Department of Lands and Forestry

2019 Update

# ECOLOGICAL LANDSCAPE ANALYSIS VALLEY SLOPE ECODISTRICT 710

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

ELA 2019-710

NOVA SCOTIA

***Ecological Landscape Analysis, Ecodistrict 710: Valley Slope***
***2019 Update for Part 1 and 2***

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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.

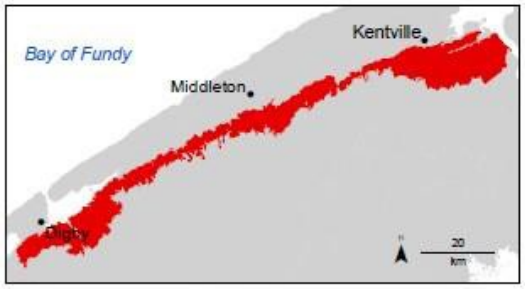
Table 2 was not updated as Integrated Resource Management Land Use Categories have not been updated.
Table 4 was not updated because the land capability for individual polygons has not changed since the original report. Land generally still has that same capability rating now as it did previously, regardless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

# Table of Contents – Parts 1 and 2



**Tables**

**A NOVA SCOTIA DEPARTMENT OF NATURAL RESOURCES PUBLICATION**




# Ecodistrict Profile

## Ecological Landscape Analysis Summary
## Ecodistrict 710: **Valley Slope**

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 Valley Slope Ecodistrict 710. 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.

Valley Slope, a narrow ecodistrict that stretches from the Acacia and Bear River valleys in Digby County east to Mount Denson in Hants County, has some of the most fertile soils in the province.

The slopes of the ecodistrict, protected from the cooler climate associated with the Bay of Fundy by its inland location, have been used extensively for apple orchards, mixed farming, and vineyards.

The soils and climate that are favourable for agriculture are also good forforests. In Valley Slope, about two-thirds of the land has a growth rating for forested land higher than the provincial average.

The Gaspereau River cuts through the ecodistrict on its way to the Minas Basin.

This ecodistrict has the lowest area of freshwater of all ecodistricts in the Western Ecoregion, with only half of 1% comprising lakes and rivers.

The total area of the Valley Slope Ecodistrict is 88,452 hectares. Private land ownership accounts for about 89%. Provincial Crown land accounts for 9% of the area while aboriginal lands represent 0.3%. Federal and other lands account for the rest. *Nova Scotia's purchase in 2013 of former Bowater Mersey Paper Company Limited lands has increased Provincial Crown land ownership to 8.5% of total area.*

Legally protected reserves within Valley Slope include the Grand-Pré National Historic Site and a small portion of the Cloud Lake Wilderness Area.

Valley Slope provides excellent habitat for red-tailed hawks, which favour mixed open and wooded habitat, as long as there are suitable nest trees near feeding areas. There are reports of goshawks nesting in this ecodistrict, and one area at the northeastern end of the Valley Slope is recognized as a consistently important nesting site.

A significant number of wintering bald eagles congregate at the northeastern end of the Valley Slope and in the adjoining Annapolis Valley Ecodistrict. Eagles use stands of large mature trees on the steep ravine along the Gaspereau River for night roosting.

Eastern white cedar, designated vulnerable in Nova Scotia, is the only Valley Slope plant species listed under the Nova Scotia Endangered Species Act as of 2008. Eastern white cedar has been identified at several sites in the ecodistrict.

Hemlock forests are common along the ravines leading to the Valley floor.

A little more than three-quarters of the ecodistrict is forested. On the upper slopes of well-drained areas, the climax forests are shade-tolerant hardwoods. Sugar maple, beech, and yellow birch, with scattered white pine, dominate these sites. Farther down the slope on the deep moist soils and in the shaded ravines, a climax forest of hemlock, red spruce, and white pine is found. The lower slopes often support characteristics of forest elements that would be present in the adjacent Annapolis Valley 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 six key landscape elements – one dominant matrix element, and five smaller patch elements – in Valley Slope.

**Spruce Hemlock Pine Hummocks and Hills** is the matrix element, representing more than 73% of the ecodistrict. This element naturally supports climax forests of long-lived species that generally grow well in shade, such as red spruce, hemlock, white pine, sugar maple, yellow birch, and white ash. About one-quarter of the matrix has been converted to agriculture or settlement.

**Tolerant Hardwood Hills**, representing nearly 19% of the ecodistrict, is the largest patch element. The climax forest community is sugar maple, yellow birch and beech, and this hardwood component is similar to the second largest patch element, **Tolerant Mixedwood Slopes**, representing a little over 6%. The remaining three patch elements – **Spruce Pine Flats**, **Wetlands** and **Pine Oak Hills and Hummocks**. *A tiny Floodplain element is also part of the ecodistrict.*

## Forest Ecosystem Management
## **For Valley Slope 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 Valley Slope Ecodistrict 710. 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 Valley Slope 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 Valley Slope – *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

