along the Roseway River. Soils are well-drained, medium-textured, usually derived from quartzite and slates, and inherently more fertile than the granite-derived tills. They occur on low hills and hummocks (zonal condition) and support a forest of red spruce with white pine and some hemlock. Following infrequent natural disturbances (fire and hurricane), early successional forests may include shade-intolerant hardwoods such as red maple, white birch, and large-tooth aspen. On lower slopes and on level terrain with progressively poorer drainage, black spruce, red maple, and tamarack dominate the forest vegetation. Shade-tolerant hardwoods are occasionally present on top of some hummocks and drumlins. Where soils are less fertile, shallow to bedrock, or have been impoverished by repeated wildfires, white pine, red spruce, and black spruce are dominant and hemlock less common. |

| Table 5a – Elements Within Sable | | |
|---|---|---|
| **Landscape Element** | **Size (Hectares)** | **Element Description** |
| Pine Oak Hills and Hummocks (Patch) | 9,457<br>3.4% | Pine Oak Hills and Hummocks occurs primarily on well-drained, coarse-textured soils derived from granite on low hills and hummocky topography. The inherent soil fertility is poor resulting in a forest of red oak and white pine (red pine uncommon) with dense heath-like vegetation a significant component of the understory, creating both regeneration problems for tree species and a potential fire hazard. Stand level disturbances, usually fire, were historically frequent although both red oak and white pine can withstand understory fires. Early successional forests may include red maple, white birch, large-tooth aspen, and red oak. On lower slopes and on level terrain with progressively poorer drainage, black spruce, red maple, and tamarack dominate the forest vegetation. Where soils are less fertile, shallow to bedrock, or which have been impoverished by repeated wildfires, open black spruce woodlands with ericaceous vegetation and bracken fern are dominant. Red oak and white pine can reach large merchantable size with time. |
| Tolerant Mixedwood Drumlins (Patch) | 5,274<br>1.9% | Located mainly at three locations in the ecodistrict, this small patch-level element occurs on drumlin landforms comprising unsorted glacial tills. Soils of the drumlins and drumlin-like flutes (linear ridges of glacial till) are well-drained of medium texture. These productive soils yield forest stands comprising tolerant hardwood and softwood species which may occur as hardwood, softwood, or mixedwood covertypes. Primary species include red spruce, hemlock, white pine, red maple, and red oak. With progressively poorer drainage on the level terrain between drumlins, black spruce, tamarack, and red maple dominate the forest vegetation. Following harvesting, regenerating areas may have more white pine, balsam fir, and red maple. Historically, drumlins have been extensively used for settlement and farming and natural forests are uncommon. Abandoned agricultural lands tend to revert to forests of white pine and white spruce. |
| Salt Marsh | 42<br><0.1% | Along the estuaries of the Sable and Jordan Rivers salt marshes have formed from coastal sediments deposited in low-lying, sheltered, intertidal areas or behind spits, bars or islands, and protected bays. Deposits of silt loam sediments, with semi-decomposed grasses and sedges trapped in the accumulating layers, formed along the tidal shores. The lands have not been used for agriculture other than the harvesting of salt marsh grass for hay or bedding for livestock. |
| **Total** | **277,612*** | *Area is not the same as in Table 1 because water has not been included. The ecodistrict also contains a tiny area of the element Salt Marsh. |