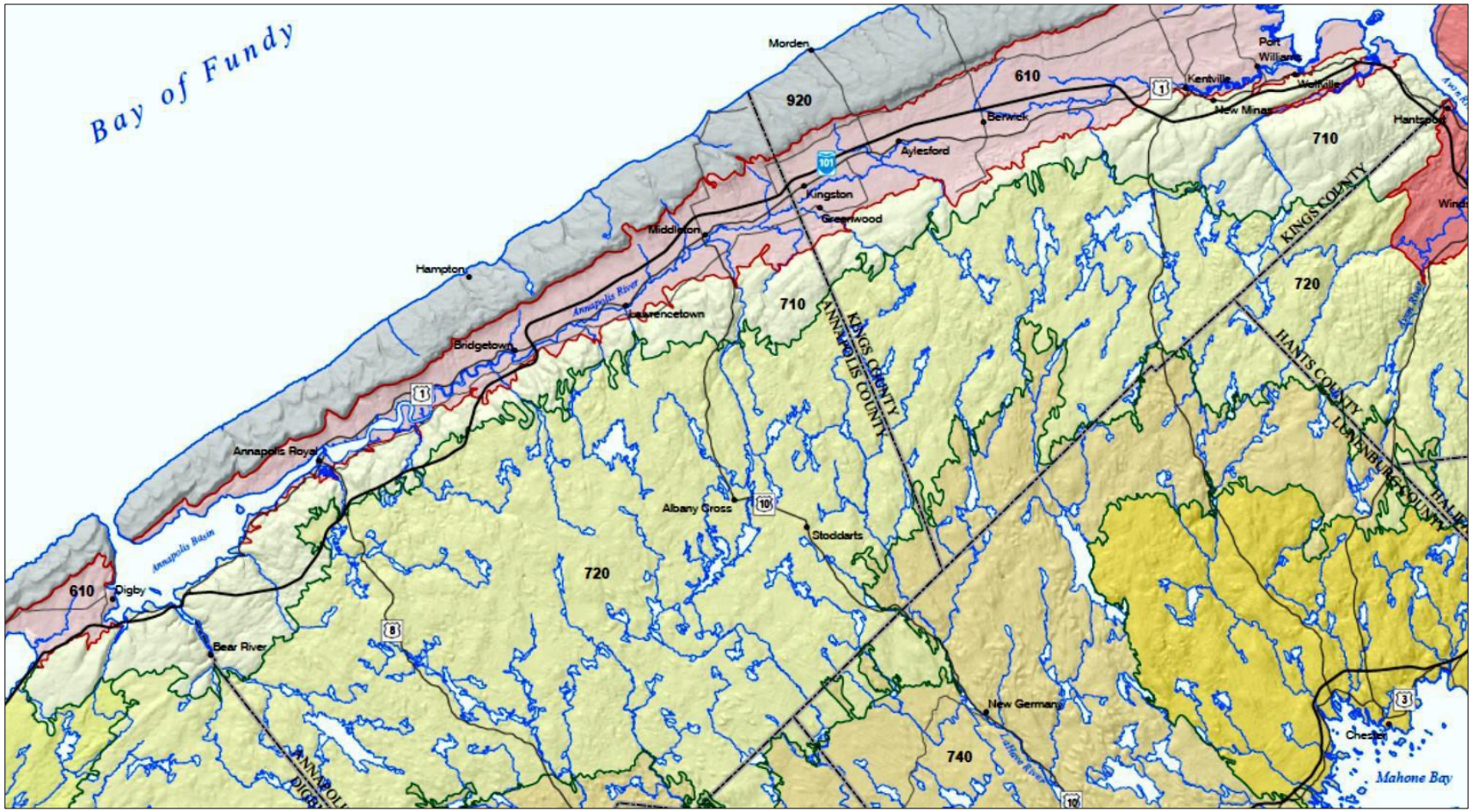
Valley Slope is one of eight ecodistricts that make up the Western Ecoregion. Valley Slope is bounded by the Annapolis Valley Ecodistrict 610 and the South Mountain Ecodistrict 720 and extends from the Bear River and Acacia River valleys in the west to Mount Denson in the east. The total area of the Valley Slope Ecodistrict is about 885 square kilometres, or 5.2% of the Western Ecoregion.

With a climate warmed by a westerly exposure and lands far enough inland to lessen the climatic effects of the Bay of Fundy, these slopes have been used extensively for apple orchards and mixed farming.

Between Annapolis Royal and Middleton, granites constitute the bedrock. Soils on this parent material tend to be coarse to moderately coarse, well-drained and commonly gravelly with surface stones limiting machine operability and tree stocking levels. Slates, schists, and quartzites underlie the slopes in Kings County, providing well-drained, moderately coarse to medium-textured soils. There are only two areas of the ecodistrict where finer textured soils occur and these are underlain by shales and sandstones near Middleton and Hantsport.

The dominant climax community naturally supported in the ecodistrict is red spruce-hemlock-white pine. A climax forest of sugar maple-yellow birch-beech is expected to occur on many of the larger hills. Relatively deep ravines, which are quite common, will support a late successional mixedwood forest of shade-tolerant hardwood and softwood species.

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




Valley Slope Ecodistrict 710, shown in the ivory colour on the map, is a long, narrow ecodistrict that runs southwest to northeast, through Digby, Kings, Annapolis, and Hants counties. The ecodistrict falls between the communities of Bear River in the west and Wolfville in the east.
(From Ecodistricts of Nova Scotia map 2007)

## Land Area

Nearly 89% of the land in this long, narrow ecodistrict is privately owned (Table 1).

The ecodistrict's few scattered Crown blocks are concentrated in the central portion of Valley Slope at Upper Clements and south of Torbrook.

**Table 1 – Land Area by Ownership in the Valley Slope Ecodistrict***

| Ownership | Area (hectares) | Percent of Total Area |
|---|---|---|
| Provincial Crown land | 7,795 | 8.8 |
| Private | 78,832 | 89.1 |
| Federal | 37 | 0.04 |
| Aboriginal | 281 | 0.3 |
| Other (Includes inland water bodies and transportation corridors) | 1,508 | 1.7 |
| **Total** | **88,452** | **100** |

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

Aboriginal land is held by the Bear River and Glooscap (formerly known as Horton) Mi'kmaq bands.

Along most of the length of the ecodistrict, its southern areas are characterized by a forested landscape. On the northern boundary, which adjoins the Annapolis Valley, the use of the land for agriculture is most prominent in Kings County, generally lessening westward.

Major population centres within the ecodistrict include portions of Wolfville, New Minas, Kentville, Annapolis Royal, Cornwallis and Smiths Cove.

## 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).

The area classified C2 in Valley Slope has significant wildlife habitat, significant wetlands, potential old forest, and recreation / trail development possibilities.

| 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 | 976 | 42.4 |
| C2 – Multiple and Adaptive Use | 668 | 29 |
| C3 – Protected and Limited Use | 525 | 22.8 |
| Unclassified | 134 | 5.8 |
| **Total** | **2,303** | **100** |

A section of the former CNR Rail line from Nictaux to Bridgewater is located in part of the ecodistrict. The rail line is generally 30 metres wide but wider at old stations and siding sites. The long-term plan for the rail corridor is trail development and this line is under a management agreement with the South Shore Annapolis Valley Recreational Trail Association. A large number of existing crossings and new crossings are being applied for.

No campsite leases are in effect within the ecodistrict. Those that have leases in a wilderness area, however, may be given the option of trading for these sites on Provincial Crown land. The wildlife park in Upper Clements has a special lease.