**Table 5b – Forest Vegetation Types[1] Within Elements in Sable**

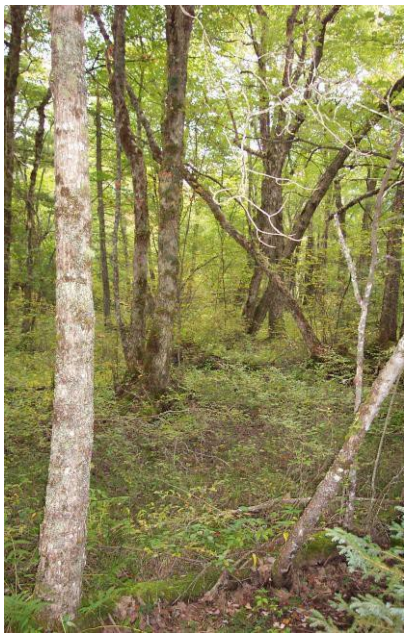
| Element | Seral Stage | | | | | |
|---|---|---|---|---|---|---|
| | Early | % * | Middle | % | Late | % |
| Pine Oak Hills and Hummocks | IH1, SP8 | 14.9 | IH2, IH6, SH9, SP4, SP6 | 55.7 | SP5, **SP9,** SH4, TH6 | 18.2 |
| Spruce Pine Hummocks | SP8 | 11.6 | SP4, SP6, SH9 | 41.7 | **SP5, SP7** | 30.9 |
| Spruce Hemlock Pine Hummocks and Hills | IH3, IH5, IH6, MW4, MW5 | 14.6 | SH5, SH6, SH8, MW2 | 47.5 | **SH1, SH2, SH3, SH4,** MW1, SP9 | 25.4 |
| Tolerant Mixedwood Drumlins | OF3, OF4, IH3, IH5 | 12.2 | IH6, MW2, MW4, SH4, SH5, SH6, SH8 | 38.9 | TH1, TH2, TH5, **MW1,** MW3, SH1, SH2, SH3 | 38.2 |
| Wetlands | WC1, WC2, WC5, WC6, WC7, WC8, WD1, WD2, WD3, WD4, WD6, WD7, WD8, SP7 | | | | | |

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

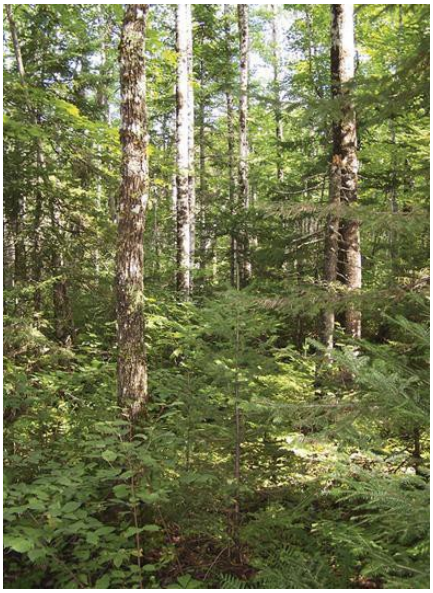
## Photos Illustrating Vegetation Types in Elements

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

Black spruce / Lambkill / Bracken (SP5) is a late successional vegetation type found in the Spruce Pine Hummocks matrix element.



Red maple / Poison ivy / Spagnum (WD4) is a vegetation type found in the Wetlands patch element.



Trembling aspen – White ash / Beaked hazelnut / Christmas fern (IH5) is an early successional vegetation type found in the Spruce Hemlock Pine Hummocks and Hills patch element.

Red oak – White pine / Teaberry (SP9) is a late successional vegetation type found in the Pine Oak Hills and Hummocks element. The above photo is from Queens County.

Red spruce –Red maple – White birch / Goldthread (MW2) is a mid-successional vegetation type found in the Tidney River Wilderness Area as part of the Tolerant Mixedwood Drumlins 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 Department of Lands and Forestry is employing to try and realize this objective. Department of Lands and Forestry's Wildlife Division 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.

The dominant natural disturbance regime in Sable is the frequent regime, which occurs when the interval between stand-initiating events is shorter than the longevity of the climax species. The natural disturbance prevents stands from developing uneven-aged characteristics.

Fire is likely the dominant disturbance agent in Sable. The matrix climax communities of black spruce-white pine and white pine-red oak would, under natural conditions, perpetuate themselves through this means. Often not all trees in a fire succumb to mortality. Fire intensity, moisture conditions, and topography are factors that enable older trees in small pockets, or as individuals, to survive and become part of the new community.

The extensive wetland-dominated areas illustrate an open seral disturbance regime. Tree growth is restricted because of adverse conditions such as excessive moisture, peat layers, and ericaceous (heath-like) vegetation. Barren areas, without fire protection, can be maintained under this regime. Repeated fires have negative effects on site productivity and encourage prolific ericaceous growth which results in conditions harmful to tree establishment and growth.