Most of the major rivers in Valley Slope that flow through the ecodistrict originate in the adjoining South Mountain 720 Ecodistrict. Some rivers, such as the Nictaux, have dams controlled by Nova Scotia Power. NS Power may own the submerged land or have flowage rights on leases for land that was flooded when the dams were installed. NS Power also has easements for power lines across Crown lands.

| Table 3 – Area Distribution by Land Category for All Owners | | |
|---|---|---|
| **Category** | **Hectares** | **Percent** |
| Forested | 72,390 | 81.8 |
| Wetland | 1,112 | 1.4 |
| Agriculture | 8,600 | 9.7 |
| Barrens | 3 | 0.003 |
| Urban | 3,819 | 4.3 |
| Road, Trail, Utility | 1,634 | 1.8 |
| Other | 794 | 1.4 |
| **Total** | **88,452** | **100** |

## Forests

The Valley Slope Ecodistrict has 72,390 hectares, or 82%, classified as forested (Table 3).

Much of the remaining area is used for agriculture or urban development, totaling more than 14%. A small area – 1,112 hectares, or 1.4%, of the ecodistrict – is wetland. Other land use includes areas of brush, alders, and gravel pits.

The current forest contains 13,279 hectares of softwood stands (75% or more softwood species), accounting for 18% of the forest cover. Red and white spruce are the dominant softwoods with lesser amounts of fir, pine and hemlock. Mixedwood stands make up 43% of the forest.

These stands are most often combinations of red spruce and fir or white spruce with hardwoods, such as red maple or white birch.

Hardwood stands comprise 22,698 hectares, or about 34%, of the forest. The hardwood component is mostly red maple and white birch with some sugar maple, beech, and white ash.

The average Land Capability (LC) of forested land in this ecodistrict is estimated to be 5.7 cubic metres per hectare per year ($m^3$/ha/yr), based on the ratings in Table 4. The average forest LC for the province is 4.9 $m^3$/ha/yr.

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

| Land Capability (LC) Rating ($m^3$/ha/yr)* | Hectares | Percent |
|---|---|---|
| 2 or less | 74 | 0.1 |
| 3 | 318 | 0.5 |
| 4 | 2,318 | 3.4 |
| 5 | 19,513 | 28.6 |
| 6 | 41,688 | 61.1 |
| 7 or more | 4,306 | 6.3 |
| **Total** | **68,217** | **100** |

*Based on growth potential for softwood species.

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

In Valley Slope, about two-thirds of the land has an LC rating of six or higher, indicating fertile areas for tree growth.

When LC 5 lands are included, 96% have this rating or higher, showing the exceptional fertility of the land.

The exceptional fertility of much of the land in Valley Slope, shown in this photo of the Kentville Ravine, results in above average forest growth.

## Water Resources

Inland waters make up only 414 hectares, or 0.5%, of the ecodistrict.

Most of the feeder waterways for the Annapolis River – including Bear, Allains and Nictaux rivers – flow through this ecodistrict. The Gaspereau River also flows through Valley Slope.

The area contains only a few lakes – the largest being Lumsden Pond, which was established as a result of hydroelectric damming in the 1940s. Many of the waterways eventually drain into the Annapolis and Cornwallis rivers.

Water supply areas for Wolfville, Kentville, Lawrencetown and Cornwallis are part of the ecodistrict.

## Minerals, Energy and Geology

The main bedrock types in Valley Slope are slates and greywackes from the Meguma Group – metamorphic and sedimentary rocks that are about half a billion years old – accounting for 45% of the ecodistrict.

Granites from the South Mountain Batholith account for about 35% of the ecodistrict. On the western end of the ecodistrict, black sandstones, conglomerates, shale, and arkose rocks comprise about 15%.

The Meguma Group is divided into the Goldenville Formation and the Halifax Formation. The Goldenville Formation consists of sandstones and siltstones that have been changed by pressure and heat. Many gold deposits in Nova Scotia are found within this formation. The Halifax Formation consists of black to grey to rust-brown slate and black siltstone.

The South Mountain Batholith is the largest granitoid batholith in the Appalachian orogeny (the process of mountain building), spanning an area of about 7,300 square kilometres. The unique mineralization associated with the granitic plutons of the batholith and the contact margins of the Meguma Group are excellent targets for future exploration and potential development. Mineralization associated with the batholith consists of polymetallic mineral deposits with tin, tungsten, uranium, molybdenum, arsenic, fluorite, copper, and zinc associations.

Smaller formations in the ecodistrict are made up of shallow marine slates, silty slates, mudstone, and sandstone with a minor limestone component.

The Horton Group of rocks comprises glaciofluvial conglomerate, sandstone, and shale. The eastern end of this ecodistrict, within the Horton Group, has had seismic exploration for onshore oil and gas. There are numerous uranium mineralization occurrences within the Horton Group.

Exploration activity within the ecodistrict is low, with the majority of activity centered on general reconnaissance exploration. Past exploration in this ecodistrict was extensive and mostly associated with exploration for iron. This area is a contact zone among several formations and is therefore important for exploration.

In the Nictaux-Torbrook area, 350,000 tonnes of iron ore were produced between 1825 and 1913. However, the Nictaux-Torbrook reserves, like others in Annapolis County, were generally small and of poor quality, with a high phosphorous content. These past production and exploration areas are current targets for prospectors and exploration companies.

There are numerous abandoned mine openings associated with the past mining activities in the Nictaux-Torbrook area. The mine openings are located on both Crown and private lands and caution should be used when walking or working in this area.

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 Resource office.

The surface geology in this ecodistrict is dominated by a thin stony till cover and bedrock is very close and often exposed at the surface. The slope is fairly steep, with a rise in elevation from nearly sea level at the base to about 150 metres above sea level at the highest elevation. This sloped area is a key location for quality aggregate quarry production. Numerous quarries in this area are used by local contractors to supply crushed rock for road building and asphalt.

The soils in this ecodistrict are derived from parent material of granite bedrock, along with slates and glacial material. The soils are typically shallow and acidic. Quite a few glaciofluvial outwash deposits (kames and eskers) are found along the base of the ecodistrict, primarily where the slope meets the valley floor at the base of the South Mountain. These deposits formed during the last glacial period, which ended about 10,000 years ago, and are good sources of gravel, sand, and rock that are used extensively in the construction industry.

## 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/.

The Grand-Pré National Historic Site is one of the cultural features of the Valley Slope Ecodistrict.

A small part of the Cloud Lake Wilderness Area is within Valley Slope Ecodistrict 710.

## Wildlife and Wildlife Habitat

Wildlife in the Valley Slope 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 Valley Slope 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 management of fish resources in Nova Scotia is shared between the federal Department of Fisheries and Oceans and the Nova Scotia Department of Fisheries and Aquaculture. While the Nova Scotia Department of Natural Resources does not have direct responsibilities related to fish, there is some overlap with regard to the aquatic habitat of fish and other wildlife.

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

Most likely due to its sloping nature, Valley Slope has an abundance of watercourses, many carrying water northwest toward the floor of the Annapolis Valley along the entire length of the ecodistrict, as well as to the Gaspereau Valley at its northeastern end. There are relatively few lakes and wetlands in the ecodistrict, and most of the wetlands occur along watercourses where the land is sufficiently flat or depressed to retain water.

Wetlands directly connected to Valley Slope watercourses are shrub swamps, fens, meadows, and lakeshore wetlands, and together these make up 76% of total wetland area in the ecodistrict.

Shrub swamps are the most abundant wetland type in the ecodistrict, at 36% of wetland area. Meadows and fens along streams occupy 20% and 19% of wetland area, respectively. As a reflection of the rarity of lakes in the ecodistrict, lakeshore wetlands make up less than 2% of total wetland area.

Unlike other types of wetlands, bogs do not have access to nutrients carried by flowing watercourses. Bogs receive their water primarily from rainfall, so they are not closely associated with watercourses in the ecodistrict, except where streams carry draining water away.

In addition to wetlands, the numerous watercourses and their tributaries provide important aquatic and riparian habitat. In these areas, aquatic plants and invertebrates support semi-aquatic mammals 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 riparian zone, the area 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.

Valley Slope lakes support common species of fish, such as yellow perch, brown bullheads, white suckers, American eel, and golden shiners.

In the spring, when waters are high, brook trout are likely present, retreating to cooler sites when lower water levels result in rising lake water temperatures.

Yellow perch are known to have a high tolerance for both acidic and warm waters. Smallmouth bass, illegally introduced as a sport fishing species, occur in the Black River Lake system, including Lumsden Pond. Smallmouth bass are voracious predators that can dramatically influence the health of native species.

The availability of fish is a limiting factor for populations of fish predators, such as otters, common loons and osprey.

**Terrestrial Habitat and Wildlife**

In assessing the overall nature of wildlife habitat within an ecodistrict, it can be helpful to focus on the habitat preferences of common species. White-tailed deer and snowshoe hare are common and high-profile species, known to be found throughout the province.

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.

Throughout most of the Valley Slope, stands of mature softwood are widely scattered, so the degree of canopy closure needed for adequate winter cover appears to be limited. However, the continuity of mature softwood stands in the northeastern end of the ecodistrict is greater, thereby affording better winter cover for wildlife. Also present is a considerable amount of agricultural land, particularly near the northwestern edge, and at the northeastern end. There is good quality habitat for white-tailed deer in this ecodistrict.

Ideal 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 successional hardwood and mixedwood.

The Valley Slope Ecodistrict provides productive habitat for snowshoe hare because of the abundance of young intolerant hardwood and mixedwood stands, especially where these are near forest openings and agricultural lands.

The abundance of snowshoe hare and deer in the Valley Slope may be limited by the relatively low occurrence of wooded swamps, with their understory of shrubs and other food plants. Like deer, snowshoe hare will occur throughout the ecodistrict, but abundance will depend on suitable habitat. The distribution and abundance of snowshoe hare will in turn influence that of their predators, mainly bobcats and coyotes.

Birds of prey (raptors) are high trophic level feeders that occupy large territories and are far less abundant than their prey species. Because they are relatively few in number, raptor species are of concern from a conservation standpoint. Identifying existing or suspected nest site locations is one important aspect of raptor conservation. Information on nest locations is accumulated opportunistically, and because of their transitory nature, this data requires regular updating.

Eastern white cedar, the only Valley Slope plant species listed in the mid-2000s under the Nova Scotia Endangered Species Act, has been identified at several sites in the ecodistrict.

Raptor habitat requirements vary, but most need large mature trees for nesting. Red-tailed hawks hunt a variety of prey in areas of mixed open and wooded habitat, so the Valley Slope would provide excellent conditions for this species provided there are suitable nest trees near feeding areas.

Goshawks are more specific in their nesting requirements, and they are much less common because of their preference for old mature forests where they need large areas of continuous forested land to hunt birds and for nesting. There are reports of goshawks nesting in this ecodistrict, and one area at the northeastern end of the Valley Slope is recognized as a consistently important site.

Another interesting feature of the ecodistrict related to raptors is the significant number of wintering bald eagles that congregate at the northeastern end of the Valley Slope and adjoining Annapolis Valley ecodistricts. Eagles use stands of large mature trees on the steep ravine along the Gaspereau River for night roosting. During the day these birds feed mainly on agricultural carrion.

Eastern white cedar has been identified at several sites in the ecodistrict, most of them between Prospect in Kings County and Carleton Corner, Annapolis County. This white cedar has been designated vulnerable in Nova Scotia, the only Valley Slope plant species listed under the Nova Scotia Endangered Species Act when this ELA report was originally written, around 2008.

*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 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 class (establishment, young, mature, multi-aged / old forest) patches and their distribution over area and time.

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

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

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

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

i. assessing the potential for old forest stands and development class distributions
ii. determining appropriate patch sizes and species composition to emulate natural structures and processes
iii. prescribing the appropriate rotation age and development class structure across a forested landscape

iv. projecting future changes to the forest due to climate change and human disturbances
v. maintaining and conserving biodiversity

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

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

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

Natural disturbance agents in the Valley Slope Ecodistrict are primarily associated with hurricanes and are of an infrequent nature. The beech bark canker, introduced in the 1890s, has reduced the beech to an understory species although scattered disease-free individuals are not uncommon.

An increase in average annual temperature due to global warming may have significant impact on forest composition, especially on the drier soils in this ecodistrict. Soil moisture may not change since precipitation amounts are not expected to decrease with climate change. However, the frequency and extent of natural disturbances such as hurricanes and windstorms may impact forests of this ecodistrict.