The infrequent natural disturbance regime is associated with tolerant softwood covertypes (red spruce, white pine, hemlock). The longer interval between major disturbances may allow many stands to begin to take on uneven-aged characteristics, such as multiple development stages, the result of scattered low severity disturbances, such as windthrow and old age.

Tolerant hardwood climax types, of which there are few in the ecodistrict, characteristically are sustained by the gap disturbance regime. Mortality often occurs on an individual or small group basis resulting in an uneven-aged structure, shade-tolerant species and formation of old growth. Mortality can result from animal damage, insects, disease, lightning, blowdown, and old age.

**Fire in Sable**

Fire has had a large impact on the forest community of Sable. Provincial fire records indicate that the probability of a fire caused by lightning is about one every 2.1 years. It has been reported that in 1903 the northern and eastern portions of Shelburne County experienced a large forest fire during the summer. The fire also covered parts of Digby and Yarmouth counties and western Queens County. Patches of swamp and heavily forested areas that escaped the fire represented about one-third to one-half of the total area.

Historically, repeated fires likely contributed to maintenance of barren conditions in the ecodistrict. About 100 years ago, it was reported that Shelburne was the most scantily forested county in the province, with two-thirds of its area being classified as either natural or fire barrens. Many of these barrens are now forested. Cultural practices traditionally included the setting of fires for blueberry growth and new growth for wildlife food.

## Forest Composition

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

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

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

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

Within this simplified description there is considerable variation in the processes and structures that evolve in particular stands. When the current forest inventory is used to classify development

classes, the height criterion is used. When forecasting future conditions using the Forest Model, the age criterion is preferred.

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

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

- early
- mid
- late

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

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

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

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

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

## Forest Composition Objectives

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

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

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

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

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

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

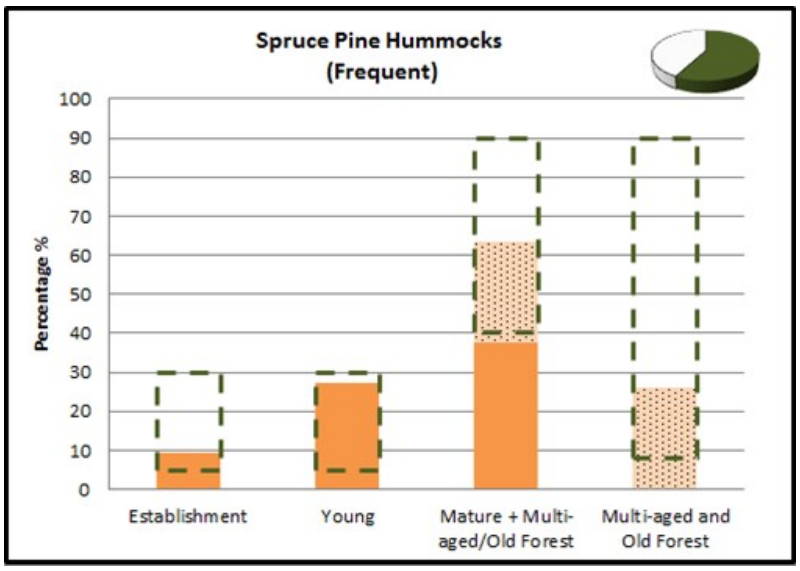
Table 6 indicates that for frequent stand-initiating disturbances, both establishment and young development class forests would typically comprise between 5 and 30% of area, while mature forest – which includes multi-aged and old forest – would cover more than 40%. Mature forest should consist of a relatively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