## 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.

### 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*

**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).

In the Valley Slope Ecodistrict, shade-tolerant hardwoods are the climax forest on the upper slopes of well-drained areas. Sugar maple, beech, and yellow birch with scattered white pine dominate these sites. Farther down the slope and in the shaded ravines, hemlock and red spruce are found. A good example of this forest type can be found at Kentville Ravine and at other locations along Highway 101 between the Bridgetown and Digby exits. On the deep moist soils, the climax forest comprises tolerant softwoods, including red spruce, hemlock, white pine, and balsam fir.

There is little in the way of historical information pertaining to the forests in this ecodistrict. Titus Smith in 1801 made only a quick pass down the slopes to Nictaux before returning to an easterly route on the South Mountain. A report from 1912 describes the forests on the north-facing slopes as "the mixed type with red spruce and hemlock predominating over the hardwoods, but there are frequently hills of pure over-mature and decrepit hardwoods, half composed of beech, 40 percent hard (sugar) maple and the rest, yellow birch."

## Valley Slope – Elements Defined

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

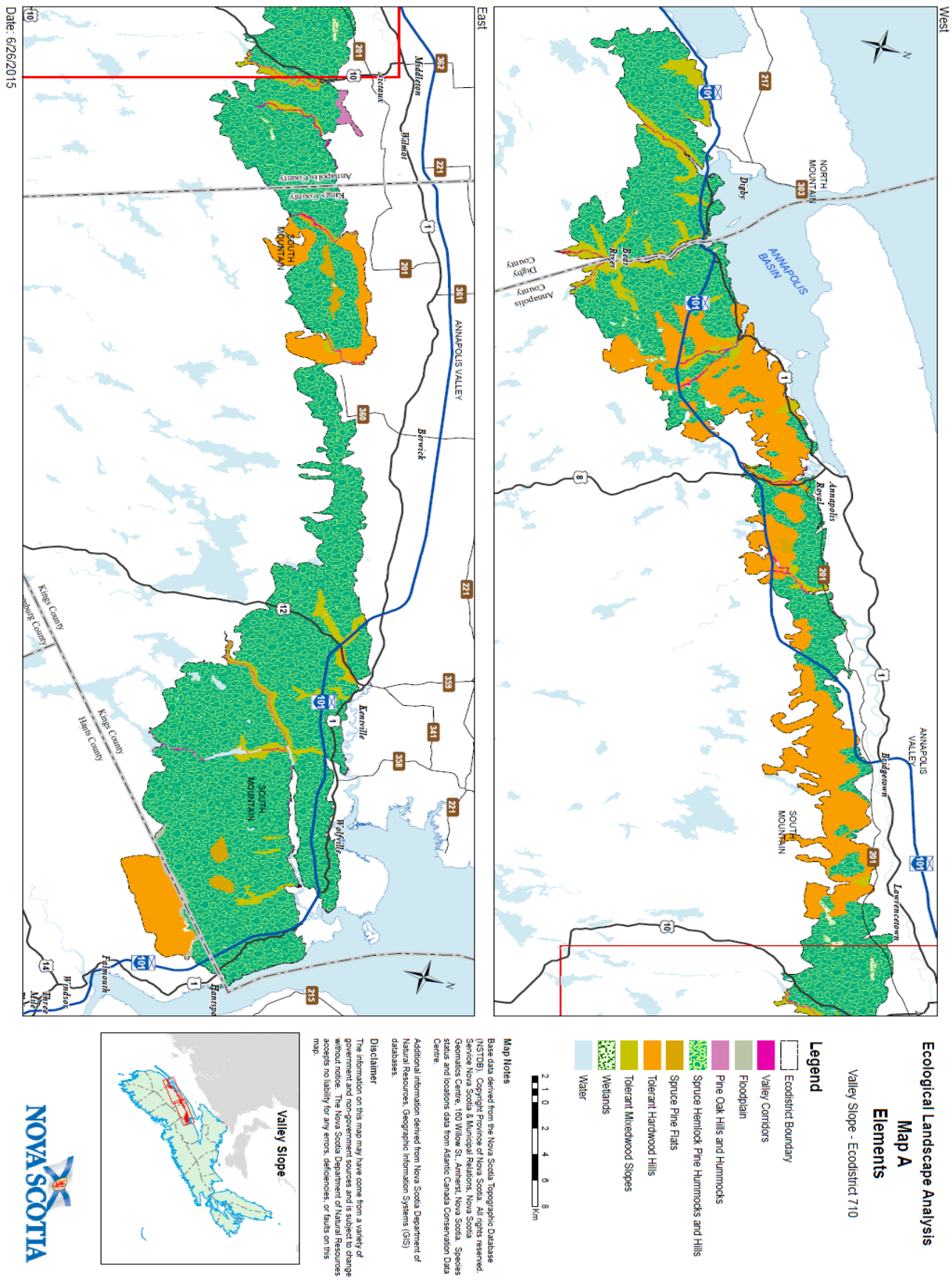
A landscape profile identified and mapped six distinctive elements in the Valley Slope Ecodistrict – one matrix, and five patches (Table 5a). A matrix is the dominant community type. Patches are smaller yet still distinctive community types.

**Spruce Hemlock Pine Hummocks and Hills** is the matrix element, representing more than 73% of the ecodistrict. This element naturally supports long-lived species that generally grow well in shade, such as softwoods of red spruce, hemlock, and white pine and hardwoods of sugar maple, yellow birch, and white ash.

**Tolerant Hardwood Hills**, representing nearly 19% of the ecodistrict, is the largest patch element, followed by **Tolerant Mixedwood Slopes** at a little over 7%. The remaining three patch elements – **Spruce Pine Flats**, **Wetlands** and **Pine Oak Hills and Hummocks** –*A tiny Floodplain element is also part of the ecodistrict.*

The ecological structure of the ecodistrict has been altered from the type of forest that would have naturally occurred. Much of the forest would have supported a climax of tolerant softwood or tolerant mixedwoods. Currently, less than one-third of the forest (up to 2007) is made up of late seral species.

## 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 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. Refer to Table 5a for descriptions of elements and Table 5b for forest vegetation types that are likely to be found within elements.

A variety of vegetation types are shown in this photo of the Acacia Valley, part of Valley Slope 710.

| Table 5a – Elements Within Valley Slope | | |
|---|---|---|
| **Element** | **Size (Hectares)** | **Element Description** |
| Spruce Hemlock Pine Hummocks and Hills (Matrix) | 63,815<br>72.5% | This is the matrix-level element in this ecodistrict. It occurs primarily on well-drained soils with a variety of textures but is most likely found on medium to fine-textured soils. The zonal condition – medium to fine-textured, moderately well-drained soils – creates a forest of red spruce, hemlock, and white pine. Where soils are better drained and/or richer as may occur on upper slopes or in seepage-enriched areas, tolerant hardwood (sugar maple, yellow birch, and white ash) may be found. Following infrequent natural disturbance, early successional forests may include shade-intolerant hardwoods such as red maple, white birch, largetooth aspen, and trembling aspen. Due to the abundance of streams flowing off the slopes toward the Annapolis Valley, small wetlands are frequently associated within this element. Approximately 25% of this matrix element has been converted to other land uses. |
| Tolerant Hardwood Hills (Patch) | 16,732<br>19.0% | Tolerant Hardwood Hills is a patch-level element in this ecodistrict and occurs on the north facing slopes of the Annapolis Valley. Soils are typically well-drained loams and sandy loams derived from glacial tills of shales and sandstones. These productive soils yield forest stands comprising shade-tolerant hardwood species, such as sugar maple, yellow birch, beech, and white ash. On crests and upper slope positions, beech and sugar maple are more dominant but as moisture progressively increases toward middle and lower slope positions, yellow birch and white ash become more common and mixedwood conditions may occur with red spruce. Red maple is possible as a canopy component on most sites in this element. Early and mid-successional forests will have red maple, white birch, and occasionally aspen. Natural disturbances are primarily small gaps created in the stand canopy by individual tree mortality or small patches created by windthrow. This element includes a small area near Kentville that has been 90% converted to other uses. The part of the area that remains forested appears to be mature mixedwoods. |
| Tolerant Mixedwood Slopes (Patch) | 5,750<br>6.5% | Tolerant Mixedwood Slopes are a patch-level element associated with steep-sided slopes and ravines along watercourses originating or travelling through upland terrain. Soils are mostly well-drained but could be drier and rapidly drained where soils are shallow to bedrock. At lower and toe slope positions, soils are often moister and richer as both move downslope to reach the watercourse and/or level terrain associated with riparian zones. Often there are seepage sites along the slope where soils are wetter and richer with plants indicating this improved condition. Soils are of variable textures derived from glacial tills and yield mixedwood forest stands comprising shade-tolerant tree species, such as sugar maple, yellow birch, beech, white ash, red spruce, hemlock, and white pine. Depending on slope and soil conditions, forests of pure hardwood or softwood may prevail. For example, steep and/or lower slopes are usually stronger to hemlock. Red maple and white birch enter as early successional species following stand disturbances, often with a component of red spruce. Natural disturbances are primarily small gaps created in the stand canopy by individual tree mortality or small patches created by windthrow. |

| Table 5a – Elements Within Valley Slope | | |
|---|---|---|
| **Element** | **Size (Hectares)** | **Element Description** |
| Spruce Pine Flats (Patch) | 802<br>0.9% | The extent of this element is very small in the ecodistrict and occurs primarily on fine-textured imperfectly drained soils associated with watercourses and wetlands. Forests of black spruce are typical but there are a few better-drained soils embedded in the element and red spruce and white pine occurs. As soil drainage gets progressively poorer, wet forests of red maple, tamarack, alders, false holly, and other woody shrubs are common. Earlier successional forests will often have red maple, white birch, and aspen as components. |
| Wetlands (Patch) | 374<br>0.4% | Wetlands is a very small patch-level element in this ecodistrict, occurring primarily to the east and west of the Nictaux River. Wetlands are often associated with existing waterways and are usually meadows, fens or bogs. Wetlands are generally treeless or sparsely forested woodlands. On some of the higher ground with better-drained soils within the wetlands or forming the edge of the wetland, forests of black spruce, white pine, tamarack, and red maple will occur. This element plays a critical role in water collection, filtering, and groundwater recharge. |
| Pine Oak Hills and Hummocks (Patch) | 189<br>0.2% | Pine Oak Hills and Hummocks is a unique patch-level element on ridged glacial sands and gravels deposited by glacial meltwaters near Nictaux. These soils are excessively drained and growth of trees is usually slowed by their dryness. White pine, red pine, and red oak are characteristic late successional species found on these inherently poor soils. Black spruce, white spruce, red oak, red maple, and aspen are representative of earlier successional forests. This element is more extensive and better represented in the adjacent Annapolis Valley Ecodistrict 610. |
| Floodplain (Patch) | 292<br>0.3% | Floodplains in the Valley Slope Ecodistrict are usually very small but along the Halfway River there are several areas of significant size where alluvial deposits have occurred. These linear, small patch-level areas are underlain with imperfectly drained, sandy loams. The soils are usually stone free. The climax forest for this element is shade-tolerant hardwoods and softwoods, such as sugar maple and yellow birch, hemlock, white pine, and red spruce. With progressively poorer drainage, black spruce and red maple dominate the forest vegetation. Due to settlement, all areas of this element have been heavily converted from natural forest conditions to other land uses. |
| **Total** | **88,026*** | *Area is not the same as in Table 1 because 256 hectares of water have not been included. |

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

| Element | Seral Stage | | | | | |
|---|---|---|---|---|---|---|
| | Early | % * | Middle | % | Late | % |
| Floodplain | IH3, IH5, IH6, OF3, MW4, MW5 | 26.1 | SH5, SH6 | 30.3 | **MW1, MW3, SH1,** SH2, SH3, SH4 | 21.8 |
| Pine Oak Hills and Hummocks | IH1, SP8 | 45.3 | IH2, IH6, SH9, SP4, SP6 | 27.0 | SP5, **SP9,** SH4, TH6 | 11.6 |
| Spruce Pine Flats | | 27.5 | | 44.7 | **SP7** | 19.8 |
| Spruce Hemlock Pine Hummocks and Hills | IH3, IH5, IH6, MW4, MW5 | 38.2 | SH5, SH6, MW2 | 25.6 | **SH1, SH2, SH3, SH4,** MW1, SP9 | 11.6 |
| Tolerant Hardwood Hills | IH3, IH5, IH6, OF1, OF3 | 34.9 | IH7, TH6, TH8 | 29.3 | **TH1, TH2,** TH3, **TH5** | 23.0 |
| Tolerant Mixedwood Slopes | IH3, IH5, IH6 | 29.0 | MW2, MW4, MW5, SH4, SH5, SH6 | 36.4 | **MW1, MW3,** SH1, SH2, SH3 | 22.7 |
| 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.