## Development Class Targets by Element

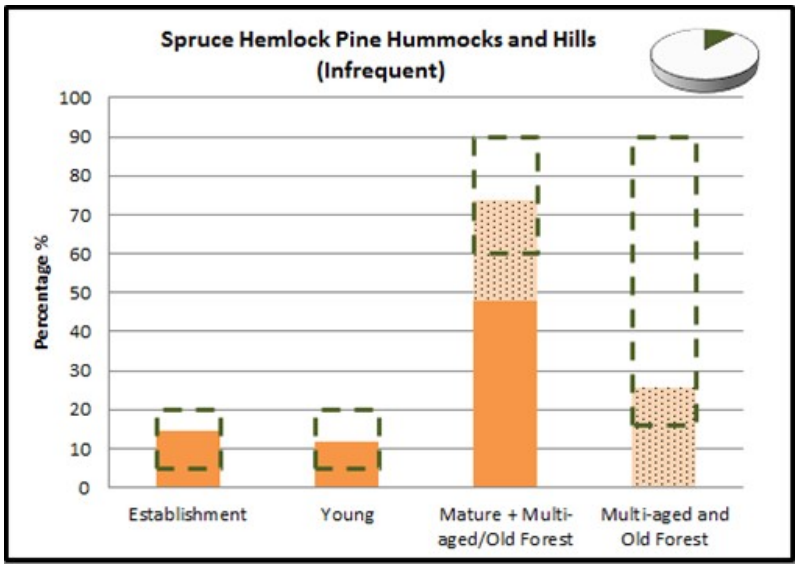
The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime (NDR). The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage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

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

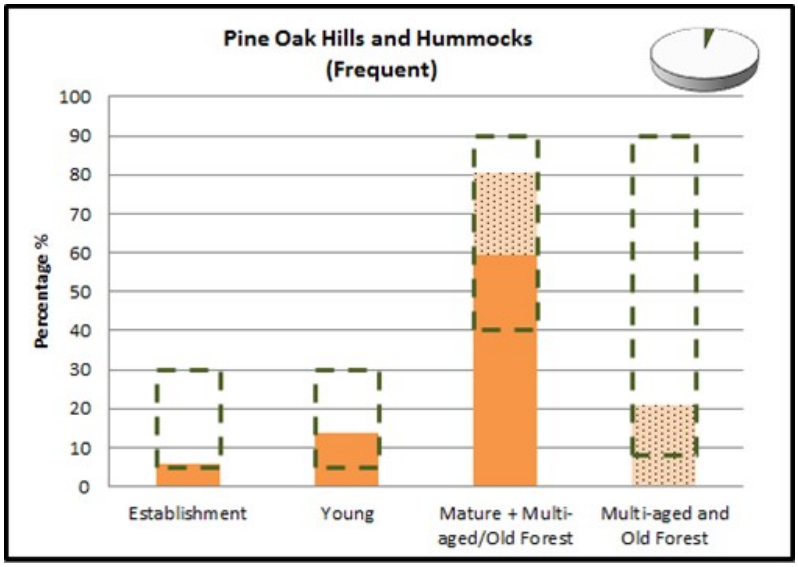
In the matrix element **Spruce Pine Hummocks**, all of the development classes are within their target ranges. These frequent NDR forests support periodic stand initiation events that favour establishment of an even-aged forest, often with scattered surviving mature pine that provide large seed trees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