Red spruce – White pine / Lambkill / Bracken (SH4) is a late successional vegetation type found in the Spruce Hemlock Pine Hummocks and Hills matrix element.

Red oak – Yellow birch / Striped maple (TH6) is a mid-successional vegetation type found in the Tolerant Hardwood Hills patch element.

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

Black spruce / False holly / Ladies' tresses sphagnum (SP7) is an edaphic vegetation type heavily influenced by moist, nutrient poor soils with black spruce as the tree dominant species. This type of forest is found in the Spruce Pine Flats element.

Red maple – Balsam fir / Wood aster / Sphagnum (WD6) is a mid-successional vegetation type found in the Wetlands patch element.

Red oak – White pine / Teaberry (SP9) is an early to late successional vegetation type found in the Pine Oak Hills and Hummocks 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 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 infrequent natural disturbance regime, the most prevalent in the ecodistrict, occurs when the interval between stand-initiating disturbance events is longer than the longevity of the climax species. This disturbance regime is associated with tolerant softwood covertypes, such as red spruce, white pine, and hemlock. Disturbance agents are often hurricanes, fires, and insects. If the interval between major disturbances is long enough, the area may take on old growth characteristics with multiple canopy layers.

The gap disturbance regime, another major regime in the ecodistrict, is a feature of a tolerant hardwood climax covertype. This regime favours the development of an uneven-aged structure, shade-tolerant species, and formation of old growth conditions. Mortality is commonly by animal or insect predation, disease, lightning, blowdown, or old age, where individual trees or small groups of trees across the landscape succumb to mortality. Regeneration occurs under openings (gaps) where mortality has occurred. Usually shade-tolerant species regenerate in the openings and as gaps in the canopy and share growing space with the surviving old growth trees. Major stand-initiating events do no occur under this regime.

Frequent and seral disturbance regimes are less common in Valley Slope. Frequent regimes are typical of black spruce communities. The interval between stand-initiating events is shorter than the longevity of the climax species. This disturbance is intense enough that there is rapid mortality and a new even-aged forest becomes established. Another disturbance takes place before the stand becomes uneven-aged. Fire and wind are the usual disturbances.

Open seral regimes take place where site conditions restrict or limit tree growth, creating sparse forest cover. The Wetlands element in Valley Slope, where excessive moisture or thick organic peat layers hinder tree growth, is a good illustration of the open seral regime.

## 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 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.

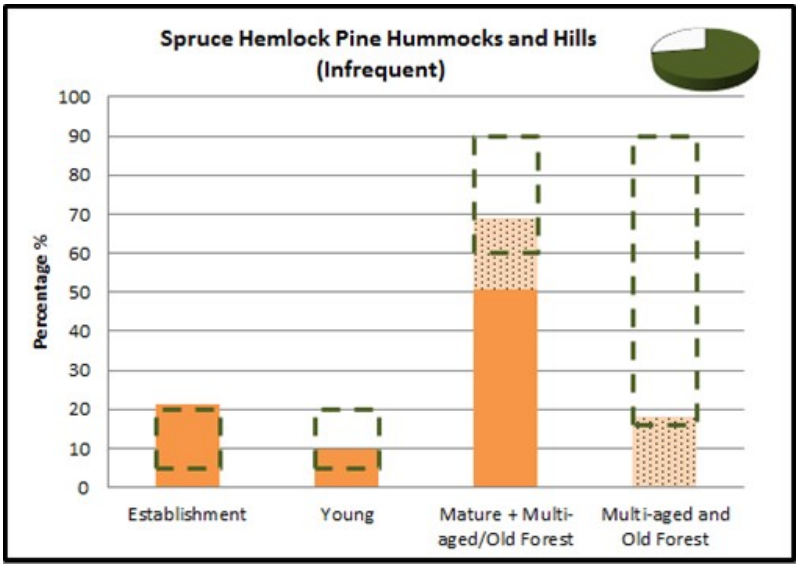
| Table 6 - Landscape Composition Target Ranges (by Development Class / Disturbance Regime) | | | | |
|---|---|---|---|---|
| **Natural Disturbance Regime** | **Development Class** | | | |
| | **Forest Establishment** | **Young Competing Forest** | **Mature Forest (including multi-aged and old forest)** | **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% |

## Development Class Targets by Element

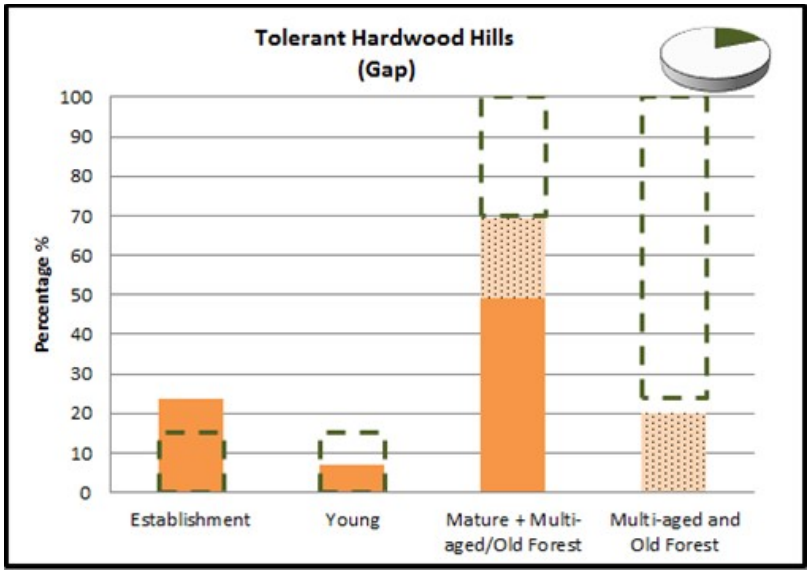
The series of charts that follow combine data on development classes for each element with desired or target percentages, based on the type of natural disturbance regime. The target percentages (from Table 6) are represented by rectangles of broken green lines. The light brown bars show the percentage 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.

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.

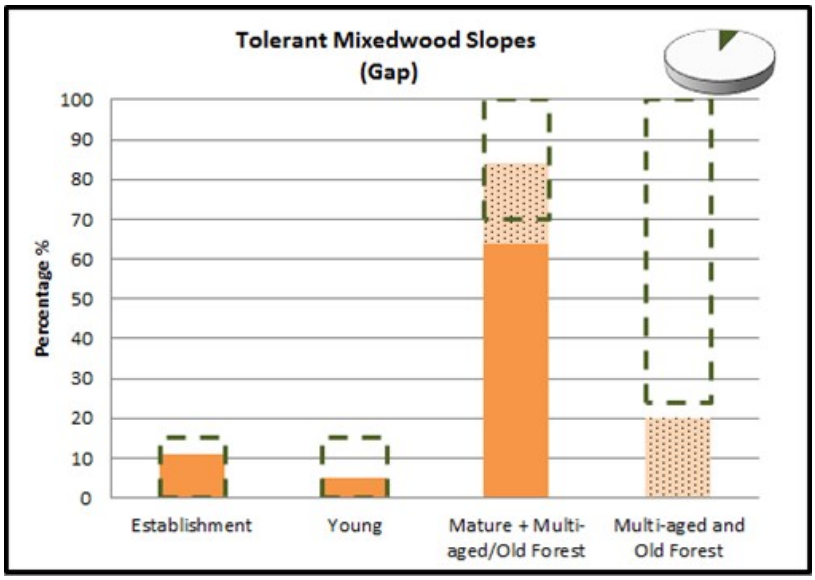
In the **Spruce Hemlock Pine Hummocks and Hills** matrix element, all classes are within their target ranges. Harvest regimes that extend rotation lengths or favour uneven-aged conditions will support mature forest targets and conserve connectivity. Favouring climax species will enhance future management options.



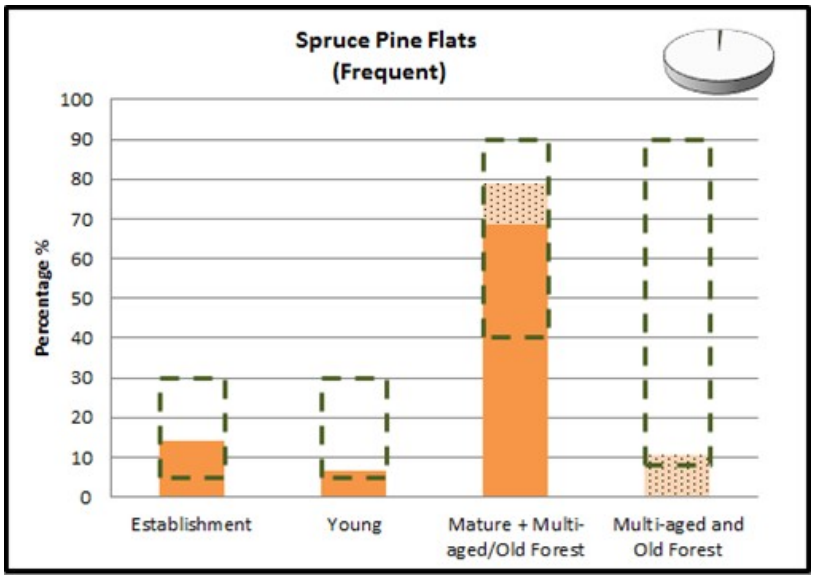
In the **Tolerant Hardwood Hills** element, the multi-aged and old forest class is below its target range. Partial harvests consistent with gap disturbance, including retention of old trees, will promote multi-aged forest development, particularly in tolerant hardwood stands. Favouring climax species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



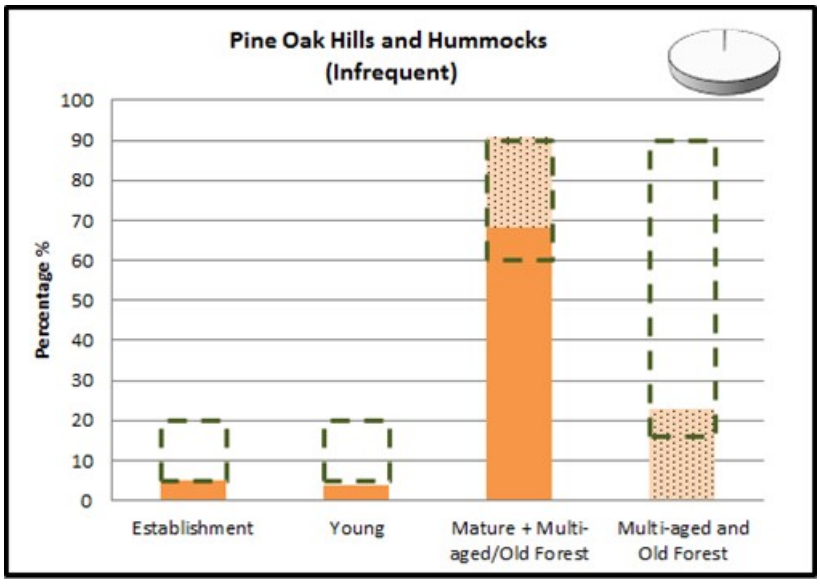

In **Tolerant Mixedwood Slopes**, mature conditions dominate close to 90% of the forest, consistent with the desired composition for gap disturbance ecosystems. This condition enhances slope stability and provides mature habitat continuity. The small area of establishment and young forest will provide some diversity.




**Spruce Pine Flats** currently supports abundant mature forest conditions. The element's small size and frequent natural disturbance regime favours rapid composition shifts. This element is more common in the neighbouring South Mountain Ecodistrict, where the target balance of development classes currently exists and is more naturally maintained.



In the tiny **Pine Oak Hills and Hummocks** element, the mature and multi-aged forest composition just slightly exceeds the target maximum of 90%. As a result, there is little young and establishment stage forest habitat. As with all small elements, composition is naturally sensitive to local fluctuation. Although more common in the adjacent Annapolis Valley Ecodistrict, land use pressure on the element is high.



## 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 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, smoothly rounded, 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). |