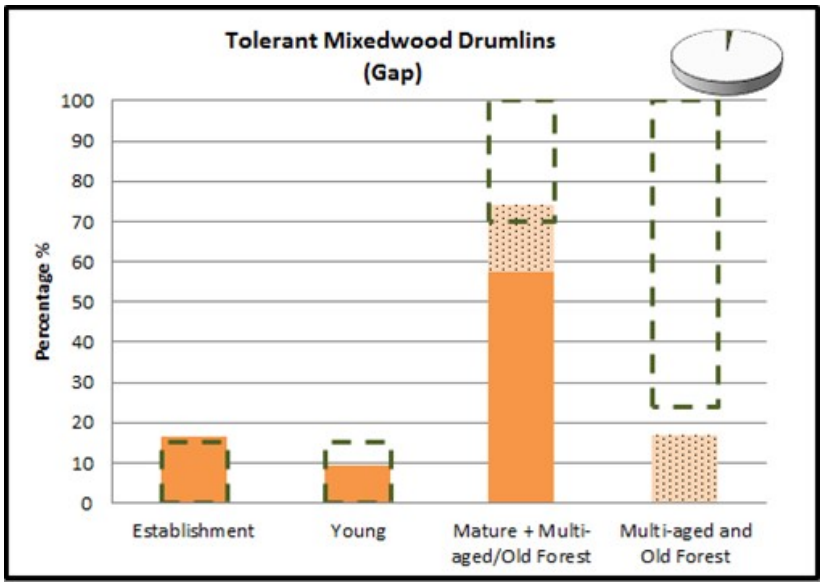

The composition of the patch element **Spruce Hemlock Pine Hummocks and Hills** is within target ranges. This supports a variety of forest management opportunities, including clearcut harvesting and uneven-aged management, as dictated by site conditions. Infrequent NDR forests support long-lived mature forests with understories of shade-tolerant regeneration.




In the small **Pine Oak Hills and Hummocks** element, the establishment class is just barely within the target range, indicating that recent stand-level disturbances have been missing. In this fire-adapted ecosystem, mature trees often survive low intensity fires, which act as stand-maintaining events by reducing overstories, clearing understories, and stimulating regeneration of pine/oak to create two layered stands.



In **Tolerant Mixedwood Drumlins**, the smallest patch element, multi-aged and old forest is below target, while young and mature classes are within their ranges. Establishment class slightly exceeds the maximum range. Partial harvests, including retention of large old trees, will promote multi-aged forest, particularly in tolerant hardwood stands. Management of immature stands to favour climax species will provide future mature forest opportunities.



## 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

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| Biodiversity | The diversityof 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:<br>**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.<br>**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. |

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| 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:<br>**Softwood:** softwood species compose 75% or more of overstory<br>**Hardwood:** hardwood species compose 75% or more of overstory<br>**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. |
| Drumlin | A low, smoothlyrounded, elongate hill of compact glacial till built under the margin of the ice and shaped by its flow. |
| 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. |

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| Ecosite | The fifth of five levels in the Ecological Land Classification for Nova Scotia Volume 1, and a subdivision of ecosections. Characterized by conditions of soil moisture and nutrient regimes. Although not mapped, the Acadian and Maritime Boreal ecosites of the province are fully described in the Forest Ecosystem Classification for Nova Scotia (2010). |
| Ecosystem | A functional unit consisting of all the living organisms (plants, animals, and microbes) in a given area, and all the non-living physical and chemical factors of their environment, linked together through nutrient cycling and energy flow. An ecosystem can be of any size – a log, pond, field, forest, or the earth's biosphere – but it always functions as a whole unit. Ecosystems are commonly described according to the major type of vegetation, such as a forest ecosystem, old-growth ecosystem, or range ecosystem. Can also refer to units mapped in the Department of Lands and Forestry Ecological Land Classification system. |
| Element | A landscape ecosystem containing characteristic site conditions that support similar potential vegetation and successional processes. Elements were mapped by combining ecosections with similar climax vegetation and natural disturbance interpretations. Depending on their role in the ecosystem, elements may be described as matrix, patch, or corridor. |
| Endangered species | A wildlife species facing imminent extirpation or extinction. A species listed as endangered under the federal or Nova Scotia endangered species legislation (NS Endangered Species Act or federal Species at Risk Act). |
| Even-aged | A forest, stand, or vegetation type in which relatively small age differences exist between individual trees. Typically results from stand-initiating disturbance. |
| Extinct species | A species that no longer exists. A species declared extinct under federal or Nova Scotia endangered species legislation (NS Endangered Species Act or federal SARA). |
| Extirpated species | A species that no longer exists in the wild in Nova Scotia but exists in the wild outside the province. A species declared extirpated under federal or Nova Scotia endangered species legislation (Nova Scotia Species at Risk Act or federal SARA). |
| Forest management | The practical application of scientific, economic, and social principles to the administration and working of a forest for specified objectives. Particularly, that branch of forestry concerned with the overall administrative, economic, legal, and social aspects and with the essentially scientific and technical aspects, especially silviculture, protection, and forest regulation. |

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| 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. |

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| 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:<br>**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.<br>**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.<br>**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. |

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| 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. |

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| 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 landbase designated under the Wilderness Areas Protection Act (e.g. Canso Barrens). |